1.1.1: The Institution ensures effective curriculum planning and delivery through a well-planned and documented process including Academic calendar and conduct of continuous internal Assessment.

INDEX

PRINCIPAL

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, Recg. By Govt. of T.S & Affiliated to JNTUH, Hyderabad)
NAAC "B++" Accredited Institute
Gunthapally (V), Abdullapurmet(M), RR Dist, Near Ramoji Film City, Hyderabad -501512.
www.aietg.ac.in email: principal.avanthi@gmail.com

Lr No: AVIH/2022-23/Committee/2 **Date: 12/08/2022**

The principal is pleased to appoint the following faculties as members of Institute Academic Committee for the Academic Year 2022-23. They are directed to take up the assignment and extend their support for the smooth conduct of Institute Academic Committee as per the guidelines.

Institute Academic Committee

2022-23

Sl.No	Name	Designation	Signature
1	Dr.G. Ramachandra Reddy	Principal (Convenor)	
2	Y. Jayapradha	Director (Member)	
3	Swamy Rao Kulakarni	IQAC Coordinator (Member)	
4	Dr.S. Kishore Reddy	HOD, ECE (coordinator)	
5	Dr. ShakeerBasha	HOD, CSE (Member)	
6	Dr.Y. Ramesh Babu	HOD, MECH (Member r)	
7	Dr.T. Kranthi Kumar	HOD, EEE (Member)	T. K
8	S. Rajendar	(Member)	
9	K. Nagaraju	HOD, H&S (Member)	
10	E. Prasanna	EEE (Member)	
11	Dr. N. Ramana Reddy	MBA (Member)	
12	P. Krishna Murthy Naidu	Librarian (Member)	
13	Syed Mahaboobvali	PD (Member)	

Copy to:

1. Notice Board

2. All the Members

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
GUNTHAPALLY (V) ABDULLAPURMET (M) R.R. DISTRICT.

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www.aietg.ac.in email: principal.avanthi@gmail.com

AVIH/AC/2022-2023/01

Date: 16-08-2022

CIRCULAR

This is to inform all the staff members that Institute Academic Committee will be meeting on 18th August 2022 at10.00 AM in the Principal's chamber to discuss the following agenda. All members are requested to attend the meeting without fail.

Agenda:

1. Preparation of Academic Calendar for the A.Y 2022-2023
2. Preparation of Faculty workloads.
3. Preparation of Semester Time Tables.
4. Discussions on utilization of Library Resources.
5. Certificate Courses/Internship Courses.
6. Discussions on Training and Placements.
7. Sports Activities.
8. R&D Activities.
9. Self-Appraisal form.
10. Discussions on FFC.
11. Discussions on AISHE.
12. Discussion on setting of level for CO & PO attainment.
13. Discussions on Research Committees.
14. Review on the feedback obtained from various stake holders.
15. Any other Issues.

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Copy to:

1. All HODs
2. IQAC coordinator
3. All the Committee Members

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MINUTES OF THE INSTITUTE ACADEMIC COMMITTEE

The Institute Academic Committee meeting was held on 18 August 2022 at 10AM in Principal's chamber. The principal welcomed the staff and briefed on the above objective of the Institute Academic Committee meeting. The principal started the deliberations by discussing the Academic issues and emphasized the need to concentrate on new University regulations.

Item-1:

- Preparation of Academic of calendar for A.Y. 2022-2023

Resolution:

- Swamy Rao Kulakarni, IQAC Coordinator prepared the Academic calendar based on the calendar provided by the University and issued it to the Department Heads of the college.
- Department wise Academic calendars were prepared by the HODs of every department based on the calendar and submitted it to principal for further approval.

Item-2:

- Preparation of Faculty workloads

Resolution:

- Department wise faculty workloads were prepared by the HODs of every department based on the curriculum and submitted it to principal for approval.

Item-3:

- Preparation of Semester Time tables

Resolution:

- Department wise semester Time tables were prepared by the HODs of every department based on the curriculum and submitted it to principal for approval.

Item-4:

- Discussions on utilization of Library Resources

Resolution:

- HODs of all the departments instructed the students to utilize Library Resources and advised the Librarian to purchase books if necessary and make them available for students and faculty members.

Item 5:

- Certificate Courses/Internship Courses

Resolutions:

- The members suggested that every student should complete two internships. One during summer vacation and the other during the semester break. It is also advised to undertake internships from MOU organizations

Item-6:

- Training and Placements

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Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Resolutions:

- TPO has to submit the training program schedules for each department and the department HODs should include the given schedule in the upcoming semester time tables and send it to principal for approval.

Item-7:

- Sports Activities

Resolutions:

- The Sports Schedule should be submitted by the Physical Director to the entire department HODs for sports hour in the time table.

Item-8:

- R&D Activities

Resolutions:

- Every faculty in the institution should get involved in various R&D activities such as publishing paper in renowned journals with high quality index, publishing books, participating in workshops/ FDPs, filing patents under the guidance of Doctorates present in the college.

Item-9:

- Self Appraisal form

Resolutions:

- Every faculty working in the institution should undergo the process of self performance evaluation under the supervision of their HOD, at least once in a year and will be allowed to opt for self appraisal forms as per the norms of the institution.

Item-10:

- Discussions on FFC

Resolutions:

- Detailed information on different parameters such as student's data, faculty data, infrastructural information, financial information etc., should be formulated and updated as per the requirements of FFC (Fact Finding Committee).

Item-11:

- Discussions on AISHE

Resolutions:

- Detailed information on different parameters such as student's data, faculty information, infrastructural information, financial related information etc should be formulated and updated as required by AISHE.

Item-12:

- Discussion on setting of level for CO & PO attainment.

Resolutions:

- The staff members have proposed to keep 50% marks as CO benchmark for Internal examinations and 26 marks out of 75 for external Examinations.
- It was approved to follow below thumb rule to calculate attainment
- 50 to 60% - level 1

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Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist

- 60% to 70% - level 2
- 70% to 80 % - level 3

Item-13:

- Discussions on Research committees

Resolutions:

- Research committees should be formed to look over and maintain a record for the proceedings of the research activities happening in the Institution.

Item-14:

- Any other Issues

Resolutions:

- The IQAC coordinator instructed all the departments to maintain updated Stock registers, Maintenance Registers, Complaint Registers, etc of all the laboratories duly verified by the committee.
- It was also resolved after the discussion that all the departments should follow IQAC Audit Action Taken Report.
- The IQAC coordinator instructed all the departments to maintain updated Stock registers, Maintenance Registers, Complaint Registers, etc of all the laboratories duly verified by the committee.
- IQAC coordinator informed all the faculty to submit the AQAR for the academic year 2022-23.

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Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Attendance sheet:

Sl.No	Name	Designation	Signature
1	Dr.G. Ramachandra Reddy	Principal (Convenor)	
2	Y. Jayapradha	Director (Member)	
3	Swamy Rao Kulakarni	IQAC Coordinator (Member)	
4	Dr.S. Kishore Reddy	HOD, ECE (coordinator)	
5	Dr. ShakeerBasha	HOD, CSE (Member)	
6	Dr.Y. Ramesh Babu	HOD, MECH (Member r)	
7	Dr.T. Kranthi Kumar	HOD, EEE (Member)	T.
8	S. Rajendar	(Member)	
9	K. Nagaraju	HOD, H&S (Member)	
10	E. Prasanna	EEE (Member)	
11	Dr. N. Ramana Reddy	MBA (Member)	
12	P. Krishna Murthy Naidu	Librarian (Member)	
13	Syed Mahaboobvali	PD (Member)	

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Date: 20/08/2022

CIRCULAR

This is to inform that the Department Academic Committee (DAC) will be held on 22th August 2022 at 3:30PM in the principal chamber. All members are requested to attend the meeting without fail.

Agenda:

1. Report of Department progress for the academic year 2021-22.
2. Identify curriculum gaps between Academic and Industry.
3. Workload and Time table preparation.
4. Review on CRT classes and placements.
5. Providing guidelines to organize FDPs.
6. Student workshops.
7. Projects of IV CSE Students.
8. Internship training programs
9. Review on the Feedback received by various stake holders.
10. Value added Courses.
11. Any other relevant point.

HOD-CSE

Head of the Department
Computer Science & Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

Copy To:

1. Principal Office.
2. DAC Members.
3. Department file.

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Minutes of the Meeting:

The following committee met on 22/08/2022 at Principal's chamber and discussed on following agenda.

Item-1:

- Report of Department progress for the academic year 2021-22.

Resolution:

- HOD-CSE assessed 2021-22 academic year results. All the faculty members who met the target of 85 percentages or more appreciated by the committee for outstanding achievement. Those who failed to achieve the 85-percentage target were reprimanded by the committee and were asked to step up their efforts.

Item-2:

- Identify curriculum gaps between Academic and industry.

Resolution:

- Mr. Dr. M. Prasad Rao suggested to bring the students to industrial visits regularly to bridge the gap between academic and industry.
- HOD-CSE proposed to organize regular industrial visits for the students in reputed companies like Infosys,BHEL,NRSC, etc
- Mr M. Shireesha has been appointed as the faculty in-charge for arranging guest lecturers for the students regularly.
- Mr U. Uma has been appointed as the overall lab in-charge for conducting of additional experiments in all laboratories.

Item-3:

- Workload and Time table preparation.

Resolution:

- Mrs. Dr. T. Lalitha Saroja has been assigned the role of timetable and workload in-charge for the current semester.
- HOD-CSE suggested allotting the workload to the faculty as per the curriculum of the current semester. Also suggested preparing of the timetable for the current semester. Workloads and timetables for the current semester is prepared according to interest

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Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

shown by the staff.

Item-4:

- Review on CRT classes and placements

Resolution:

- Mr Dr. Abdul Ahad Afroz has been appointed as CRT in charge for smooth running Of classes.
- Ms.P. Haimavathi has been appointed as training and placement in-charge to regular follow up the students.
- HOD advised Students who cleared all the subjects and secured CGPA above 7 should enroll for Pega Academic Program. All the remaining students should attend CRT classed conducted by the college.
- The coordinator informed the faculty members to organize various activities in the form of Competitions, Guest lectures, Career guidance, Entrepreneurship programs etc for the students to improve their knowledge, skills and keep them abreast with the changing demands of the companies.
- The DAC has taken stock of the placement record of the institute. All those students who were placed in prestigious MNCs and the faculty members behind them were praised by the committee for their achievement. The committee has advised the placement cell of the institute to augment their efforts in up-skilling the present lot of students to meet the demands of the job market and improve the placement record. All the students should attend CRT classes conducted by the FACE ACADEMY. All the students avail the internships provided by SASHAKT HR Services PVT. Ltd. MANAC infotech pvt ltd etc.

Item-5:

- Providing guidelines to organize FDPs

Resolution:

- Mrs A. Sravani has been appointed as the faculty in charge for conducting FDPs, for which the attendance of the staff members is mandatory.
- HOD-CSE advised the faculty members to attend at least one FDP organized by AICTE/ IIT/ NIT/ Universities and informed each and every faculty to enroll in

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Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

NPTEL courses and to complete certification. He further stated about the provision of research incentives to the faculty involved in research and development activities as per the research promotion policy of the college in order to promote research culture and encourage faculty to involve in research activities. Discussions were carried out on the learning activities conducted by the faculty members in the last semesters.

Item-6:

- Student workshops

Resolution:

- Mrs A.Sravani has been appointed as the faculty in charge for organizing workshop

HOD-CSE suggested organizing training programs on in-demand skills for both teaching and non-teaching staff of department.

Item-7:

- Electives as per CBCS

Resolution:

- Dr Shakeer Basha, HOD, speaking about Choice Based Credit System informed all the faculty to give choice to the students to choose the Open electives. He also informed that the Professional electives are very useful for higher education and placement purposes and informed faculty members to encourage students in this direction.

Item-8:

- Value added Courses

Resolution:

- HOD proposed that the department should include three values added courses not mentioned in the curriculum in addition to the regular courses to improve students' employability.

Item-9:

- Academic Projects for B. Tech students.

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Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Resolution:

- The committee has advised the department staff members to identify the scope of projects in latest trends.

Item-10:

- Any other relevant point

Resolution:

- The DAC appreciated the efforts of the management for organizing online yoga sessions and psychological counseling for students by experts. They felt that such programs help the student's battle mental issues and stress during the times of uncertainty.

List of DAC members attended:

S.No	Name of the Faculty	Designation	Role	Signature
1	Dr. G. Ramachandra Reddy	Principal	Chair Person	
2	Dr. Shaik Shakeerbasha	HOD	Member	
3	Dr. M. Prasad Rao	Associate Professor	Academic Member	M. Prasad Rao
4	Dr. K.Suri Babu	Associate Professor	Academic Member	
5	Dr. Shahebaz Ahmad Khan	Assistant Professor	Academic Member	
6	Dr. T. Lalitha Saroja	Associate Professor	Academic Member	D. Saroja
7	Dr. Abdul Ahad Afroz	Associate Professor	Academic Member	Afroz
8	A. Sravani	Assistant Professor	Academic Member	Sravani
9	M. Shieesha	Assistant Professor	Academic Member	
10	L. Shiva Shankar	Assistant Professor	Academic Member	
11	S. Rajender	Assistant Professor	Academic Member	SR
12	U. Uma	Assistant Professor	Academic Member	
13	P. Haimavathi	Assistant Professor	Academic Member	
14	Y. Satish Kumar	Assistant Professor	Academic Member	
16	Dr. Hameeda Shaik	Assistant Professor	Academic Member	
17	N.Pavani	Assistant Professor	Academic Member	N.Pavani

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

HOD-CSE
Head of the Department
Computer Science & Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

DEPARTMENT OF ELECTRONICS AND COMMUNICATIONS ENGINEERING

Date: 22/08/2022

CIRCULAR

This is to inform that the Department Academic Committee (DAC) will be held on 24th August 2022 at 3:00PM in the HOD chamber. All members are requested attend the meeting without fail.

Agenda:

1. Report of Department progress for the academic year 2021-22.
2. Identify curriculum gaps between Academic and Industry.
3. Workload and time table preparation.
4. Electives as per CBCS
5. Review on CRT classes and placements.
6. Providing guidelines to organize FDPs.
7. Student workshops.
8. Suggestions on Internship programs.
9. Value added Courses.
10. Review of Feedback by various stakeholders.
11. Projects for IV-ECE Students
12. Any other relevant point.

HOD-ECE

Head of the Department
Electronics & Communication Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

Copy To:

1. Principal Office
2. DAC Member

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Minutes of the Meeting:

The following committee met on 24/08/2022 at HOD's chamber and discussed on following agenda.

Item-1:

- Report of Department progress for the academic year 2021-22.

Resolution:

- HOD-ECE assessed 2021-22 academic year results. All the faculty members who met the 85 percentages or more appreciated by the committee for outstanding achievement. Those who failed to achieve above 70-percentage were reprimanded by the committee and were asked to step up their efforts.

Item-2:

- Identify curriculum gaps between Academic and Industry

Resolution:

- Mr. Dr. J. Bangaru Siddhartha suggested to bring the students to industrial visits regularly to bridge the gap between academic and industry.
- HOD-ECE proposed to organize regular industrial visits for the students in reputed companies like BSNL, NRSC etc.
- Mr. Dr. G. Chandrashekar has been appointed as the faculty in-charge for arranging guest lecturers for the students regularly.
- Mr. Dr. V. Nagaraju has been appointed as the overall lab in-charge for smooth conducting of experiments in all laboratories.

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Item-3:

- Workload and Time table preparation.

Resolution:

- Mrs. M.Yamini has been assigned the role of timetable and workload in-charge for the current semester.
- HOD-ECE suggested allotting the workload to the faculty as per the curriculum of the current semester, also suggested preparing of the timetable for the current semester. Workloads and Timetables for the current semester are prepared according to interest shown by the staff.

Item-4:

- Review on CRT classes and placements.

Resolution:

- Mrs. T.Padmavathi has been appointed as CRT in charge for smooth running of classes.
- Mr. S.Saidireddy has been appointed as training and placement in-charge to regular follow up the students.
- HOD advised Students who cleared all the subjects and secured CGPA above 7 should enroll for Pega Academic Program. Students who cleared all subjects and obtained CGPA between 6 and 7 should enroll for Full Stack Training Program. All the remaining students should attend CRT classed conducted by the college. The coordinator informed the faculty members to organize various activities in the form of Competitions, Guest lectures, Career guidance, Entrepreneurship programs etc for the students to improve their knowledge, skills and keep them with the changing demands of the companies.

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- The DAC has taken stock of the placement record of the institute. All those students who were placed in prestigious MNCs and the faculty members behind them were praised by the committee for their achievement The committee has advised the placement cell of the institute to augment their efforts in up-skilling the present lot of students to meet the demands of the job market and improve the placement record. All the students should attend CRT classes conducted by the FACE ACADEMY. All the students avail the internships provided by SASHAKT HR Services PVT. Ltd, MANAC infotech pvt ltd.

Item-5:

- Providing guidelines to organize FDPs

Resolution:

- Dr. G. Sai Kumar has been appointed as the faculty in charge for conducting FDPs, for which the attendance of the staff members is mandatory.
- HOD-ECE advised the faculty members to attend at least one FDP organized by AICTE/ IIT/ NIT/ Universities and informed each and every faculty to enroll in NPTEL courses and to complete certification. He further stated about the research incentives to the faculty involved in Research and Development activities as per the research Promotion Policy of the college in order to promote research culture and to encourage faculty to involve in research activities. Discussions were carried out on the learning activities conducted by the faculty members in the last semester.

Item-6:

- Student workshops.

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Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Resolution:

- Mr. R. Laxmikanth has been appointed as the faculty in charge for organizing workshop

And instructed to collaborate with MNC's for better outcomes.

- HOD-ECE suggested organizing training programs on in-demand skills for both teaching and non-teaching staff of department.

Item-7:

- Suggestions on certification programs.

Resolution:

- The committee believed various certification programs will enable students to confidently face the challenges of the changing job market. Hence, it is advised that training in add-on courses should be made compulsory for all the students by arranging guest lectures.

Item-8:

- Value added Courses.

Resolution:

- HOD proposed that department should include three value added courses not mentioned in the curriculum in addition to the regular courses to improve student's employability.

Item-9:

- Electives as per CBCS

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Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Resolution:

- Dr S. Kishore Reddy, HOD, speaking about Choice Based Credit System informed all the faculty to give choice to the students to choose the Open electives. He also informed that the Professional electives are very useful for higher education and placement purposes and informed faculty members to encourage students in this direction.

Item-10:

- Academic Projects for B. Tech students.

Resolution:

- The committee has advised the department staff members to identify the scope of projects in latest trends.

Item-11:

Any other relevant point.

Resolution:

The DAC appreciated the efforts of the management for organizing online yoga sessions and psychological counseling for students by experts. They felt that such programs help the students battle mental issues and stress during the times of uncertainty.

List of DAC members attended:

S.No.	Name of the Faculty	Designation	Role	Signature
1	Dr. G.Ramachandra Reddy	Principal	Chair Person	
2	Dr. S. Kishore Reddy	HOD	coordinator	
3	Dr. G.Sai Kumar	Associate Professor	Academic Member	
4	Dr. J. Bangaru Siddhartha	Assistant Professor	Academic Member	
5	Dr. G. Chandrashekar	Assistant Professor	Academic Member	

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6	Dr. M. Satyanarayana	Assistant Professor	Academic Member	
7	Dr. V Nagaraju	Assistant Professor	Academic Member	V.Nag
8	D.Neelakanteswara	Assistant Professor	Academic Member	Neelak
9	O.Mounika	Assistant Professor	Academic Member	
10	S. SaidiReddy	Assistant Professor	Academic Member	
11	T. Padmavathi	Assistant Professor	Academic Member	Padmavathi
12	R. Laxmikanth	Assistant Professor	Academic Member	Laxmi kanth
13	G. Srinivas	Assistant Professor	Academic Member	Srinu
14	V. Nagaswathi	Assistant Professor	Academic Member	
15	M.Yamini	Assistant Professor	Academic Member	
16	B. Kalpana	Assistant Professor	Academic Member	Kalp

HOD-ECE
Head of the Department
Electronics & Communication Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

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Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Date: 24/08/2022

CIRCULAR

This is to inform that the Department Academic Committee (DAC) will be held on 26th August 2022 at 3:00PM in the HOD chamber. All members are requested to attend the meeting without fail.

Agenda:

1. Reviews of Department progress for the academic year 2021-22.
2. Identify curriculum gaps between Academic and Industry.
3. Target value Refinement of PO's and PSO's attainments.
4. Workload and Time table preparation.
5. Review on CRT classes and placements.
6. Providing guidelines to organize FDPs.
7. Student workshops.
8. Suggestions on Add-on courses.
9. Projects for IV-EEE Students
10. Review of Feedback received by various stakeholders.
11. Any other relevant point.

T.K

HOD-EEE

Head of the Department
Electrical & Electronics Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

Copy To:

1. Principal Office
2. DAC Members

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Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Minutes of the Meeting:

The following committee met on 26/08/2022 at HOD's chamber and discussed on following agenda.

Item-1:

- Report of Department progress for the academic year 2021-22.

Resolution:

- HOD-EEE assessed 2021-22 academic year results. All the faculty members who met the 80 percentages or more appreciated by the committee for outstanding achievement. Those who failed to achieve the 80% were reprimanded by the committee and were asked to step up their efforts.

Item-2:

- Identify curriculum gaps between Academic and Industry.

Resolution:

- Mr. Dr. M. Surender Reddy suggested to bring the students to industrial visits regularly to bridge the gap between academic and industry.
- Mr. Chandra Shekar has been appointed as the faculty in-charge of industrial visits to bring the students to reputed organizations like, BHEL, Masqati Dairy, T-Hub, TCS.etc.
- Mr. Dr.S. Srikanth Reddy has been appointed as the faculty in-charge for arranging guest lecturers for the students regularly.

Item-3:

- Target value Refinement of PO's and PSO's attainments.

Resolution:

- Committee discussed and observed PO's and PSO's target levels to reach to satisfactory level.

Item-4:

- Workload and Timetable preparation.

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Resolution:

- Mr. M. Satish Kumar has been assigned the role of timetable and workload in-charge for the current semester. HOD-EEE allotted the workload to the faculty as per the curriculum of the current semester, also suggested to prepare the timetable for the current semester. Workloads and Timetables for the current semester is prepared.

Item-5:

- Review of CRT classes and placements.

Resolution:

- Mrs. M. Ragini has been appointed as CRT In charge of the smooth running of classes.
- HOD-EEE suggested students to undergo company specific training for the job aspirants. All the remaining students should attend CRT classes conducted by the college.
- The coordinator informed the faculty members to organize various activities in the form of Competitions, Guest lectures, Career guidance, Entrepreneurship programmes etc. for the students to improve their knowledge, skills and keep them abreast with the changing demands of the companies.
- The DAC has taken stock of the placement record of the institute. All those students who were placed in prestigious MNCs and the faculty members behind them were praised by the committee for their achievement. The committee has advised the placement cell of the institute to augment their efforts in up-skilling the present lot of students to meet the demands of the job market and improve the placement record.

Item-6:

- Providing guidelines to organize FDPs.

Resolution:

- Mr. Dr. S. Srikanth Reddy has been appointed as the faculty in charge for conducting FDPs, for which the attendance of the staff members is mandatory.
- HOD-EEE suggested conducting at least one FDP on the latest topics organized by AICTE I IIT/ NIT Universities and informed every faculty to enrol in NPTEL courses.
- The emphasis should be on bridging the knowledge gaps and re-skilling of the faculty members. Experts from industry and academia have to guide the faculty members in updating their knowledge, skill set and the teaching methodologies. He further stated about the provision of research incentives to the faculty involved in research and development activates as per research promotion policy of the college in order to encourage faculty in research activities.

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Item-7:

- Student workshops.

Resolution:

- Mr. M. Shankar has been appointed as the faculty in charge for organizing workshop.
- HOD-EEE suggested organizing training programs on in-demand skills for both teaching and non-teaching staff of the department.

Item-8:

- Suggestions on Add-on courses.

Resolution:

- The committee believed that add-on courses and various certification programs will enable students to confidently face the challenges of the changing job market. Hence, it is advised that training in add-on courses should be made compulsory for all the students by arranging guest lectures.

Item-9:

- Academic Projects for B. Tech students.

Resolution:

- The committee has advised the department staff members to identify the scope of projects in latest trends.

Item-10:

- Electives as per CBCS

Resolution:

- Dr T.Kranthi Kumar HOD, speaking about Choice Based Credit System informed all the faculty to give choice to the students to choose the Open electives. He also informed that the Professional electives are very useful for higher education and placement purposes and informed faculty members to encourage students in this direction.

Item-11:

- Any other relevant point

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
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NAAC "B++" Accredited Institute
Gunthapally (V), Abdullapurmet(M), RR Dist, Near Ramoji Film City, Hyderabad -501512.
www.aietg.ac.in email: principal.avanthi@gmail.com

Resolution:

- The DAC appreciated the efforts of the management for organizing online yoga sessions and psychological counselling for students by experts. They felt that such programs help the students battle mental issues and stress during the times of uncertainty.

List of DAC members attended:

S.No.	Name	Designation	Role	Signature
1	Dr. G. Ramachandra Reddy	Principal	Chairperson	
2	Dr. T. Kranti Kumar	HOD	coordinator	T. Kranti
3	E. Prasanna	Assistant Professor	Academic Member	
4	M. Ragini	Assistant Professor	Academic Member	
5	K. Chandrasekhar	Assistant Professor	Academic Member	
6	Dr. M. Surender Reddy	Assistant Professor	Academic Member	
7	M. Shankar	Assistant Professor	Academic Member	
8	M. Satish Kumar	Assistant Professor	Academic Member	
9	P. Saraswathi	Assistant Professor	Academic Member	
10	K. Madhavi	Assistant Professor	Academic Member	Madhavi
11	U. Ganesh	Assistant Professor	Academic Member	
12	S. Srikanth Reddy	Assistant Professor	Academic Member	
13	B. Srikanth	Assistant Professor	Academic Member	B. Srikanth
14	G. Pavan Kumar	Assistant Professor	Academic Member	
15	D.Nageshwar Rao	Assistant Professor	Academic Member	

T. Kranti

HOD-EEE

Head of the Department
Electrical & Electronics Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

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www.aietg.ac.in email: principal.avanthi@gmail.com

DEPARTMENT OF MECHANICAL ENGINEERING

Date: 23/08/2022

CIRCULAR

This is to inform that the Department Academic Committee (DAC) will be held on 25th September 2022 at 3:00PM in the HOD chamber. All members are requested attend the meeting without fail.

Agenda:

1. Reviews of Department progress for the academic year 2021-22.
2. Identify curriculum gaps between Academic and Industry.
3. Electives as per CBCS.
4. Workload and Time table preparation.
5. Review on CRT classes and placements.
6. Providing guidelines to organize FDPs.
7. Student workshops.
8. Suggestions on Add on courses.
9. Review on feedback received by stakeholders.
10. Any other relevant point.

HOD-MECH

Head of the Department
Mechanical Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

Copy To:

1. Principal Office
2. DAC Members

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Minutes of the Meeting:

The following committee met on 25/08/2022 at HOD's chamber and discussed on following agenda.

Item-1:

- Report of Department progress for the academic year 2021-22.

Resolution:

- HOD-MECH assessed 2021-22 academic year results. All the faculty members who met the 80 percentages or more appreciated by the committee for outstanding achievement. Those who failed to achieve the 80 percentage were reprimanded by the committee and were asked to step up their efforts.

Item-2:

- Identify curriculum gaps between Academic and Industry.

Resolution:

- Mrs. B. Swathi suggested to bling the students to industrial visits regularly to bridge the gap between academic and industry.
- Mr. V. Hari Nayak has been appointed as the faculty in-charge of industrial visits to take the students to reputable organizations like BHEL, PARLE, DRDO etc.
- Mr. M. Venkateshwarlu has been appointed as the faculty in-charge for arranging guest lecturers for the students regularly.
- Mr. V. Prahalad Relangi has been appointed as the overall lab in-charge for conducting additional experiments in all laboratories.

Item-3:

- Target value Refinement of PO's and PSO's attainments.

Resolution:

- Committee discussed and observed PO's and PSO's target levels to reach to satisfactory level.

Item-4:

- Workload and Time table preparation.

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Resolution:

Resolution:

- Mr. K. Sumanth has been assigned the role of timetable and workload in-charge for the current semester.
- HOD-MECH allotted the workload to the faculty as per the curriculum of the current semester, also suggested to preparing the timetable for the current semester.
- Workloads and Timetables for the current semester is prepared.

Item-5:

- Review on CRT classes and placements.

Resolution:

- Mr. A. Shankar has been appointed as CRT In charge of the smooth running of classes.
- The DAC has taken stock of the placement record of the institute. All those students who were placed in prestigious MNCs and core companies and the faculty members behind them were praised by the committee for their achievement. The committee has advised the placement cell of the institute to augment their efforts in up-skilling the present lot of students to meet the demands of the job market and improve the placement record.

Item-6:

- Providing guidelines to organize FDPs.

Resolution:

- Mrs. A. Swathi has been appointed as the faculty in charge for conducting FDPs, for which the attendance of the staff members is mandatory.
- HOD -MECH suggested conducting of at least two FDPs on the latest topics. The emphasis should be on bridging the knowledge gaps and re-skilling of the faculty members. Experts from the industry and academia have to guide the faculty members in updating their knowledge, skill-set and the teaching methodologies.

Item-7:

- Student workshops

PRINCIPAL
Avanthi Institute of Engg. & Tec
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dis

Resolution:

- Mr. A. Shankar has been appointed as the faculty in charge for organizing workshops.
- HOD-MECH suggested organizing programs on in demand skills for both teaching and non-teaching staff of department.

Item-8:

- Electives as per CBCS

Resolution:

- Dr Y. Ramesh babu HOD, speaking about Choice Based Credit System informed all the faculty to give choice to the students to choose the Open electives. He also informed that the Professional electives are very useful for higher education and placement purposes and informed faculty members to encourage students in this direction.

Item-9:

- Academic Projects for B. Tech students.

Resolution:

- The committee has advised the department staff members to identify the scope of projects in latest trends.
-

Item-10:

- Any other relevant point

Resolution:

The DAC appreciated the efforts of the management for organizing online yoga sessions and psychological counseling for students by experts. They felt that such programs help the students battle mental issues and stress during the times of uncertainty.

List of DAC members attended:

S.No.	Name of the Faculty	Designation	Role	Signature
1	Dr G. Ramachandra Reddy	Principal	Chair Person	
2	Y. Ramesh Babu	HOD	Coordinator	

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

3	M.Venkateshwarlu	Assistant Professor	Academic Member	M.V
4	V.Harinayak	Assistant Professor	Academic Member	Hari
5	V. Prahlad Relangi	Assistant Professor	Academic Member	
6	K.Sumanth	Assistant Professor	Academic Member	
7	B.Swathi	Assistant Professor	Academic Member	
8	A. Swathi	Assistant Professor	Academic Member	Swathi
9	A. Shankar	Assistant Professor	Academic Member	A.Sh

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

HOD-MECH
Head of the Department
Mechanical Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

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www.aietg.ac.in email: principal.avanthi@gmail.com

DEPARTMENT OF MBA

Date: 22/08/2022

CIRCULAR

This is to inform that the Department Academic Committee (DAC) will be held on 23rd August 2022 at 12:30PM in the HOD chamber. All members are requested to attend the meeting without fail.

Agenda:

1. Reviews of Department progress for the academic year 2021-22.
2. Identify curriculum gaps between Academic and Industry.
3. Workload and Time table preparation.
4. Review placements.
5. Providing guidelines to organize FDPs.
6. Electives as per CBCS
7. Student workshops.
8. Suggestions on Add-on courses.
9. Projects for II-MBA Students
10. Review on feedback received from various stakeholders.
11. Any other relevant point.

HOD-MBA

Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Copy To:

1. Principal Office
2. DAC Members

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Minutes of the Meeting:

The following committee met on 23/08/2022 at HOD's chamber and discussed on following agenda.

Item-1:

- Report of Department progress for the academic year 2021-22.

Resolution:

- HOD MBA assessed 2021-22 academic year results. All the faculty members who met the 80 percentages or more appreciated by the committee for outstanding achievement. Those who failed to achieve the 80% were reprimanded by the committee and were asked to step up their efforts.

Item-2:

- Identify curriculum gaps between Academic and Industry.

Resolution:

- Mr. Dr. N.Ramana Reddy suggested to bring the students to industrial visits regularly to bridge the gap between academic and industry.
- Mr. D.Manikanta has been appointed as the faculty in-charge of industrial visits to bring the students to reputed organizations like, Masqati Dairy, T-Hub, TCS.etc.
- Mr. G. Lingaiah has been appointed as the faculty in-charge for arranging guest lecturers for the students regularly.

Item-3:

- Target value Refinement of PO's and PSO's attainments.

Resolution:

- Committee discussed and observed PO's and PSO's target levels to reach to satisfactory level.

Item-4:

- Workload and Timetable preparation.

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Resolution:

- Mr. Ashraf Hussian has been assigned the role of timetable and workload in-charge for the current semester. HOD-EEE allotted the workload to the faculty as per the curriculum of the current semester, also suggested to prepare the timetable for the current semester. Workloads and Timetables for the current semester is prepared.

Item-5:

- Review of placements.

Resolution:

- Dr. A. Venkata Bala Krishna The coordinator informed the faculty members to organize various activities in the form of Competitions, Guest lectures, Career guidance, Entrepreneurship programmes etc. for the students to improve their knowledge, skills and keep them abreast with the changing demands of the companies.
- The DAC has taken stock of the placement record of the institute. All those students who were placed in prestigious MNCs and the faculty members behind them were praised by the committee for their achievement. The committee has advised the placement cell of the institute to augment their efforts in up-skilling the present lot of students to meet the demands of the job market and improve the placement record.

Item-6:

- Providing guidelines to organize FDPs.

Resolution:

- Dr B. Nayeema has been appointed as the faculty in charge for conducting FDPs, for which the attendance of the staff members is mandatory.
- HOD-EEE suggested conducting at least one FDP on the latest topics organized by AICTE / IIT/ NIT Universities and informed every faculty to enroll in NPTEL courses.
- The emphasis should be on bridging the knowledge gaps and re-skilling of the faculty members. Experts from industry and academia must guide the faculty members in updating their knowledge, skill set and the teaching methodologies. He further stated about the provision of research incentives to the faculty involved in research and development activates as per research promotion policy of the college to encourage faculty in research activities.

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Item-7:

- Student workshops.

Resolution:

- Mrs. S. Sandhya has been appointed as the faculty in charge for organizing workshop.
- HOD MBA suggested organizing training programs on in-demand skills for both teaching and non-teaching staff of the department.

Item-8:

- Suggestions on Add-on courses.

Resolution:

- The committee believed that add-on courses and various certification programs will enable students to confidently face the challenges of the changing job market. Hence, it is advised that training in add-on courses should be made compulsory for all the students by arranging guest lectures.

Item-9:

- Academic Projects for MBA students.

Resolution:

- The committee has advised the department staff members to identify the scope of projects in latest trends.

Item-9:

- Electives as per CBCS

Resolution:

- Dr B.Nayeema, HOD, speaking about Choice Based Credit System informed all the faculty to give choice to the students to choose the Open electives. He also informed that the Professional electives are very useful for higher education and placement purposes and informed faculty members to encourage students in this direction.

Item-10:

- Any other relevant point

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Resolution:

- The DAC appreciated the efforts of the management for organizing online yoga sessions and psychological counselling for students by experts. They felt that such programs help the students battle mental issues and stress during the times of uncertainty.

List of DAC members attended:

S.No	Name	Designation	Role	Signature
1	**Dr. G. Ramachandra Reddy**	**Principal**	**Chairperson**	
2	Dr. B.Nayeema	HOD	coordinator	
3	Jayaprada Duggirala	Assistant Professor	Academic Member	
4	Dr.N.Raman Reddy	Assistant Professor	Academic Member	
5	Dr. A. Venkata Bala Krishna	Assistant Professor	Academic Member	Venkata
6	Kashavennalolu Sabitha	Assistant Professor	Academic Member	
7	Lingaiah Gudipati	Assistant Professor	Academic Member	
8	Mankala Naresh	Assistant Professor	Academic Member	Naresh
9	Medipally Sudhakar	Assistant Professor	Academic Member	M.Sdr
10	Morri Sharadha	Assistant Professor	Academic Member	
11	Nageshwer Rao M	Assistant Professor	Academic Member	Nageshwer
12	Naresh Aelkaraj	Assistant Professor	Academic Member	Anaresh
13	Oruganti Venkatesh	Assistant Professor	Academic Member	
14	Siliveru Rambabu	Assistant Professor	Academic Member	S Ram

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist

HOD-MBA
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

B. Tech./B. Pharm. IV YEAR I & II SEMESTERS

I SEM

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork	**29.08.2022**	
2	1st Spell of Instructions (including Dussehra Recess)	29.08.2022	31.10.2022 (9 Weeks)
3	Dussehra Recess	03.10.2022	08.10.2022 (1 Week)
4	First Mid Term Examinations	01.11.2022	07.11.2022 (1 Week)
5	Submission of First Mid Term Exam Marks to the University on or before	12.11.2022	
6	2nd Spell of Instructions	09.11.2022	03.01.2023 (8 Weeks)
7	Second Mid Term Examinations	04.01.2023	10.01.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	11.01.2023	19.01.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	17.01.2023	
10	End Semester Examinations	*20.01.2023*	02.02.2023(2 Weeks)

Note: No. of Working/instructional days: 94

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	**03.02.2023**	
2	1st Spell of Instructions	03.02.2023	31.03.2023 (8 Weeks)
3	First Mid Term Examinations	01.04.2023	08.04.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	15.04.2023	
5	2nd Spell of Instructions	10.04.2023	17.06.2023 (10 Weeks)
6	**Summer Vacation**	15.05.2023	27.05.2023 (2 Weeks)
7	Second Mid Term Examinations	19.06.2023	24.06.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	26.06.2023	01.07.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	01.07.2023	
10	End Semester Examinations	03.07.2023	15.07.2023 (2 Weeks)

Note: No. of Working/ instructional days: 91

01/9/22

REGISTRAR

PRINCIPAL
Avanthi Institute of Engg. & Tech.
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

B. Tech./B. Pharm. III YEAR I & II SEMESTERS

I SEM

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork	**09.09.2022**	
2	1st Spell of Instructions (including Dussehra Recess)	09.09.2022	10.11.2022 (9 Weeks)
3	Dussehra Recess	03.10.2022	08.10.2022 (1 Week)
4	First Mid Term Examinations	11.11.2022	17.11.2022 (1 Week)
5	Submission of First Mid Term Exam Marks to the University on or before	24.11.2022	
6	2nd Spell of Instructions	18.11.2022	12.01.2023 (8 Weeks)
7	Second Mid Term Examinations	16.01.2023	21.01.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	23.01.2023	28.01.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	30.01.2023	
10	End Semester Examinations	30.01.2023	11.02.2023 (2 Weeks)

Note: No. of Working/ instructional days: 92

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	**13.02.2023**	
2	1st Spell of Instructions	13.02.2023	08.04.2023 (8 Weeks)
3	First Mid Term Examinations	10.04.2023	15.04.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	22.04.2023	
5	2nd Spell of Instructions (including Summer Vacation)	17.04.2023	24.06.2023 (10 Weeks)
6	**Summer Vacation**	15.05.2023	27.05.2023 (2 Weeks)
7	Second Mid Term Examinations	26.06.2023	01.07.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	03.07.2023	08.07.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	08.07.2023	
10	End Semester Examinations	10.07.2023	22.07.2023 (2 Weeks)

Note: No. of Working/ instructional days: 90

REGISTRAR

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (M), R.R. Dist.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

B. Tech./B.Pharm. II YEAR I & II SEMESTERS

I SEM

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork	**28.11.2022**	
2	1st Spell of Instructions	28.11.2022	21.01.2023 (8 Weeks)
3	First Mid Term Examinations	23.01.2023	30.01.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	04.02.2023	
5	2nd Spell of Instructions	31.01.2023	29.03.2023 (8 Weeks)
6	Second Mid Term Examinations	31.03.2023	08.04.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	10.04.2023	15.04.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	15.04.2023	
9	End Semester Examinations	17.04.2023	29.04.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 93

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	**01.05.2023**	
2	1st Spell of Instructions (including Summer Vacation)	01.05.2023	08.07.2023 (10 Weeks)
3	**Summer Vacation**	15.05.2023	27.05.2023 (2 Weeks)
4	First Mid Term Examinations	10.07.2023	15.07.2023 (1 Week)
5	Submission of First Mid Term Exam Marks to the University on or before	22.07.2023	
6	2nd Spell of Instructions	18.07.2023	11.09.2023 (8 Weeks)
7	Second Mid Term Examinations	12.09.2023	16.09.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	19.09.2023	23.09.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	23.09.2023	
10	End Semester Examinations	25.09.2023	07.10.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 92

24/11/22
REGISTRAR

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

B.Tech. I YEAR I & II SEMESTERS

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork (including Induction programme)	**03.11.2022**	
2	1st Spell of Instructions	03.11.2022	28.12.2022 (8 Weeks)
3	First Mid Term Examinations	29.12.2022	04.01.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	10.01.2023	
5	2nd Spell of Instructions	05.01.2023	02.03.2023 (8 Weeks)
6	Second Mid Term Examinations	03.03.2023	09.03.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	10.03.2023	16.03.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	16.03.2023	
9	End Semester Examinations	17.03.2023	01.04.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 91

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	**03.04.2023**	
2	1st Spell of Instructions (including Summer Vacation)	03.04.2023	10.06.2023 (10 Weeks)
	Summer Vacation	15.05.2023	27.05.2023 (2 Weeks)
3	First Mid Term Examinations	12.06.2023	17.06.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	23.06.2023	
5	2nd Spell of Instructions	19.06.2023	12.08.2023 (8 Weeks)
6	Second Mid Term Examinations	14.08.2023	19.08.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	21.08.2023	26.08.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	26.08.2023	
9	End Semester Examinations	28.08.2023	09.09.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 90

22/10/22

REGISTRAR

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (M), R.R. Dist.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

M.Tech./ M.Pharm. I YEAR I & II SEMESTERS

I SEM

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork	**26.10.2022**	
2	1st Spell of Instructions	26.10.2022	20.12.2022 (8 Weeks)
3	First Mid Term Examinations	21.12.2022	28.12.2022 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	04.01.2023	
5	2nd Spell of Instructions	29.12.2022	25.02.2023 (8 Weeks)
6	Second Mid Term Examinations	27.02.2023	04.03.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	06.03.2023	11.03.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	11.03.2023	
9	End Semester Examinations	13.03.2023	25.03.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 94

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	**27.03.2023**	
2	1st Spell of Instructions (including Summer Vacation)	27.03.2023	03.06.2023 (10 Weeks)
3	**Summer Vacation**	15.05.2023	27.05.2023 (2 Weeks)
4	First Mid Term Examinations	05.06.2023	10.06.2023 (1 Week)
5	Submission of First Mid Term Exam Marks to the University on or before	17.06.2023	
6	2nd Spell of Instructions	12.06.2023	08.08.2023 (8 Weeks)
7	Second Mid Term Examinations	09.08.2023	16.08.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	17.08.2023	23.08.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	23.08.2023	
10	End Semester Examinations	24.08.2023	06.09.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 91

22/10/22
REGISTRAR

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (M), R.R. Dist.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
ACADEMIC CALENDAR 2022-23

M. Tech./ M. Pharm. II YEAR I & II SEMESTERS

I SEM

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork	**21.10.2022**	
2	1st Spell of Instructions	21.10.2022	15.12.2022 (8 Weeks)
3	Preparation of Project Work Proposals	21.10.2022	17.11.2022 (4 Weeks)
4	Project Work Review-I: (Project Submission & approval)	18.11.2022	24.11.2022 *(1 Week)*
5	Last date for submission of list of approved PRC-I students from the College to the University Examination branch.	26.11.2022	
6	First Mid Term Examinations	16.12.2022	22.12.2022 (1 Week)
7	Submission of First Mid Term Exam Marks to the University on or before	30.12.2022	
8	2nd Spell of Instructions	23.12.2022	16.02.2023 (8 Weeks)
9	Second Mid Term Examinations	17.02.2023	23.02.2023 (1 Week)
10	Preparation Holidays and Practical Examinations	24.02.2023	02.03.2023 (1 Week)
11	Submission of Second Mid Term Exam Marks to the University on or before	01.03.2023	
12	End Semester Examinations	03.03.2023	16.03.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 92

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester (Project Work Continuation) (25.11.2022 to 16.03.2023 – 16 weeks)	**17.03.2023**	
2	Project Work Review -II (Phase-I)	17.03.2023	23.03.2023 (1 Week)
3	** Project Work Review -II (Phase-II)	11.04.2023	13.04.2023 (3 days)
4	Last date for submission of PRC-II marks	20.04.2023	
5	Project Work Review -III (Phase –I) (24.03.2023 to 26.08.2023 – 22 Weeks)	28.08.2023	02.09.2023 (1 Week)
6	Last date for submission of Project Work Review-III (Phase-I) Marks	09.09.2023	
7	* Date of eligibility of thesis submission	09.09.2023	
8	Submission of Thesis and Project Viva –Voce Examination (PRC-III Phase-I)	--	
9	** Project Work Review – III (Phase –II) (04.09.2023 to 02.12.2023 – 13 Weeks)	04.12.2023	06.12.2023 (3 days)
10	Last date for submission of Project Work Review –III (Phase-II) Marks	09.12.2023	
11	Submission of Thesis and Project Viva –Voce Examination (Phase-II) follows	---	

* After completion of 40 weeks from the date of approval of project work proposal and subject to approval of Project Work Review-III.

** Phase-II will be conducted only for unsuccessful students in Phase –I

Note: 1 The unsuccessful students in Project Work Review-II (Phase-II) shall appear for Project Work Review-II at the time of Project Work Review-III. These students shall reappear for Project Work Review-III in the next academic year at the time of Project Work Review -I only after completion of Project Work Review -II, and then Project Work Review -III follows.

2 The Project Viva-Voce External examination Marks must be submitted on the day of examination to the University.

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18/10/22
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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

MBA/MCA I YEAR I & II SEMESTERS

I SEM

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork (including Induction programme)	**03.11.2022**	
2	1st Spell of Instructions	03.11.2022	28.12.2022 (8 Weeks)
3	First Mid Term Examinations	29.12.2022	04.01.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	10.01.2023	
5	2nd Spell of Instructions	05.01.2023	02.03.2023 (8 Weeks)
6	Second Mid Term Examinations	03.03.2023	09.03.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	10.03.2023	16.03.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	16.03.2023	
9	End Semester Examinations	17.03.2023	01.04.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 91

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	**03.04.2023**	
2	1st Spell of Instructions (including Summer Vacation)	03.04.2023	10.06.2023 (10 Weeks)
	Summer Vacation	15.05.2023	27.05.2023 (2 Weeks)
3	First Mid Term Examinations	12.06.2023	17.06.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	23.06.2023	
5	2nd Spell of Instructions	19.06.2023	12.08.2023 (8 Weeks)
6	Second Mid Term Examinations	14.08.2023	19.08.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	21.08.2023	26.08.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	26.08.2023	
9	End Semester Examinations	28.08.2023	09.09.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 90

28/10/22

REGISTRAR

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

MBA/MCA II YEAR I & II SEMESTERS

I SEM

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork	**10.11.2022**	
2	1st Spell of Instructions	10.11.2022	04.01.2023 (8 Weeks)
3	First Mid Term Examinations	05.01.2023	11.01.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	19.01.2023	
5	2nd Spell of Instructions	12.01.2023	11.03.2023 (8 Weeks)
6	Second Mid Term Examinations	13.03.2023	18.03.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	20.03.2023	25.03.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	25.03.2023	
9	End Semester Examinations	***27.03.2023***	***12.04.2023 (2 Weeks)***

Note: No. of Working / Instructional Days: 93

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	*13.04.2023*	
2	1st Spell of Instructions (including Summer Vacation)	13.04.2023	21.06.2023 (10 Weeks)
3	**Summer Vacation**	***15.05.2023***	***27.05.2023 (2 Weeks)***
4	First Mid Term Examinations	22.06.2023	28.06.2023 (1 Week)
5	Submission of First Mid Term Exam Marks to the University on or before	04.07.2023	
6	2nd Spell of Instructions	30.06.2023	24.08.2023 (8 Weeks)
7	Second Mid Term Examinations	25.08.2023	31.08.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	01.09.2023	08.09.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	08.09.2023	
10	End Semester Examinations	**09.09.2023**	**23.09.2023 (2 Weeks)**

Note: No. of Working / Instructional Days: 92

22/10/22

REGISTRAR

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, Recg. By Govt. of T.S & Affiliated to JNTUH, Hyderabad)

NAAC "B++" Accredited Institute

Gunthapally (V), Abdullapurmet(M), RR Dist, Near Ramoji Film City, Hyderabad -501512.

www.aietg.ac.in email: principal.avanthi@gmail.com

INSTITUTION ACADEMIC CALENDAR FOR THE ACADEMIC YEAR 2022-23

IST -SEM

ACTIVITY	DATE
COLLEGE ACADEMIC COMMITTEE MEETING	22-08-2022
IQAC MEETING -I	22-08-2022
COMMENCEMENT OF CLASS WORK IV B TECH	29-08-2022
Ist SPELL OF INSTRUCTIONS IV B TECH	29-08-2022
CRT TRAINING FOR IV B. TECH	
VINAYAKA CHAVITHI HOLIDAY	31-08-2022
TEACHERS DAY CELEBRATIONS	05-09-2022
COMMENCEMENT OF CLASS WORK III B TECH	09-09-2022
Ist SPELL OF INSTRUCTIONS III B TECH	09-09-2022
PLANNING TO ORGANIZE WORKSHOP ON PROFESSIONALISM AND ETHICS	13-09-2022 TO 18-09-2022
ENGINEERS DAY CELEBRATIONS	15-09-2022
Ist SPELL OF INSTRUCTIONS II B TECH	19-09-2022
BATHUKAMMA STARTING DAY HOLIDAY	25-09-2022
MAHATMA GANDHI JAYANTHI HOLIDAY	02-10-2022
DUSSEHRA HOLIDAYS	03-10-2022 TO 08-10-2022
COMMENCEMENT OF CLASS WORK I MBA	03-10-2022
Ist SPELL OF INSTRUCTIONS I MBA	03-10-2022
COMMENCEMENT OF CLASS WORK II MTECH	21-10-2022
Ist SPELL OF INSTRUCTIONS II MTECH	21-10-2022
DEEPAVALI HOLIDAY	25-10-2022
COMMENCEMENT OF CLASS WORK I MTECH	26-10-2022
Ist SPELL OF INSTRUCTIONS I MTECH	26-10-2022

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY ★ GUNTHAPALLY (V) ABDULLAPURMET (M) R.R. DISTRICT.

I[st] MID EXAMINATIONS IV B TECH	01-11-2022
INDUCTION PROGRAM FOR I B TECH	03-11-2022
I[st] SPELL OF INSTRUCTIONS I B TECH	04-11-2022
GURU NANAK JAYANTHI HOLIDAY	08-11-2022
IIND SPELLOF INSTRUCTIONS IV B TECH	09-11-2022
COMMENCEMENT OF CLASS WORK II MBA	10-11-2022
PLANNING TO ORGANIZE ORIENTATION DAY	10-11-2022
I[st] SPELL OF INSTRUCTIONS II MBA	10-11-2022
I[st] MID EXAMINATIONS III B TECH	11-11-2022
IIND SPELLOF INSTRUCTIONS III B TECH	18-11-2022
COMMENCEMENT OF CLASS WORK II B TECH	28-11-2022
PLANNING TO CONDUCT INDUSTRIAL VISITS B TECH & MBA	01-12-2022 TO 03-12-2022
I[st] MID EXAMINATIONS I MBA	04-12-2022
PLANNING ORGANIZE SEMINAR ON WEB PAGE DESIGN	06-12-2022 TO 09-12-2022
IIND SPELLOF INSTRUCTIONS I MBA	12-12-2022
PLANNING TO ORGANIZE FDP ON RECENT TRENDS IN DIGITAL SIGNAL PROCESSING SYSTEM DESIGN BY DEPARTMENT OF ECE	12-12-2022 TO 16-12-2022
PLANNING TO CONDUCT ANTI RAGGING MEETING	14-12-2022 TO 16-12-2022
I[st] MID EXAMINATIONS II MTECH	16-12-2022
I[st] MID EXAMINATIONS I MTECH	21-12-2022
PLANNING TO CONDUCT WORKSHOP ON ELECTRIC VEHICLES CARRER OPPORTUNITIES	21-12-2022 TO 27-12-2022
II[nd] SPELLOF INSTRUCTIONS II MTECH	23-12-2022
PLANNING TO ORGANIZE FRESHERS' DAY	23-12-2022 TO 24-12-2022
CHRISTMAS HOLIDAY	25-12-2022
BOXING DAY HOLIDAY	26-12-2022

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
GUNTHAPALLY (V), ABDULLAPURMET (M), R.R. DISTRICT.

I[st] MID EXAMINATIONS I B TECH	29-12-2022
PLANNING TO ORGANIZE SPORTS DAY	27-12-2022 TO 29-12-2022
II[nd] SPELLOF INSTRUCTIONS I MTECH	29-12-2022
NEW YEAR CELEBRATIONS	31-12-2022
NEW YEAR HOLIDAY	01-01-2023
PLANNING TO CONDUCT INTERNSHIP TRAINING PROGRAM FOR IV B TECH	02-01-2023 TO 29-04-2023
II[nd] MID EXAMINATIONS IV B TECH	04-01-2023
II[nd] SPELLOF INSTRUCTIONS I B TECH	05-01-2023
I[st] MID EXAMINATIONS II MBA	05-01-2023
PREPARATION AND PRACTICLE EXAMINATIONS IV B TECH	11-01-2023
II[nd] SPELLOF INSTRUCTIONS II MBA	12-01-2023
SANKRANTHI/PONGAL HOLIDAYS	14-01-2023 TO 15-01-2023
II[nd] MID EXAMINATIONS III B TECH	16-01-2023
END SEMESTER EXAMINATIONS IV B TECH	20-01-2023
I[st] MID EXAMINATIONS II B TECH	23-01-2023
PREPARATION AND PRACTICLE EXAMINATIONS III B TECH	23-01-2023
REPUBLIC DAY CELEBRATIONS	26-01-2023
II[nd] SPELLOF INSTRUCTIONS II YR B TECH	30-01-2023
END SEMESTER EXAMINATIONS III YR B TECH	30-01-2023
II[nd] MID EXAMINATIONS I MBA	12-02-2023
PLANNING TO CONDUCT INDUSTRIAL VISITS II MBA	13-02-2023 TO 17-02-2023
II[nd] MID EXAMINATIONS II MTECH	17-02-2023
MAHA SHIVARATRI HOLIDAY	18-02-2023
PREPARATION AND PRACTICLE EXAMINATIONS I MBA	19-02-2023
PLANNING TO ORGANIZE FDP ON BIG DATA ANALYTICS BY DEPARTMENT OF CSE	20-02-2023 TO 24-02-2023

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
GUNTHAPALLY (V)
ABDULLAPURMET (M)
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PREPARATION AND PRACTICLE EXAMINATIONS II MTECH	24-02-2023
END SEMESTER EXAMINATIONS I MBA	26-02-2023
IInd MID EXAMINATIONS I MTECH	27-02-2023
IInd MID EXAMINATIONS I B TECH	03-03-2023
END SEMESTER EXAMINATIONS II MTECH	03-03-2023
PLANNING TO ORGANIZE TRADITIONAL DAY	04-03-2023 TO 06-03-2023
PREPARATION AND PRACTICLE EXAMINATIONS I MTECH	06-03-2023
HOLI HOLIDAY	07-03-2023
INTERNATIONAL WOMEN'S DAY CELEBRATIONS	08-03-2023
PREPARATION AND PRACTICLE EXAMINATIONS I B TECH	10-03-2023
PLANNING TO ORGANIZE FDP ON SOLAR POWER SYSTEM BY DEPARTMENT OF EEE	12-03-2023 TO 16-03-2023
END SEMESTER EXAMINATIONS I MTECH	13-03-2023
IInd MID EXAMINATIONS II MBA	13-03-2023
INAUGURATION AND MOU EXCHANGE PROGRAM FOR LAUNCHING PEGA UNIVERSITY PROGRAM	15-03-2023
PLANNING TO CONDUCT GUEST LECTURES FOR II B TECH	15-03-2023 TO 25-03-2023
END SEMESTER EXAMINATIONS I B TECH	17-03-2023
PREPARATION AND PRACTICLE EXAMINATIONS II MBA	20-03-2023
UGADHI HOLIDAY	22-03-2023
END SEMESTER EXAMINATIONS II MBA	27-03-2023
SRI RAMANAVAMI HOLIDAY	30-03-2023
IInd MID EXAMINATIONS II B TECH	31-03-2023
BABU JAGJIVANRAM JAYANTHI HOLIDAY	05-04-2023
GOOD FRIDAY HOLIDAY	07-04-2023
PREPARATION AND PRACTICLE EXAMINATIONS II B TECH	10-04-2023

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
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DR B R AMBEDKAR JAYANTHI HOLIDAY	14-04-2023
END SEMESTER EXAMINATIONS II B TECH	17-04-2023

IInd -SEM

ACTIVITY	DATE
COMMENCEMENT OF CLASS WORK IV BTECH	03-02-2023
I[st] SPELL OF INSTRUCTIONS IV BTECH	03-02-2023
COMMENCEMENT OF CLASS WORK III BTECH	13-02-2023
I[st] SPELL OF INSTRUCTIONS III BTECH	13-02-2023
CRT TRAINING FOR III B. TECH	
COMMENCEMENT OF CLASS WORK II MBA	14-03-2023
I[st] SPELL OF INSTRUCTIONS II MBA	14-03-2023
COMMENCEMENT OF CLASS WORK I MBA	27-03-2023
I[st] SPELL OF INSTRUCTIONS I MBA	27-03-2023
I[st] MID EXAMINATIONS IV BTECH	01-04-2023
COMMENCEMENT OF CLASS WORK I BTECH	03-04-2023
I[st] SPELL OF INSTRUCTIONS I BTECH	03-04-2023
I[st] MID EXAMINATIONS III BTECH	10-04-2023
II[nd] SPELLOF INSTRUCTIONS IV BTECH	10-04-2023
II[nd] SPELLOF INSTRUCTIONS III BTECH	17-04-2023
IQAC MEETING -II	19-04-2023
RAMZAN HOLIDAY	22-04-2023
PLANNING TO ORAGANIZE TECH RESONANCE 2K23	24-04-2023 TO 29-04-2023
COMMENCEMENT OF CLASS WORK II BTECH	01-05-2023
I[st] SPELL OF INSTRUCTIONS II BTECH	01-05-2023

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
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PLANNING TO CONDUCT INDUSTRIAL VISITS	12-05-2023 TO 14-05-2023
PLANNING TO ORGANIZE FDP ON BY DEPARTMENT OF MECHANICAL ENGINEERING	15-05-2023 TO 19-05-2023
SUMMER VACATION	15-05-2023 TO 27-05-2023
PLANNING TO CONDUCT INTERNSHIP TRAINING PROGRAM FOR II B TECH	15-05-2023 TO 31-05-2023
Ist MID EXAMINATIONS II MBA	28-05-2023
IInd SPELLOF INSTRUCTIONS II MBA	03-06-2023
Ist MID EXAMINATIONS I MBA	05-06-2023
PLANNING TO CONDUCT GUEST LECTURES FOR III&IV B TECH	07-06-2023 TO 19-06-2023
Ist MID EXAMINATIONS I BTECH	12-06-2023
IInd SPELLOF INSTRUCTIONS I MBA	12-06-2023
PLANNING TO ORGANIZE YOUTH FEST	15-06-2023 TO 17-06-2023
IInd SPELLOF INSTRUCTIONS I BTECH	19-06-2023
IInd MID EXAMINATIONS IV BTECH	19-06-2023
IInd MID EXAMINATIONS III BTECH	26-06-2023
PREPARATION AND PRACTICLE EXAMINATIONS IV BTECH	26-06-2023
BAKRID HOLIDAY	29-06-2023
PREPARATION AND PRACTICLE EXAMINATIONS III BTECH	03-07-2023
END SEMISTER EXAMINATIONS IV BTECH	03-07-2023
Ist MID EXAMINATIONS II BTECH	10-07-2023
END SEMISTER EXAMINATIONS III BTECH	10-07-2023
PLANNING TO CONDUCT GUEST LECTURES FOR II B TECH	15-07-2023 TO 24-07-2023
BONALU HOLIDAY	17-07-2023
IInd SPELLOF INSTRUCTIONS II BTECH	18-07-2023
PLANNING TO ORGANIZE GRADUATION DAY	21-07-2023 TO 24-07-2023
MOHARAM HOLIDAY	29-07-2023

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
GUNTHAPALLY (V) ABDULLAPURMET (M) R.R. DISTRICT.

PLANNING TO CONDUCT INDUSTRIAL VISITS	01-08-2023 TO 10-08-2023
IInd MID EXAMINATIONS II MBA	05-08-2023
IInd MID EXAMINATIONS I MBA	09-08-2023
PLANNING TO ORAGANIZE TREE PLANTATION	09-08-2023 TO 12-08-2023
PREPARATION AND PRACTICLE EXAMINATIONS II MBA	12-08-2023
IInd MID EXAMINATIONS I BTECH	14-08-2023
INDEPENDENCE DAY CELEBRATIONS	15-08-2023
PREPARATION AND PRACTICLE EXAMINATIONS I MBA	17-08-2023
END SEMISTER EXAMINATIONS II MBA	19-08-2023
PREPARATION AND PRACTICLE EXAMINATIONS I BTECH	21-08-2023
END SEMISTER EXAMINATIONS I MBA	24-08-2023
END SEMISTER EXAMINATIONS I BTECH	28-08-2023
SRI KRISHNA ASHTAMI HOLIDAY	07-09-2023
IInd MID EXAMINATIONS II BTECH	12-09-2023
VINAYAKA CHAVITHI HOLIDAY	18-09-2023
PREPARATION AND PRACTICLE EXAMINATIONS II BTECH	19-09-2023
END SEMISTER EXAMINATIONS II BTECH	25-09-2023

IQAC COORDINATOR

CO ORDINATOR
Avanthi Institute of Engineering & Technology,
Gunthapally (V), Abdullapur Met (Mdl),
Ranga Reddy Dist, Telangana.

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2. All HODs
3. Office

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
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R.R. DISTRICT.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT ACADEMIC CALENDAR 2022-23

IST -SEM

ACTIVITY	DATE
DEPARTMENT ACADEMIC COMMITTEE MEETING	22-08-2022
WORK LOAD & TIME TABLE PREPARATION	25-08-2022
COMMENCEMENT OF CLASS WORK IV B TECH	29-08-2022
Ist SPELL OF INSTRUCTIONS IV B TECH	29-08-2022
CRT TRAINING FOR IV B. TECH	
VINAYAKA CHAVITHI HOLIDAY	31-08-2022
TEACHERS DAY CELEBRATIONS	05-09-2022
COMMENCEMENT OF CLASS WORK III B TECH	09-09-2022
Ist SPELL OF INSTRUCTIONS III B TECH	09-09-2022
ENGINEERS DAY CELEBRATIONS	15-09-2022
Ist SPELL OF INSTRUCTIONS II B TECH	19-09-2022
BATHUKAMMA STARTING DAY HOLIDAY	25-09-2022
MAHATMA GANDHI JAYANTHI HOLIDAY	02-10-2022
DUSSEHRA HOLIDAYS	03-10-2022 TO 08-10-2022
COMMENCEMENT OF CLASS WORK II MTECH	21-10-2022
PREPARATION OF PROJECT WOEK PROPOSALS II M TECH	21-10-2022
Ist SPELL OF INSTRUCTIONS II MTECH	21-10-2022
DEEPAVALI HOLIDAY	25-10-2022
COMMENCEMENT OF CLASS WORK I MTECH	26-10-2022
Ist SPELL OF INSTRUCTIONS I MTECH	26-10-2022
Ist MID EXAMINATIONS IV B TECH	01-11-2022

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
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GURU NANAK JAYANTHI HOLIDAY	08-11-2022
IIND SPELLOF INSTRUCTIONS IV B TECH	09-11-2022
I[st] MID EXAMINATIONS III B TECH	11-11-2022
SUBMISSION OF IV B TECH MID-I MARKS TO UNIVERSITY	12-11-2022
PROJECT WORK REVIEW-I II M.TECH	18-11-2022
IIND SPELLOF INSTRUCTIONS III B TECH	18-11-2022
SUBMISSION OF III B TECH MID-I MARKS TO UNIVERSITY	24-11-2022
COMMENCEMENT OF CLASS WORK II B TECH	28-11-2022
PLANNING TO CONDUCT INDUSTRIAL VISITS	01-12-2022 TO 03-12-2022
PLANNING ORGANIZE SEMINAR ON WEB PAGE DESIGN	06-12-2022 TO 09-12-2022
PLANNING TO CONDUCT ANTI RAGGING MEETING	14-12-2022 TO 16-12-2022
I[st] MID EXAMINATIONS II MTECH	16-12-2022
I[st] MID EXAMINATIONS I MTECH	21-12-2022
II[nd] SPELLOF INSTRUCTIONS II MTECH	23-12-2022
PLANNING TO ORGANIZE FRESHERS' DAY	23-12-2022 TO 24-12-2022
CHRISTMAS HOLIDAY	25-12-2022
BOXING DAY HOLIDAY	26-12-2022
PLANNING TO ORGANIZE SPORTS DAY	27-12-2022 TO 29-12-2022
II[nd] SPELLOF INSTRUCTIONS I MTECH	29-12-2022
SUBMISSION OF II M TECH MID-I MARKS TO UNIVERSITY	30-12-2022
NEW YEAR CELEBRATIONS	31-12-2022
NEW YEAR HOLIDAY	01-01-2023
PLANNING TO CONDUCT INTERNSHIP TRAINING PROGRAM FOR IV B TECH	02-01-2023 TO 29-04-2023
SUBMISSION OF I M TECH MID-I MARKS TO UNIVERSITY	04-01-2023
II[nd] MID EXAMINATIONS IV B TECH	04-01-2023

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PREPARATION AND PRACTICLE EXAMINATIONS IV B TECH	11-01-2023
SANKRANTHI/PONGAL HOLIDAYS	14-01-2023 TO 15-01-2023
IInd MID EXAMINATIONS III B TECH	16-01-2023
SUBMISSION OF IV B TECH MID-II MARKS TO UNIVERSITY	17-01-2023
END SEMESTER EXAMINATIONS IV B TECH	20-01-2023
Ist MID EXAMINATIONS II B TECH	23-01-2023
PREPARATION AND PRACTICLE EXAMINATIONS III B TECH	23-01-2023
REPUBLIC DAY CELEBRATIONS	26-01-2023
IInd SPELLOF INSTRUCTIONS II YR B TECH	30-01-2023
END SEMESTER EXAMINATIONS III YR B TECH	30-01-2023
SUBMISSION OF III B TECH MID-II MARKS TO UNIVERSITY	30-01-2023
SUBMISSION OF II B TECH MID-I MARKS TO UNIVERSITY	04-02-2023
IInd MID EXAMINATIONS II MTECH	17-02-2023
MAHA SHIVARATRI HOLIDAY	18-02-2023
PLANNING TO ORGANIZE FDP ON BIG DATA ANALYTICS	20-02-2023 TO 24-02-2023
PREPARATION AND PRACTICLE EXAMINATIONS II MTECH	24-02-2023
IInd MID EXAMINATIONS I MTECH	27-02-2023
SUBMISSION OF II M TECH MID-II MARKS TO UNIVERSITY	01-03-2023
END SEMESTER EXAMINATIONS II MTECH	03-03-2023
PLANNING TO ORGANIZE TRADITIONAL DAY	04-03-2023 TO 06-03-2023
PREPARATION AND PRACTICLE EXAMINATIONS I MTECH	06-03-2023
HOLI HOLIDAY	07-03-2023
INTERNATIONAL WOMEN'S DAY CELEBRATIONS	08-03-2023
SUBMISSION OF I M TECH MID-II MARKS TO UNIVERSITY	11-03-2023
END SEMESTER EXAMINATIONS I MTECH	13-03-2023

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PLANNING MOU EXCHANGE PROGRAM FOR LAUNCHING PEGA UNIVERSITY PROGRAM	15-03-2023
PLANNING TO CONDUCT GUEST LECTURES FOR II B TECH	15-03-2023 TO 25-03-2023
PREPARATION AND PRACTICLE EXAMINATIONS II MBA	20-03-2023
UGADHI HOLIDAY	22-03-2023
SRI RAMANAVAMI HOLIDAY	30-03-2023
IInd MID EXAMINATIONS II B TECH	31-03-2023
BABU JAGJIVANRAM JAYANTHI HOLIDAY	05-04-2023
GOOD FRIDAY HOLIDAY	07-04-2023
PREPARATION AND PRACTICLE EXAMINATIONS II B TECH	10-04-2023
DR B R AMBEDKAR JAYANTHI HOLIDAY	14-04-2023
SUBMISSION OF II B TECH MID-II MARKS TO UNIVERSITY	15-04-2023
END SEMESTER EXAMINATIONS II B TECH	17-04-2023

IInd -SEM

ACTIVITY	DATE
WORK LOAD & TIME TABLE PREPARATION	31-01-2023
COMMENCEMENT OF CLASS WORK IV BTECH	03-02-2023
Ist SPELL OF INSTRUCTIONS IV BTECH	03-02-2023
COMMENCEMENT OF CLASS WORK III BTECH	13-02-2023
Ist SPELL OF INSTRUCTIONS III BTECH	13-02-2023
CRT TRAINING FOR III B. TECH	
COMMENCEMENT OF II MTECH II SEMESTER	17-03-2023
PROJECT WORK REVIEW -II PAHSE-I	17-03-2023

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COMMENCEMENT OF I MTECH II SEMESTER	27-03-2023
IST SPELL OF INSTRUCTIONS I MTECH	27-03-2023
Ist MID EXAMINATIONS IV BTECH	01-04-2023
Ist MID EXAMINATIONS III BTECH	10-04-2023
IInd SPELLOF INSTRUCTIONS IV BTECH	10-04-2023
SUBMISSION OF IV B TECH MID-I MARKS TO UNIVERSITY	15-04-2023
IInd SPELLOF INSTRUCTIONS III BTECH	17-04-2023
SUBMISSION OF PRC-II MARKS TO UNIVERSITY	20-04-2023
RAMZAN HOLIDAY	22-04-2023
SUBMISSION OF III B TECH MID-I MARKS TO UNIVERSITY	23-04-2023
PLANNING TO ORAGANIZE TECH RESONANCE 2K23	24-04-2023 TO 29-04-2023
COMMENCEMENT OF CLASS WORK II BTECH	01-05-2023
Ist SPELL OF INSTRUCTIONS II BTECH	01-05-2023
PLANNING TO CONDUCT INDUSTRIAL VISITS	12-05-2023 TO 14-05-2023
SUMMER VACATION	15-05-2023 TO 27-05-2023
PLANNING TO CONDUCT INTERNSHIP TRAINING PROGRAM FOR II B TECH	15-05-2023 TO 31-05-2023
Ist MID EXAMINATIONS I MTECH	05-06-2023
PLANNING TO CONDUCT GUEST LECTURES FOR III&IV B TECH	07-06-2023 TO 19-06-2023
IIND SPELL OF INSTRUCTIONS I M TECH	12-06-2023
PLANNING TO ORGANIZE YOUTH FEST	15-06-2023 TO 17-06-2023
SUBMISSION OF I M TECH MID-I MARKS TO UNIVER SITY	17-06-2023
IInd MID EXAMINATIONS IV BTECH	19-06-2023
IInd MID EXAMINATIONS III BTECH	26-06-2023
PREPARATION AND PRACTICLE EXAMINATIONS IV BTECH	26-06-2023
BAKRID HOLIDAY	29-06-2023

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SUBMISSION OF IV B TECH MID-II MARKS TO UNIVERSITY	01-07-2023
PREPARATION AND PRACTICLE EXAMINATIONS III BTECH	03-07-2023
END SEMISTER EXAMINATIONS IV BTECH	03-07-2023
SUBMISSION OF III B TECH MID-II MARKS TO UNIVERSITY	08-07-2023
Ist MID EXAMINATIONS II BTECH	10-07-2023
END SEMISTER EXAMINATIONS III BTECH	10-07-2023
PLANNING TO CONDUCT GUEST LECTURES FOR II B TECH	15-07-2023 TO 24-07-2023
BONALU HOLIDAY	17-07-2023
IInd SPELLOF INSTRUCTIONS II BTECH	18-07-2023
PLANNING TO ORGANIZE GRADUATION DAY	21-07-2023 TO 24-07-2023
SUBMISSION OF II B TECH MID-I MARKS TO UNIVERSITY	22-07-2023
MOHARAM HOLIDAY	29-07-2023
PLANNING TO CONDUCT INDUSTRIAL VISITS	01-08-2023 TO 10-08-2023
PLANNING TO ORAGANIZE TREE PLANTATION	09-08-2023 TO 12-08-2023
IInd MID EXAMINATIONS I M TECH	09-08-2023
INDEPENDENCE DAY CELEBRATIONS	15-08-2023
PREPARATION AND PRACTICAL EXAMINATIONS I M TECH	17-08-2023
SUBMISSION OF I M TECH MID-II MARKS TO UNIVERSITY	23-08-2023
END SEMISTER EXAMINATIONS I M TECH	24-08-2023
PROJECT WORK REVIEW - III	28-08-2023
SRI KRISHNA ASHTAMI HOLIDAY	07-09-2023
SUBMISSION OF PROJECT WORK REVIEW-III MARKS TO UNIVERSITY	09-09-2023
IInd MID EXAMINATIONS II BTECH	12-09-2023
VINAYAKA CHAVITHI HOLIDAY	18-09-2023
PREPARATION AND PRACTICLE EXAMINATIONS II BTECH	19-09-2023

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SUBMISSION OF II B TECH MID-II MARKS TO UNIVERSITY	23-09-2023
END SEMISTER EXAMINATIONS II BTECH	25-09-2023

HOD
Head of the Department
Computer Science & Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl)
Ranga Reddy District. Telangana.

Copy to:

1. Principal
2. All Department Faculty
3. Students
4. Library
5. Office

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by State Act No. 30 of 2008)

Kukatpally, Hyderabad, Telangana (India).

ACADEMIC REGULATIONS (R22) FOR B.TECH REGULAR STUDENTS WITH EFFECT FROM THE ACADEMIC YEAR 2022-23

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

Jawaharlal Nehru Technological University Hyderabad (JNTUH) offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) at its non-autonomous constituent and affiliated colleges with effect from the academic year **2022-23.**

2.0 Eligibility for Admission

2.1 Admission to the undergraduate(UG) programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instructions for the entire undergraduate programme in Engineering & Technology will be **English** only.

3.0 B.Tech. Programme Structure

3.1 A student after securing admission shall complete the B.Tech. programme in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course. Each student shall secure 160 credits (with CGPA ≥ 5) required for the completion of the undergraduate programme and award of the B.Tech. degree.

3.2 **UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1 Semester Scheme

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Each undergraduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters of 22 weeks (≥ 90 instructional days) each and in each semester - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) indicated by UGC, and curriculum/course structure suggested by AICTE are followed.

3.2.2 Credit Courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one hour/ week/ semester for Theory/ Lecture (L) courses or Tutorials.
- One credit for two hours/ week/ semester for Laboratory/ Practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab are mandatory courses. These courses will not carry any credits.

3.2.3 Subject Course Classification

All subjects/ courses offered for the undergraduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The University has followed almost all the guidelines issued by AICTE/UGC.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry subjects
2		ES - Engineering Sciences	Includes Fundamental Engineering Subjects
3		HS – Humanities and Social Sciences	Includes subjects related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses (EℓC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	Project Work	B.Tech. Project or UG Project or UG Major Project or Project Stage I & II

8		Industry Training/ Internship/ Industry Oriented Mini-project/ Mini- Project/ Skill Development Courses	Industry Training/ Internship/ Industry Oriented Mini-Project/ Mini-Project/ Skill Development Courses
9		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Minor Courses	-	1 or 2 Credit Courses (subset of HS)
11	Mandatory Courses (MC)	-	Mandatory Courses (non-credit)

4.0 Course Registration

4.1 A 'faculty advisor or counselor' shall be assigned to a group of 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The on-line registration requests for any 'current semester' shall be **completed before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'**.

4.3 A student can apply for **on-line** registration, **only after** obtaining the '**written approval**' from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department, Faculty Advisor/ Counselor and the student.

4.4 A student may be permitted to register for all the subjects/ courses in a semester as specified in the course structure with maximum additional subject(s)/course(s) limited to 6 Credits (any 2 elective subjects), based on **progress** and SGPA/ CGPA, and completion of the '**pre-requisites'** as indicated for various subjects/ courses, in the department course structure and syllabus contents.

4.5 Choice for '**additional subjects/ courses**', not more than any 2 elective subjects in any Semester, must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Mentor/HOD.

4.6 If the student submits ambiguous choices or multiple options or erroneous entries during **on-line** registration for the subject(s) / course(s) under a given/ specified course group/ category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.

4.7 Subject/ course options exercised through **on-line** registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/ course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within **a week** after the commencement of class-work for that semester.

4.8 Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor 'within a period of 15 days' from the beginning of the current semester.

4.9 **Open Electives**: The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by his own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.) of subjects even in the forthcoming semesters.

4.10 **Professional Electives**: The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

5.0 Subjects/ courses to be offered

5.1 A subject/ course may be offered to the students, **only if** a minimum of 15 students opt for it.

5.2 More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on - '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

5.3 If more entries for registration of a subject come into picture, then the Head of the Department concerned shall decide, whether or not to offer such a subject/ course for **two (or multiple) sections**.

5.4 In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the student of the '**parent department**'.

6.0 Attendance requirements:

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6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (including attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab) for that semester. **Two periods** of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. **This attendance should also be included in the attendance uploaded every fortnight in the University Website.**

6.2 Shortage of attendance in aggregate upto 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable for condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in **NO** case be condoned.

6.5 **Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled,** including all academic credentials (internal marks etc.) of that semester. **They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking re-admission into that semester as and when offered; if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0 Academic Requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in Item No. **6**.

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40 marks including minimum 35% of average Mid-Term examinations for 25 marks) in the internal examinations, not less than 35% (21 marks out of 60 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject/ course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is

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deemed to have failed, if he (i) does not submit a report on Industry Oriented Mini Project/Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	**First year first semester to first year second semester**	**Regular course of study of first year first semester.**
2	**First year second semester to Second year first semester**	**(i) Regular course of study of first year second semester.** **(ii) Must have secured at least 20 credits out of 40 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
3.	**Second year first semester to Second year second semester**	**Regular course of study of second year first semester.**
4	**Second year second semester to Third year first semester**	**(i) Regular course of study of second year second semester.** **(ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
5	**Third year first semester to Third year second semester**	**Regular course of study of third year first semester.**
6	**Third year second semester to Fourth year first semester**	**(i) Regular course of study of third year second semester.** **(ii) Must have secured at least 72 credits out of 120 credits i.e., 60% credits up to third year second**

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		semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	**Fourth year first semester to Fourth year second semester**	**Regular course of study of fourth year first semester.**

7.4 A student (i) shall register for all courses/subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA $\geq$ 5.0 (in each semester), and CGPA $\geq$ 5 (at the end of 8 semesters), (iv) **passes all the mandatory courses,** to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA **(at the end of undergraduate programme),** and shall be indicated in the grade card / marks memo of IV-year II semester.

7.5 If a student registers for '**extra subjects'** (in the parent department or other departments/branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his department, the performances in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be considered while calculating the SGPA and CGPA. For such **'extra subjects'** registered, percentage of marks and letter grade alone will be indicated in the grade card / marks memo as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations Items 6 and 7.1 – 7.4 above.

7.6 A student eligible to appear in the semester end examination for any subject/ course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.7 A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements**. The academic regulations under which a student has been re-admitted shall be applicable. Further, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which the student has been detained.

7.8 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of academic credits.** The academic regulations under which the student has been readmitted shall be applicable to him.

8.0 Evaluation - Distribution and Weightage of Marks

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8.1 The performance of a student in every subject/course (including practicals and Project Stage – I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

8.2 In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 15 marks with a total duration of 2 hours as follows:

1. Mid_Term Examination for 25 marks:
   a. Part - A : Objective/quiz paper for 10 marks.
   b. Part – B : Descriptive paper for 15 marks.

Student shall have to earn 35%, i.e 9 marks out of 25 marks from average of two mid-term examinations (I Mid-Term & II Mid-Term).

The remaining 15 marks of Continuous Internal Assessment (out of 40) are distributed as:

2. Assignment for 5 marks. (Average of 2 Assignments each for 5 marks)
3. Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 10 marks.

- The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 5 full questions out of which, the student has to answer 3 questions, each carrying 5 marks. The student has to get minimum of 35% (on 25 marks allocated for Mid-Term examinations) on average of two Mid-Term examinations.

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the subject concerned for 10 marks before II Mid-Term Examination.

The details of the end semester question paper pattern are as follows:

8.2.1 The semester end examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.

- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.
- The duration of Semester End Examination is 3 hours.

8.3 For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks
2. **10 marks for viva-voce (**or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the examination branch of the University.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course

8.4 The evaluation of courses having ONLY internal marks in I-Year I Semester and II-Year II Semester is as follows:

1. I Year I Semester course (*ex., Elements of CE/ME/EEE/ECE/CSE*): The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

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2. II Year II Semester *Real-Time (or) Field-based Research Project* course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

8.5 There shall be an Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.

8.6 The UG project shall be initiated at the end of the IV Year I Semester and the duration of the project work is one semester. The student must present Project Stage – I during IV Year I Semester before II Mid examinations, in consultation with his Supervisor, the title, objective and plan of action of his Project work to the departmental committee for approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start his project work.

8.7 UG project work shall be carried out in two stages: Project Stage – I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage – II during IV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEE Theory examinations.

8.8 For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

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A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.9 For Project Stage – II, the external examiner shall evaluate the project work for 60 marks and the internal project commiittee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project/ Internship/SDC etc. and the main Project shall be different from the topic already taken. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project, University selects an external examiner from the list of experts in the relevant branch submitted by the Principal of the College.

A student who has failed, may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.10 A student shall be given one time chance to re-register for a maximum of two subjects:

- If the internal marks secured by a candidate in Mid examinations (average of two mid-term examinations consisting of Objective & descriptive parts) are less than 35% and failed in those subjects (or)
- failed in Assignment & Subject Viva-voce/ PPT/Poster Presentation/ Case Study on a topic in the concerned subject but fulfilled the attendance requirement.

A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in next academic year. Also, the student has to earn 35% of total internal marks (14 out of 40 marks including Mid-Term examinations, Assignment & Subject Viva-voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject).

In the event of the student taking this chance, his Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

9.0 Grading Procedure

9.1 Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory/Practicals/ Industry-Oriented Mini Project/Internship/SDC and Project Stage. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

9.2 As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A^+ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B^+ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	Ab	0

9.3 A student who has obtained an '**F**' grade in any subject shall be deemed to have '**failed**' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

9.4 To a student who has not appeared for an examination in any subject, '**Ab**' grade will be allocated in that subject, and he is deemed to have '**Failed**'. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.

9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

9.6 A student earns Grade Point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'Credit Points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit Points (CP) = Grade Point (GP) x Credits .... For a course

9.7 A student passes the subject/ course only when **GP ≥ 5 ('C' grade or above)**

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects/ courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\textbf{SGPA} = \{ \textstyle\sum_{i=1}^{N} C_i\, G_i \} / \{ \sum_{i=1}^{N} C_i \} \text{ .... For each semester,}$$

where 'i' is the subject indicator index (considering all subjects in a semester), 'N' is the no. of subjects **'registered'** for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses (of 160) in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\textbf{CGPA} = \{ \textstyle\sum_{j=1}^{M} C_j\, G_j \} / \{ \sum_{j=1}^{M} C_j \} \text{ ... for all S semesters registered}$$

(i.e., up to and inclusive of S semesters, S ≥ 2),

where **'M'** is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has **'registered'** i.e., from the 1^{st} semester onwards up to and inclusive of the 8^{th} semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	C	5	4 x 5 = 20
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	C	5	3 x 5 = 15
	21			152

SGPA = 152/21 = 7.24

Illustration of Calculation of CGPA up to 3rd Semester:

Semester	Course/ Subject Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point (GP)	Credit Points (CP)
I	Course 1	3	A	8	24

I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	**69**		**Total Credit Points**	**518**

CGPA = 518/69 = 7.51

The calculation process of CGPA illustrated above will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. programme.

9.10 For merit ranking or comparison purposes or any other listing, **only** the '**rounded off**' values of the CGPAs will be used.

9.11 SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0 Passing Standards

10.1 A student shall be declared successful or 'passed' in a semester, if he secures a GP ≥ 5 (**'C'** grade or above) in every subject/course in that semester (i.e. when the student gets an SGPA ≥ 5.0 at the end of that particular semester); and he shall be declared successful or 'passed' in the entire undergraduate programme, only when gets a CGPA ≥ 5.00 (**'C'** grade or above) for the award of the degree as required.

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10.2 After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.) and credits earned. **There is NO exemption of credits in any case.**

11.0 Declaration of results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

$$\% \text{ of Marks} = (\text{final CGPA} - 0.5) \times 10$$

12.0 Award of Degree

12.1 A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified**' for the award of B.Tech. degree in the branch of Engineering selected at the time of admission.

12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3 A student with final CGPA (at the end of the undergraduate programme) $>$ 8.00, and fulfilling the following conditions - shall be placed in '**First Class with Distinction**'. However, he

(i) Should have passed all the subjects/courses in '**First Appearance**' within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA $>$ 8 shall be placed in **'First Class'.**

12.4 Students with final CGPA (at the end of the undergraduate programme) $\geq$ 7.0 but $<$ 8.00 shall be placed in **'First Class'.**

12.5 Students with final CGPA (at the end of the undergraduate programme) $\geq$ 6.00 but $<$ 7.00, shall be placed in '**Second Class**'.

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme) $\geq$ 5.00 but $<$ 6, shall be placed in '**pass class**'.

12.7 A student with final CGPA (at the end of the undergraduate programme) $<$ 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**Gold Medal**'.

12.9 Award of 2-Year B.Tech. Diploma Certificate

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (with in 4 years from the date of admission) upto B. Tech. – II Year – II Semester, if the student want to exit the 4-Year B. Tech. program. The student **once opted and awarded for 2-Year UG Diploma Certificate, the student will not be permitted to join** in B. Tech. III Year – I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree.
2. A student may be permitted to take one year break after completion of II Year – II Semester or B. Tech. – III Year – II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

13.0 Withholding of results

13.1 If the student has not paid the fees to the University at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0 Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of R18 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R22 Regulations and he is required to complete the study of B.Tech./B. Pharmacy programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student who has been detained in any semester of II, III and IV years of R18 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech./B. Pharmacy within the stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

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3. A student of R18 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of R22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both R18 & R22 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The R22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in R22 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R22 Regulations. **There is NO exemption of credits in any case**.
6. If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the University.

Note: If a student readmitted to R22 Regulations and has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R22 Regulations, the College Principals concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

15.0 Student Transfers

15.1 There shall be no branch transfers after the completion of admission process.

15.2 There shall be no transfers from one college/stream to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.

15.3 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of JNTUH, and also pass the subjects of JNTUH which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of JNTUH, the students have to study those subjects in JNTUH in spite of the fact that those subjects are repeated.

15.4 The transferred students from other Universities/Institutions to JNTUH affiliated colleges who are on rolls are to be provided one chance to write the CBT (for internal marks) in the **equivalent subject(s)** as per the clearance letter issued by the University.

15.5 The autonomous affiliated colleges have to provide one chance to write the internal examinations in the **equivalent subject(s)** to the students transferred from other

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universities/institutions to JNTUH autonomous affiliated colleges who are on rolls, as per the clearance (equivalence) letter issued by the University.

16.0 Scope

16.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

16.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

16.3 The University may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the University authorities.

16.4 Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by State Act No. 30 of 2008)

Kukatpally, Hyderabad, Telangana (India).

ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME) FROM THE AY 2023-24

1. **Eligibility for the award of B.Tech Degree (LES)**

   The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 120 credits and secure 120 credits with CGPA ≥ 5 from II year to IV-year B.Tech. programme (LES) for the award of B.Tech. degree.

3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

5. **Promotion rule**

S. No	Promotion	Conditions to be fulfilled
1	**Second year first semester to second year second semester**	**Regular course of study of second year first semester.**
2	**Second year second semester to third year first semester**	**(i) Regular course of study of second year second semester.** **(ii) Must have secured at least 24 credits out of 40 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
3	**Third year first semester to third year second semester**	**Regular course of study of third year first semester.**
4	**Third year second semester to fourth year first semester**	**(i) Regular course of study of third year second semester.**

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		(ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	**Fourth year first semester to fourth year second semester**	**Regular course of study of fourth year first semester.**

6. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

7. LES students are not eligible for 2-Year B. Tech. Diploma Certificate.

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Malpractices Rules

Disciplinary Action For / Improper Conduct in Examinations

	Nature of Malpractices/Improper conduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled and sent to the University.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The

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		student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant – superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

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	result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject

		and all other subjects the student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award a suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.
2. Punishment for Institutions: (if the squad reports that the college is also involved in encouraging malpractices)
   a. A show-cause notice shall be issued to the college.
   b. Impose a suitable fine on the college.
   c. Shifting the examination center from one college to another college for a specific period of not less than one year.

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(Established by State Act No. 30 of 2008)

Kukatpally, Hyderabad, Telangana (India).

ACADEMIC REGULATIONS FOR B.TECH. REGULAR STUDENTS WITH EFFECT FROM ACADEMIC YEAR 2018-19 (R-18)

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

Jawaharlal Nehru Technological University Hyderabad (JNTUH) offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) at its non-autonomous constituent and affiliated colleges with effect from the academic year 2018-19.

2.0 Eligibility for admission

2.1 Admission to the under graduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instructions for the entire under graduate programme in Engineering & Technology will be **English** only.

3.0 B.Tech. Programme structure

3.1 A student after securing admission shall complete the B.Tech. programme in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course. Each student shall secure 160 credits (with CGPA ≥ 5) required for the completion of the under graduate programme and award of the B.Tech. degree.

3.2 **UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1 Semester scheme

Each under graduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters of 22 weeks (≥ 90 instructional days) each, each semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'

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under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) indicated by UGC, and curriculum/course structure as suggested by AICTE are followed.

3.2.2 Credit courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one hour/ week/ semester for theory/ lecture (L) courses or Tutorials.
- One credit for two hours/ week/ semester for laboratory/ practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab are mandatory courses. These courses will not carry any credits.

3.2.3 Subject Course Classification

All subjects/ courses offered for the under graduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The University has followed almost all the guidelines issued by AICTE/UGC.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes mathematics, physics and chemistry subjects
2		ES - Engineering Sciences	Includes fundamental engineering subjects
3		HS – Humanities and Social sciences	Includes subjects related to humanities, social sciences and management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses (EℓC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	Project Work	B.Tech. project or UG project or UG major project or Project Stage I & II
8		Industrial training/ Mini- project	Industrial training/ Summer Internship/ Industrial Oriented Mini-project/ Mini-project

9		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Minor courses	-	1 or 2 Credit courses (subset of HS)
11	Mandatory Courses (MC)	-	Mandatory courses (non-credit)

4.0 Course registration

4.1 A 'faculty advisor or counselor' shall be assigned to a group of 20 students, who will advise the students about the under graduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The on-line registration requests for any 'current semester' shall be **completed before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'**.

4.3 A student can apply for **on-line** registration, **only after** obtaining the '**written approval**' from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor/ counselor and the student.

4.4 A student may be permitted to register for all the subjects/ courses in a semester as specified in the course structure with maximum additional subject(s)/course(s) limited to 4 credits, based on **progress** and SGPA/ CGPA, and completion of the '**pre-requisites'** as indicated for various subjects/ courses, in the department course structure and syllabus contents.

4.5 Choice for '**additional subjects/ courses**' must be clearly indicated, which needs the specific approval and signature of the faculty advisor/ counselor.

4.6 If the student submits ambiguous choices or multiple options or erroneous entries during **on-line** registration for the subject(s) / course(s) under a given/ specified course group/ category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.

4.7 Subject/ course options exercised through **on-line** registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/ course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the head of the

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department, with due notification and time-framed schedule, within the **first week** after the commencement of class-work for that semester.

4.8 Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor 'within a period of 15 days' from the beginning of the current semester.

4.9 **Open electives**: The students have to choose three open electives (OE-I, II & III) from the list of open electives given. However, the student cannot opt for an open elective subject offered by his own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.

4.10 **Professional electives**: The students have to choose six professional electives (PE-I to VI) from the list of professional electives given.

5.0 **Subjects/ courses to be offered**

5.1 A typical section (or class) strength for each semester shall be 60.

5.2 A subject/ course may be offered to the students, **only if** a minimum of 20 students (1/3 of the section strength) opt for it. The maximum strength of a section is limited to 80 (60 + 1/3 of the section strength).

5.3 More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on - '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

5.4 If more entries for registration of a subject come into picture, then the Head of the Department concerned shall decide, whether or not to offer such a subject/ course for **two (or multiple) sections**.

5.5 In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the student of the '**parent department**'.

6.0 **Attendance requirements:**

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (excluding attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab) for that semester. Two periods of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. **This attendance should also be included in the fortnightly upload of attendance to the University.**

The attendance of Mandatory Non-Credit courses should be uploaded separately to the University.

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6.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable for condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in **no** case be condoned.

6.5 **Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking re-admission into that semester as and when offered; if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0 Academic requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.**6.**

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (26 marks out of 75 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject/ course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Industrial Oriented Mini Project/Summer Internship and seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he (i) does not submit a report on Industrial Oriented Mini Project/Summer Internship, or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar as required in the IV year I Semester, or (iii) secures less than 40% marks in Industrial Oriented Mini Project/Summer Internship and seminar evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

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7.3 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester to second year first semester	(i) Regular course of study of first year second semester. (ii) Must have secured at least 18 credits out of 37 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester to second year second semester	Regular course of study of second year first semester.
4	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 47 credits out of 79 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to third year second semester	Regular course of study of third year first semester.
6	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 73 credits out of 123 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

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7.4 A student (i) shall register for all courses/subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA $\geq$ 5.0 (in each semester), and CGPA (at the end of each successive semester) $\geq$ 5.0, (iv) **passes all the mandatory courses,** to successfully complete the under graduate programme. The performance of the student in these 160 credits shall be taken into account for the calculation of 'the final CGPA **(at the end of under graduate programme),** and shall be indicated in the grade card of IV-year II semester.

7.5 If a student registers for '**extra subjects**' (in the parent department or other departments/branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his department, the performances in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be taken into account while calculating the SGPA and CGPA. For such '**extra subjects'** registered, percentage of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1 – 7.4 above.

7.6 A student eligible to appear in the semester end examination for any subject/ course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.7 A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements**. The academic regulations under which a student has been readmitted shall be applicable. However, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which the student has been detained.

7.8 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which the student has been readmitted shall be applicable to him.

8.0 Evaluation - Distribution and Weightage of marks

8.1 The performance of a student in every subject/course (including practicals and Project Stage – I & II) will be evaluated for 100 marks each, with 25 marks allotted for CIE (Continuous Internal Evaluation) and 75 marks for SEE (Semester End-Examination).

8.2 For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of one objective paper, one descriptive paper and one assignment. The objective paper and the descriptive paper shall be for 10 marks each with a total duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for descriptive paper). The objective paper is set with 20 multiple choice, fill-in the blanks and matching type of questions for a total of 10 marks. The descriptive paper shall contain 4 full questions out of which, the student has to answer 2 questions, each

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carrying 5 marks. While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus. Five marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The total marks secured by the student in each mid-term examination are evaluated for 25 marks, and the average of the two mid-term examinations shall be taken as the final marks secured by each student in Continuous Internal Evaluation. If any student is absent from any subject of a mid-term examination, an on-line test will be conducted for him by the University. The details of the end semester question paper pattern are as follows:

8.2.1 The semester end examinations (SEE) will be conducted for 75 marks consisting of two parts viz. i) **Part- A** for 25 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question consisting of ten sub-questions. The first five sub-questions are from each unit and carry 2 marks each. The next five sub-questions are one from each unit and carry 3 marks each.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

8.2.2 For subjects like **Engineering Graphics/Engineering Drawing,** the SEE shall consist of five questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions. There shall be no Part – A, and Part – B system.

8.2.3 For subjects like **Machine Drawing Practice/Machine Drawing**, the SEE shall be conducted for 75 marks consisting of two parts viz. (i) Part – A for 30 marks. 3 out of 4 questions must be answered, (ii) Part – B for 45 marks. Part – B is compulsory.

8.2.4 For the Subject **Estimation, Costing and Project Management**, the SEE paper should consist of Part- A, Part-B and Part C. (i) Part – A – 1 out of 2 questions from Unit – I for 30 Marks, (ii) Part – B – 1 out of 2 questions from Unit – II for 15 Marks, (iii) Part – C – 3 out of 5 questions from Units – III, IV, V for 30 Marks.

8.2.5 For subjects **Structural Engineering – I & II (RCC & STEEL),** the SEE will be conducted for 75 marks consisting of 2 parts viz. (i) Part – A for 15 marks and, (i) Part – B for 60 marks. Part – A is a compulsory question consisting of ten sub-questions. The first five sub-questions are from each unit relating to design theory and codal provisions and carry 2 marks each. The next five sub-questions are from each unit and carry 1 mark each. Part – B consists of 5 questions (numbered 2 to 6) carrying 12 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there is either or choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

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8.3 For practical subjects there shall be a continuous internal evaluation during the semester for 25 marks and 75 marks for semester end examination. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and internal practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned. The semester end examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the clusters of colleges which are decided by the examination branch of the University.

8.4 For the subject having design and/or drawing, (such as engineering graphics, engineering drawing, machine drawing, machine drawing practice and estimation), the distribution shall be 25 marks for continuous internal evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for semester end examination. There shall be two internal tests in a semester and the average of the two shall be considered for the award of marks for internal tests.

8.5 There shall be an Industrial Oriented Mini Project/Summer Internship, in collaboration with an industry of their specialization. Students will register for this immediately after III year II semester examinations and pursue it during summer vacation. Industrial Oriented Mini Project/Summer Internship shall be submitted in a report form and presented before the committee in IV year I semester. It shall be evaluated for 100 external marks. The committee consists of an external examiner, Head of the Department, supervisor of the Industrial Oriented mini project/Summer Internship and a senior faculty member of the department. There shall be no internal marks for Industrial Oriented Mini Project/Summer Internship.

8.6 There shall be a seminar presentation in IV year I semester. For the seminar, the student shall collect the information on a specialized topic, prepare a technical report, and submit it to the department. It shall be evaluated by the departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 100 internal marks. There shall be no semester end examination for the seminar.

8.7 UG project work shall be carried out in two stages: Project Stage – I during IV Year I Semester, Project Stage – II during IV Year II Semester. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester. First report includes project work carried out in IV Year I semester and second report includes project work carried out in IV Year I & II Semesters. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.

8.8 For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall evaluate the project work for 75 marks and project supervisor shall evaluate for 25 marks. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

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A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.9 For Project Stage – II, the external examiner shall evaluate the project work for 75 marks and the project supervisor shall evaluate it for 25 marks. The topics for industrial oriented mini project, seminar and Project Stage – I shall be different from one another. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project stage – II, University selects an external examiner from the list of experts in the relevant branch submitted by the Principal of the College.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.10 The laboratory marks and the internal marks awarded by the college are subject to scrutiny and scaling by the University wherever necessary. In such cases, the internal and laboratory marks awarded by the college will be referred to a committee. The committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective institutions as per the University rules and produced before the committees of the University as and when asked for.

8.11 For mandatory courses of Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for passing the subject/course. **These marks should also be uploaded along with the internal marks of other subjects.**

8.12 No marks or letter grades shall be allotted for mandatory/non-credit courses. Only Pass/Fail shall be indicated in Grade Card.

9.0 Grading procedure

9.1 Grades will be awarded to indicate the performance of students in each theory subject, laboratory / practicals, seminar, Industry Oriented Mini Project, and project Stage - I & II. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

9.2 As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points

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Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A^+ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B^+ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	Ab	0

9.3 A student who has obtained an '**F**' grade in any subject shall be deemed to have '**failed**' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

9.4 To a student who has not appeared for an examination in any subject, '**Ab**' grade will be allocated in that subject, and he is deemed to have '**failed**'. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.

9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

9.6 A student earns grade point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'credit points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit points (CP) = grade point (GP) x credits .... For a course

9.7 A student passes the subject/ course only when **GP $\geq$ 5 ('C' grade or above)**

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects/ courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\textbf{SGPA} = \{ \textstyle\sum_{i=1}^{N} C_i\, G_i \} \,/\, \{ \textstyle\sum_{i=1}^{N} C_i \} \text{ .... \textbf{For each semester},}$$

where 'i' is the subject indicator index (takes into account all subjects in a semester), 'N' is the no. of subjects '**registered**' for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits

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allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\mathbf{CGPA = \{ \sum_{j=1}^{M} C_j\, G_j \} / \{ \sum_{j=1}^{M} C_j \} \ldots \text{ for all S semesters registered}}$$

(i.e., up to and inclusive of S semesters, S ≥ 2),

where '**M**' is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered**' i.e., from the 1st semester onwards up to and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	C	5	4 x 5 = 20
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	C	5	3 x 5 = 15
	21			152

SGPA = 152/21 = 7.24

Illustration of calculation of CGPA up to 3rd semester:

Semester	Course/Subject Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point (GP)	Credit Points (CP)
I	Course 1	3	A	8	24
I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20

II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	**69**		**Total Credit Points**	**518**

CGPA = 518/69 = 7.51

The above illustrated calculation process of CGPA will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. Programme.

9.10 For merit ranking or comparison purposes or any other listing, **only** the '**rounded off**' values of the CGPAs will be used.

9.11 SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0 Passing standards

10.1 A student shall be declared successful or 'passed' in a semester, if he secures a GP ≥ 5 ('C' grade or above) in every subject/course in that semester (i.e. when the student gets an SGPA ≥ 5.00 at the end of that particular semester); and he shall be declared successful or 'passed' in the entire under graduate programme, only when gets a CGPA ≥ 5.00 for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.), credits earned.

11.0 Declaration of results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

% of Marks = (final CGPA – 0.5) x 10

12.0 Award of degree

12.1 A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified'** for the award of B.Tech. degree in the chosen branch of Engineering selected at the time of admission.

12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3 A student with final CGPA (at the end of the under graduate programme) ≥ 8.00, and fulfilling the following conditions - shall be placed in '**first class with distinction**'. However, he

(i) Should have passed all the subjects/courses in '**first appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should have secured a CGPA ≥ 8.00, at the end of each of the 8 sequential semesters, starting from I year I semester onwards.

(iii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA > 8 shall be placed in **'first class'.**

12.4 Students with final CGPA (at the end of the under graduate programme) ≥ 6.50 but <

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8.00 shall be placed in **'first class'.**

12.5 Students with final CGPA (at the end of the under graduate programme) ≥ 5.50 but < 6.50, shall be placed in '**second class**'.

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the under graduate programme) ≥ 5.00 but < 5.50, shall be placed in '**pass class**'.

12.7 A student with final CGPA (at the end of the under graduate programme) < 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**Gold Medal**'.

13.0 Withholding of results

13.1 If the student has not paid the fees to the University at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0 Student transfers

14.1 There shall be no branch transfers after the completion of admission process.

14.2 There shall be no transfers from one college/stream to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.

14.3 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of JNTUH, and also pass the subjects of JNTUH which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of JNTUH, the students have to study those subjects in JNTUH in spite of the fact that those subjects are repeated.

14.4 The transferred students from other Universities/institutions to JNTUH affiliated colleges who are on rolls are to be provided one chance to write the CBT (internal marks) in the **equivalent subject(s)** as per the clearance letter issued by the University.

14.5 The autonomous affiliated colleges have to provide one chance to write the internal examinations in the **equivalent subject(s)** to the students transferred from other universities/institutions to JNTUH autonomous affiliated colleges who are on rolls, as per the clearance (equivalence) letter issued by the University.

15.0 Scope

15.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

15.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

15.3 The University may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the University authorities.

15.4 Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by State Act No. 30 of 2008)

Kukatpally, Hyderabad, Telangana (India).

ACADEMIC REGULATIONS FOR B.TECH. (LATERAL ENTRY SCHEME) FROM THE AY 2019-20

1. Eligibility for award of B. Tech. Degree (LES)

The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 123 credits and secure 123 credits with CGPA ≥ 5 from II year to IV year B.Tech. programme (LES) for the award of B.Tech. degree.

3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

5. Promotion rule

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 25 credits out of 42 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.
4	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester.

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		(ii) Must have secured at least 51 credits out of 86 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	**Fourth year first semester to fourth year second semester**	**Regular course of study of fourth year first semester.**

6. **All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).**

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to

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	of the examination (theory or practical) in which the student is appearing.	appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled and sent to the University.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant – superintendent / any officer on duty or	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject

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	misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.

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9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award a suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
    a. A show cause notice shall be issued to the college.
    b. Impose a suitable fine on the college.
    c. Shifting the examination centre from one college to another college for a specific period of not less than one year.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by State Act No. 30 of 2008)

Kukatpally, Hyderabad, Telangana (India).

ACADEMIC REGULATIONS FOR B.TECH. REGULAR STUDENTS
WITH EFFECT FROM THE
ACADEMIC YEAR 2016-17 (R-16)

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

1.1 JNTUH offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) at its non-autonomous constituent and affiliated colleges with effect from the academic year 2016-17 in the following branches of Engineering:

Sl. No.	Branch
1.	Civil Engineering
2.	Electrical and Electronics Engineering
3.	Mechanical Engineering
4.	Electronics and Communication Engineering
5.	Computer Science and Engineering
6.	Chemical Engineering
7.	Electronics and Instrumentation Engineering
8.	Bio-Medical Engineering
9.	Information Technology
10.	Mechanical Engineering (Mechatronics)
11.	Electronics and Telematics Engineering
12.	Metallurgy and Material Technology
13.	Electronics and Computer Engineering
14.	Mechanical Engineering (Production)
15.	Aeronautical Engineering
16.	Instrumentation and Control Engineering
17.	Biotechnology
18.	Automobile Engineering
19.	Mining Engineering
20.	Petroleum Engineering
21.	Civil and Environmental Engineering
22.	Mechanical Engineering (Nano Technology)
23.	Computer Science & Technology
24.	Pharmaceutical Engineering

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2.0 Eligibility for admission

2.1 Admission to the under graduate programme shall be made either on the basis of the merit rank obtained by the qualified candidate in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instructions for the entire under graduate programme in E&T will be **English** only.

3.0 B.Tech. Programme structure

3.1 A student after securing admission shall pursue the under graduate programme in B.Tech. in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course.

Each semester is structured to provide 24 credits, totaling to 192 credits for the entire B.Tech. programme.

Each student shall secure 192 credits (with CGPA ≥ 5) required for the completion of the under graduate programme and award of the B.Tech. degree.

3.2 **UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1 Semester scheme

Each under graduate programme is of 4 academic years (8 semesters) with the academic year being divided into two semesters of 22 weeks (≥ 90 instructional days) each, each semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and curriculum / course structure as suggested by AICTE are followed.

3.2.2 Credit courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one hour/ week/ semester for theory/ lecture (L) courses.
- One credit for two hours/ week/ semester for laboratory/ practical (P) courses or tutorials (T).

Courses like Environmental Science, Professional Ethics, Gender Sensitization lab and other student activities like NCC/NSO and NSS are identified as mandatory courses. These courses will not carry any credits.

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3.2.3 Subject Course Classification

All subjects/ courses offered for the under graduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The university has followed almost all the guidelines issued by AICTE/UGC.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes mathematics, physics and chemistry subjects
2		ES - Engineering Sciences	Includes fundamental Engineering subjects
3		HS – Humanities and Social sciences	Includes subjects related to humanities, social sciences and management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses (EℓC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	Project Work	B.Tech. project or UG project or UG major project
8		Industrial training/ Mini- project	Industrial training/ Internship/ UG Mini-project/ Mini-project
9		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Minor courses	-	1 or 2 Credit courses (subset of HS)
11	Mandatory Courses (MC)	-	Mandatory courses (non-credit)

4.0 Course registration

4.1 A 'faculty advisor or counselor' shall be assigned to a group of 15 students, who will advise student about the under graduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

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4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The on-line registration requests for any 'current semester' shall be **completed before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'**.

4.3 A student can apply for **on-line** registration, **only after** obtaining the '**written approval**' from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor/ counselor and the student.

4.4 A student may be permitted to register for the subjects/ courses of **choice** with a total of 24 credits per semester (minimum of 20 credits and maximum of 28 credits per semester and permitted deviation of ± 17%), based on **progress** and SGPA/ CGPA, and completion of the '**pre-requisites**' as indicated for various subjects/ courses, in the department course structure and syllabus contents. However, a **minimum** of 20 credits per semester must be registered to ensure the '**studentship**' in any semester.

4.5 Choice for 'additional subjects/ courses' to reach the maximum permissible limit of 28 credits (above the typical 24 credit norm) must be clearly indicated, which needs the specific approval and signature of the faculty advisor/ counselor.

4.6 If the student submits ambiguous choices or multiple options or erroneous entries during **on-line** registration for the subject(s) / course(s) under a given/ specified course group/ category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.

4.7 Subject/ course options exercised through **on-line** registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/ course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the head of the department, with due notification and time-framed schedule, within the **first week** after the commencement of class-work for that semester.

4.8 Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor (subject to retaining a minimum of 20 credits), '**within a period of 15 days**' from the beginning of the current semester.

4.9 **Open electives**: The students have to choose one open elective (OE-I) in III year I semester, one (OE-II) in III year II semester, and one (OE-III) in IV year II semester, from the list of open electives given. However, the student cannot opt for an open elective subject offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.

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4.10 **Professional electives**: students have to choose professional elective (PE-I) in III year II semester, Professional electives II, III, and IV (PE-II, III and IV) in IV year I semester, Professional electives V, and VI (PE-V and VI) in IV year II semester, from the list of professional electives given. However, the students may opt for professional elective subjects offered in the related area.

5.0 **Subjects/ courses to be offered**

5.1 A typical section (or class) strength for each semester shall be 60.

5.2 A subject/ course may be offered to the students, **only if** a minimum of 20 students (1/3 of the section strength) opt for it. The maximum strength of a section is limited to 80 (60 + 1/3 of the section strength).

5.3 More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on - '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

5.4 If more entries for registration of a subject come into picture, then the Head of Department concerned shall decide, whether or not to offer such a subject/ course for **two (or multiple) sections**.

6.0 **Attendance requirements:**

6.1 A student shall be eligible to appear for the semester end examinations, if student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (excluding attendance in mandatory courses Environmental Science, Professional Ethics, Gender Sensitization Lab, NCC/NSO and NSS) for that semester.

6.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable towards condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in **no** case be condoned.

6.5 **Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

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6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0 Academic requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.**6.**

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% marks (26 out of 75 marks) in the semester end examination, and a minimum of 40% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject/ course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to UG mini-project and seminar, if student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student would be treated as failed, if student (i) does not submit a report on UG mini-project, or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar as required in the IV year I Semester, or (iii) secures less than 40% marks in UG mini-project/ seminar evaluations.

Student may reappear once for each of the above evaluations, when they are scheduled again; if student fails in such 'one reappearance' evaluation also, student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	**First year first semester to first year second semester**	**Regular course of study of first year first semester.**
2	**First year second semester to second year first semester**	**i. Regular course of study of first year second semester.** **ii. Must have secured at least 24 credits out of 48 credits i.e., 50% of credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
3.	**Second year first semester to second year second semester**	**Regular course of study of second year first semester.**
4	**Second year second semester to third year first semester**	**i. Regular course of study of second year second semester.** **ii. Must have secured at least 58 credits out of 96 credits i.e., 60% of**

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		credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to third year second semester	Regular course of study of third year first semester.
6	Third year second semester to fourth year first semester	i. Regular course of study of third year second semester. ii. Must have secured at least 86 credits out of 144 credits i.e., 60% of credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

7.4 A student shall register for all subjects covering 192 credits as specified and listed in the course structure, fulfills all the attendance and academic requirements for 192 credits, 'earn all 192 credits' by securing SGPA $\geq$ 5.0 (in each semester) and CGPA (at the end of each successive semester) $\geq$ 5.0 to successfully complete the under graduate programme.

7.5 After securing the necessary 192 credits as specified for the successful completion of the entire under graduate programme, the student can avail exemption of two subjects up to 6 credits, that is, one open elective and one professional elective subject or two professional elective subjects for optional drop out from these 192 credits earned; resulting in 186 credits for under graduate programme performance evaluation, i.e., the performance of the student in these 186 credits shall alone be taken into account for the calculation of 'the final CGPA (at the end of under graduate programme, which takes the SGPA of the IV year II semester into account)' , and shall be indicated in the grade card of IV year II semester. However, the performance of student in the earlier individual semesters, with the corresponding SGPA and CGPA for which grade cards have already been given will not be altered.

7.6 If a student registers for some more '**extra subjects**' (in the parent department or other departments/branches of engg.) other than those listed subjects totaling to 192 credits as specified in the course structure of his department, the performances in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 192 credits) will not be taken into account while calculating the SGPA and CGPA. For such '**extra subjects**' registered, % of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1 – 7.5 above.

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7.7 A student eligible to appear in the end semester examination for any subject/ course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, CIE assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.8 A student **detained in a semester due to shortage of attendance, may be re-admitted when the same semester is offered in the next academic year for fulfillment of academic requirements**. The academic regulations under which student has been readmitted shall be applicable. However, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which student has been detained.

7.9 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which student has been readmitted shall be applicable to him.

8.0 Evaluation - Distribution and Weightage of marks

8.1 The performance of a student in every subject/course (including practicals and UG major project) will be evaluated for 100 marks each, with 25 marks allotted for CIE (Continuous Internal Evaluation) and 75 marks for SEE (Semester End-Examination).

8.2 For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of one objective paper, one descriptive paper and one assignment. The objective paper and the essay paper shall be for 10 marks each with a total duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for essay paper). The objective paper is set with 20 bits of multiple choice, fill-in the blanks and matching type of questions for a total of 10 marks. The essay paper shall contain 4 full questions out of which, the student has to answer 2 questions, each carrying 5 marks. While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus. Five marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-examination, and the second assignment should be submitted before the conduct of the second mid-examination. The total marks secured by the student in each mid-term examination are evaluated for 25 marks, and the average of the two mid-term examinations shall be taken as the final marks secured by each student in internals/sessionals. If any student is absent from any subject of a mid-term examination, an on-line test will be conducted for him by the university. The details of the question paper pattern are as follows,

- The end semester examinations will be conducted for 75 marks consisting of two parts viz. i) **Part- A** for 25 marks, ii) **Part - B** for 50 marks.
- Part-A is compulsory question which consists of ten sub-questions. The first five sub-questions are from each unit and carry 2 marks each. The next five sub-questions are one from each unit and carry 3 marks each.

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- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

8.3 For practical subjects there shall be a continuous internal evaluation during the semester for 25 sessional marks and 75 semester end examination marks. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and internal practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned. The semester end examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the clusters of colleges which are decided by the examination branch of the university.

8.4 For the subject having design and/or drawing, (such as engineering graphics, engineering drawing, machine drawing) and estimation, the distribution shall be 25 marks for continuous internal evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for semester end examination. There shall be two internal tests in a semester and the average of the two shall be considered for the award of marks for internal tests.

8.5 There shall be an UG mini-project, in collaboration with an industry of their specialization. Students will register for this immediately after III year II semester examinations and pursue it during summer vacation. The UG mini-project shall be submitted in a report form and presented before the committee in IV year I semester. It shall be evaluated for 100 marks. The committee consists of an external examiner, Head of the Department, supervisor of the UG mini-project and a senior faculty member of the department. There shall be no internal marks for UG mini-project.

8.6 There shall be a seminar presentation in IV year I semester. For the seminar, the student shall collect the information on a specialized topic, prepare a technical report and submit it to the department. It shall be evaluated by the departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 100 marks. There shall be no semester end examination for the seminar.

8.7 Out of a total of 100 marks for the UG major project, 25 marks shall be allotted for internal evaluation and 75 marks for the end semester examination (viva voce). The end semester examination of the UG major project shall be conducted by the same committee as appointed for the UG mini-project. In addition, the UG major project supervisor shall also be included in the committee. The topics for UG mini project, seminar and UG major project shall be different from one another. The evaluation of UG major project shall be made at the end of IV year II semester. The internal evaluation shall be on the basis of two seminars given by each student on the topic of UG major project.

8.8 The laboratory marks and the sessional marks awarded by the college are subject to scrutiny and scaling by the university wherever necessary. In such cases, the sessional and laboratory marks awarded by the college will be referred to a committee. The committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective institutions as per the university rules and produced before the committees of the university as and when asked for.

8.9 For mandatory courses environmental science, professional ethics and gender sensitization lab, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for passing the subject/course.

8.10 For mandatory courses NCC/ NSO and NSS, a 'satisfactory participation certificate' shall be issued to the student from the authorities concerned, only after securing ≥ 65% attendance in such a course.

8.11 No marks or letter grade shall be allotted for all mandatory/non-credit courses.

9.0 Grading procedure

9.1 Marks will be awarded to indicate the performance of student in each theory subject, laboratory / practicals, seminar, UG mini project and UG major project. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

9.2 As a measure of the performance of student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A^+ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B^+ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	Ab	0

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9.3 A student obtaining **'F'** grade in any subject shall be deemed to have **'failed'** and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

9.4 A student who has not appeared for examination in any subject, **'Ab'** grade will be allocated in that subject, and student shall be considered **'failed'**. Student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered.

9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

9.6 A student earns grade point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'credit points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit points (CP) = grade point (GP) x credits .... For a course

9.7 The student passes the subject/ course only when **GP ≥ 5 ('C' grade or above)**

9.8 The semester grade point average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects/ courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\mathbf{SGPA = \{ \textstyle\sum_{i=1}^{N} C_i\, G_i \} \,/\, \{ \sum_{i=1}^{N} C_i \}} \text{ .... } \textbf{For each semester},$$

where 'i' is the subject indicator index (takes into account all subjects in a semester), 'N' is the no. of subjects **'registered'** for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

9.9 The cumulative grade point average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\mathbf{CGPA = \{ \textstyle\sum_{j=1}^{M} C_j\, G_j \} \,/\, \{ \sum_{j=1}^{M} C_j \}} \text{ ... } \textbf{for all S semesters registered}$$

(i.e., up to and inclusive of S semesters, S ≥ 2),

where **'M'** is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has **'registered'** i.e., from the 1^{st} semester onwards up to and inclusive of the 8^{th} semester, 'j' is the subject indicator index (takes

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into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of first year first semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	C	5	4 x 5 = 20
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	C	5	3 x 5 = 15
	21			152

SGPA = 152/21 = 7.24

Illustration of calculation of CGPA:

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
I Year I Semester				
Course 1	4	A	8	4 x 8 = 32
Course 2	4	A+	9	4 x 9 = 36
Course 3	4	B	6	4 x 6 = 24
Course 4	3	O	10	3 x 10 = 30
Course 5	3	B+	7	3 x 7 = 21
Course 6	3	A	8	3 x 8 = 24
I Year II Semester				
Course 7	4	B+	7	4 x 7 = 28
Course 8	4	O	10	4 x 10 = 40
Course 9	4	A	8	4 x 8 = 32
Course 10	3	B	6	3 x 6 = 18
Course 11	3	C	5	3 x 5 = 15
Course 12	3	A+	9	3 x 9 = 27
	Total Credits = 42			Total Credit Points = 327

CGPA = 327/42 = 7.79

9.10 For merit ranking or comparison purposes or any other listing, **only** the **'rounded off'** values of the CGPAs will be used.

9.11 For calculations listed in regulations 9.6 to 9.9, performance in failed subjects/ courses (securing **F** grade) will also be taken into account, and the credits of such subjects/ courses will also be included in the multiplications and summations. After passing the failed subject(s) newly secured letter grades will be taken into account for calculation of SGPA and CGPA. However, mandatory courses will not be taken into consideration.

10.0 Passing standards

10.1 A student shall be declared successful or 'passed' in a semester, if student secures a GP $\geq$ 5 ('C' grade or above) in every subject/course in that semester (i.e. when student gets an SGPA $\geq$ 5.00 at the end of that particular semester); and a student shall be declared successful or 'passed' in the entire under graduate programme, only when gets a CGPA $\geq$ 5.00 for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, and grade earned etc.), credits earned, SGPA, and CGPA.

11.0 Declaration of results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

% of Marks = (final CGPA – 0.5) x 10

12.0 Award of degree

12.1 A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 192 credits (with CGPA $\geq$ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified**' for the award of the B.Tech. degree in the chosen branch of Engineering as selected at the time of admission.

12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3 Students with final CGPA (at the end of the under graduate programme) $\geq$ 8.00, and fulfilling the following conditions -

(i) Should have passed all the subjects/courses in '**first appearance**' within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should have secured a CGPA $\geq$ 8.00, at the end of each of the 8 sequential semesters, starting from first year first semester onwards.

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(iii) Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason, shall be placed in '**first class with distinction**'.

12.4 Students with final CGPA (at the end of the under graduate programme) ≥ 6.50 but < 8.00, shall be placed in '**first class**'.

12.5 Students with final CGPA (at the end of the under graduate programme) ≥ 5.50 but < 6.50, shall be placed in '**second class**'.

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the under graduate programme) ≥ 5.00 but < 5.50, shall be placed in '**pass class**'.

12.7 A student with final CGPA (at the end of the under graduate programme) < 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**university rank**' and '**gold medal**'.

13.0 Withholding of results

13.1 If the student has not paid the fees to the university/ college at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0 Transitory regulations

14.1 A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the degree programme, may be considered eligible for readmission to the same subjects/ courses (or equivalent subjects/ courses, as the case may be), and same professional electives/ open electives (or from set/category of electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the date of commencement of student's first year first semester).

15.0 Student transfers

15.1 There shall be no branch transfers after the completion of admission process.

15.2 There shall be no transfers from one college/stream to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.

15.3 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of JNTUH, and also pass the subjects of JNTUH which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different

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semesters of JNTUH, the students have to study those subjects in JNTUH in spite of the fact that those subjects are repeated.

15.4 The transferred students from other Universities/institutions to JNTUH affiliated colleges who are on rolls to be provide one chance to write the CBT (internal marks) in the **failed subjects and/or subjects not studied** as per the clearance letter issued by the university.

15.5 The autonomous affiliated colleges have to provide one chance to write the internal examinations in the **failed subjects and/or subjects not studied,** to the students transferred from other universities/institutions to JNTUH autonomous affiliated colleges who are on rolls, as per the clearance (equivalence) letter issued by the University.

16.0 Scope

16.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

16.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

16.3 The university may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the date notified by the university authorities.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by State Act No. 30 of 2008)

Kukatpally, Hyderabad, Telangana (India).

Academic Regulations for B.Tech. (Lateral Entry Scheme) w.e.f the AY 2017-18

1. **Eligibility for award of B. Tech. Degree (LES)**

   The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 144 credits and secure 144 credits with CGPA ≥ 5 from II year to IV year B.Tech. programme (LES) for the award of B.Tech. degree. **Out of the 144 credits secured, the student can avail exemption up to 6 credits**, that is, one open elective subject and one professional elective subject or two professional elective subjects resulting in 138 credits for B.Tech programme performance evaluation.

3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

5. **Promotion rule**

S. No	Promotion	Conditions to be fulfilled
1	**Second year first semester to second year second semester**	**Regular course of study of second year first semester.**
2	**Second year second semester to third year first semester**	**(i) Regular course of study of second year second semester. (ii) Must have secured at least 29 credits out of 48 credits i.e., 60% of credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
3	**Third year first semester to third year second semester**	**Regular course of study of third year first semester.**
4	**Third year second semester to fourth year first semester**	**(i) Regular course of study of third year second semester. (ii) Must have secured at least 58 credits out of 96 credits i.e., 60% of credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
5	**Fourth year first semester to fourth year second semester**	**Regular course of study of fourth year first semester.**

6. **All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).**

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MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractice/Improper conduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled and sent to the university.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and UG major project) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation

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		of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant – superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

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7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared including practical examinations and UG major project of that semester/year examinations.

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12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the university for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   a. A show cause notice shall be issued to the college.
   b. Impose a suitable fine on the college.
   c. Shifting the examination centre from the college to another college for a specific period of not less than one year.

* * * * *

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Examination Reform Policy

November 2018

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION
Nelson Mandela Marg, Vasant Kunj, New Delhi-110070

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Examination Reform Policy

November 2018

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MESSAGE

AICTE is taking a multi-pronged approach to recalibrate the technical education in the country, to provide competent professionals. Challenged by keeping the pace of education with the advancements in the technology and industry needs, AICTE has pushed reforms by way of a model curriculum for various engineering disciplines, providing good quality self-learning content through MOOCs, framing a policy for the training of technical teachers 3-week student induction program and enunciating guidelines for the mandatory internship for student among others. Continuing with the streak, AICTE has now come out with an Examination Reform Policy, which would not only improve the quality of technical education in general but also examine the effectiveness of earlier initiatives of AICTE and also those on the anvil.

Evaluation, grading and certification in our system rest on examinations which play an important role in the progression of a learner on the learning path. The examinations not only indicate whether the desired learning outcomes have been achieved but also assess the level of achievements against benchmarks. Thus, examinations serve as checkpoints for both the learner and the external world, allowing appropriate certification to be issued reflecting the proficiency of an individual operating in socio-economic spheres.

This policy comes at a time when knowledge is freely available for creating resources, opportunities for more knowledge, which requires skill of higher order beyond remembering and comprehension. This policy intends to push the evaluation notches up on the Bloom's taxonomy and examine the learner for higher order cognitive skills to drive critical thinking, creativity and problem solving which have to be the attributes of any technical professional. It is hoped that this will also force necessary alignment in the teaching-learning processes on one hand to the bridging of the gap between theory and practicals on the other and prepare students for innovation and creativity.

We request the technical institutions and universities in the country to adopt this examination reform policy. To facilitate this, model question papers and question banks will be developed/ shared through AICTE website. With a view to impart momentum to this much-awaited reform, AICTE shall be conducting a series of training workshops for faculty, across the country.

We thank members of the committee led by Prof. Shettar, Vice-Chancellor, KLE University for developing the policy which will go a long way to enhance the employability ratio and also enable youngsters to become problem-solvers, innovators and job creators. We especially thank MHRD for providing guidance and support throughout the process of creation of this Policy.

(Prof. Anil D. Sahasrabudhe)

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PREFACE

Globalisation of the world economy and higher education are driving profound changes in engineering education system. Worldwide adaptation of Outcome-Based Education (OBE) framework and enhanced focus on higher-order learning and professional skills necessitates paradigm shift in traditional practices of curriculum design, education delivery and assessment. In recent years, worldwide sweeping reforms are being undertaken to bring about essential changes in engineering education in terms of what to teach (content) and how to teach (knowledge delivery) and how to assess (student learning).

Examinations/student assessments play a very important role in deciding the quality of education. The academic quality of examinations (question papers) in Indian engineering education system has been a matter of concern from a long time. This report attempts to bring out recommendations for reforms in examination system to meet challenges of emerging engineering education landscape.

The recommendations are presented in four sections. Beginning in Section-1, the most important drivers for examination reforms in Indian engineering education system are discussed. Section-2 brings out strategies to be adopted to align assessment with the desired student learning outcomes. A two-step method is proposed for mapping the examination questions with course outcomes. Section-3 highlights the necessity of designing question papers to test higher order abilities and skills. Application of blooms taxonomy framework to create an optimal structure of examination papers to test the different cognitive skills is discussed in detail. Challenge of assessing higher order abilities and professional skills through traditional examination system is brought out in Section-4. Several educational experiences and assessment opportunities are identified to overcome the challenges. Appendices contain the supplement material that is helpful for Universities/ Colleges to implement recommendations.

At this juncture, reforms in examinations are critical for the improvement of the quality and relevance of Indian engineering education. It is hoped that the Report will be of use to Universities and Colleges to bring out the much-needed change. The cooperation received from AICTE officials in bringing out the Report is gratefully acknowledged.

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ACKNOWLEDGEMENT

The development of an outcome based Examination Reform Policy for technical education is a result of thoughtful deliberations, involving dedicated and specialized experts. This Policy has been framed to meet the expectations of an academically challenging environment, develop problem-solving skills by students, aligning with current global standards and to enrich the students learning to make them self-enablers and/or match job requirements on successful completion of their degree.

The performance-based new-age reforms in the examination will benefit each student for preparing him/her for success in the knowledge society. This will create proper mapping between program outcomes and assessment tools that lead to the accurate and reliable measurement of attainment of outcomes of the students. In short, the Policy focuses on providing the ability of student to understand the subject and apply the knowledge to real world problems.

We are thankful to the members of the committee Prof. Ashok S. Shettar, Prof. Rama Krishna Challa, Prof. Sanjay Agarwal and Prof. Upendra Pandel who were devotedly committed towards framing this Policy. We thank them for identifying Competencies and Performance Indicators (PIs) with Program Outcomes (POs); Sample Questions for all six levels of Bloom's Taxonomy; Model Question Papers for end semester examinations based on Bloom's Taxonomy; and Sample Scoring Rubrics for communication (written & oral), and assessment of design projects and semester mini projects.

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I also sincerely thank all officers and officials of AICTE, who have contributed in one way or other for the development of this Policy.

Thanking all once again and seeking continued support and also feedback on the Policy.

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INTRODUCTION

Globalisation of the world economy and higher education are driving profound changes in engineering education system. There is a continuing need to dynamically adapt to these changes, to ensure that we remain competitive and can respond effectively to the challenges of globalisation. Future engineering graduates not only need to be knowledgeable in his/her discipline but also needs a new set of soft, professional skills and competencies [1].

In recent years, there have been essential changes in engineering education in terms of what to teach (content) and how to teach (knowledge delivery) and how to assess (student learning).

AICTE has already taken initiation to come out with model curriculum for engineering programs. The digital initiatives of MHRD and AICTE have made available very large number of MOOC courses through SWAYAM, that can help the colleges and teachers to adopt innovative methodologies in the delivery of course.

The present report focusses on the recommendations for reforms in examinations (assessment of student) in the context of emerging landscape of engineering education.

Examinations/student assessments play a very important role in deciding the quality of education. They must not only assess student's achievements (and grades) but also measure whether the desired learning outcomes have been achieved. The achievement of objectives and program outcomes are crucial and needs to be proven through accurate and reliable assessments.

The academic quality of examinations (question papers) in Indian engineering education system has been a matter of concern from a long time. It is widely acknowledged that "assessment drives learning'', what and how students learn depends to a major extent on how they think they will be assessed [2]. The question papers that require simple memory recall will not ensure deep, meaningful learning. High expectations for learning motivate the students to rise to the occasion. The assessment (examination) must embed those high expectations to ensure that the learner is motivated to attain them.

Considering the above imperatives, it is clear that reforms in Examinations are critical for improvement of the quality of Indian engineering education. The most important drivers for reforms in examination system of Indian engineering education are:

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1. Adaptation of Outcome-Based Education Framework

Outcome-based education (OBE)- a performance-based approach has emerged as a major reform model in the global engineering education scenario [3]. The country that wants to be a signatory member of a multinational agreement for the mutual recognition of engineering degrees, i.e. the Washington Accord (WA) must implement OBE. This will be an endorsement that the engineering education system has demonstrated a strong, long-term commitment to quality assurance in producing engineers ready for industry practice in the international scene. Being signatory to the Washington Accord, Indian accreditation agency 'National Board of Accreditation (NBA)' has made it mandatory for engineering institutions to adapt OBE framework for their curriculum design, delivery and assessment. In OBE framework, the educational outcomes of a program are clearly and unambiguously specified. These determine the curriculum content and its organization, the teaching methods and strategies and the assessment process.

Though Indian Universities and Colleges have started adapting OBE framework for their engineering programs, the focus is limited to the curriculum design part, i.e. connecting curriculum components to the program outcomes. Very little attention is being given for connecting examination questions/assessment tools to the program outcomes. The absence of proper mapping between program outcomes and assessment tools lead to the inaccurate and unreliable measurement of attainment of outcomes by the students. This missing connect creates a big gap in the effective adaptation of OBE framework, making the whole exercise futile.

2. Importance of Higher-order Abilities and Professional Skills

In the present examination system, memorization occupies a dominant place. The recall of factual knowledge, though essential to any examination, is only one of several major abilities to be demonstrated by the graduates. The assessment process must also test higher level skills viz. ability to apply knowledge, solve complex problems, analyse, synthesise and design. Further, professional skills like the ability to communicate, work in teams, lifelong learning have become important elements for employability of the graduates [4]. It is important that the examinations also give appropriate weightage to the assessment of these higher-level skills and professional competencies.

Keeping in view of the above challenges and looking at some of the worldwide best practices in assessment, the present report comes up with several recommendations that can be used by Universities/ Colleges to design their assessment strategies.

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ASSESSMENT STRATEGY FOR OUTCOME-BASED EDUCATION

1. Mapping Program Outcomes to Assessment (Examinations)

Graduate attributes (GAs) articulate the generic abilities to be looked for in a graduate of any undergraduate degree program. They form the Program Outcomes (POs) that reflect the skills, knowledge and abilities of graduates regardless of the field of study. This does not mean that POs are necessarily independent of disciplinary knowledge –rather, these qualities may be developed in various disciplinary contexts.

In outcome-based education, a "design down" process is employed which moves from POs to Course Outcomes (COs) and outcomes for individual learning experiences. Outcomes at each successive level need to be aligned with, and contribute to, the program outcomes.

Courses are the building blocks of a program. Teaching strategies, learning activities, assessments and resources should all be designed and organized to help students achieve the learning outcomes at the course level. In the assessment activities, students demonstrate their level of achievement of the course learning outcomes. In a constructively aligned program, the courses are carefully coordinated to ensure steady development or scaffolding from the introduction to mastery of the learning outcomes, leading to achievement of the intended POs. For the effectiveness of the program, the achievement of POs is crucial which needs to be proven through accurate and reliable assessments.

2. Two-step Process for Bringing Clarity to POs

POs give useful guidance at the program level for the curriculum design, delivery and assessment of student learning. However, they represent fairly high-level generic goals that are not directly measurable. Real observability and measurability of the POs at course level is very difficult. To connect high-level learning outcomes (POs) with course content, course outcomes and assessment, there is a necessity to bring further clarity and specificity to the program outcomes [5]. This can be achieved through the following two-step process of identifying Competencies and Performance Indicators (PI).

(1) Identify Competencies to be attained: For each PO define competencies –different abilities implied by program outcome statement that would generally require different assessment measures. This helps us to create a shared understanding of the competencies we want students to achieve. They serve as an intermediate step to the creation of measurable indicators.

Example:

Program Outcome (Attribute 3)

Design:

PO3: Design/Development of Solutions: Design solutions for complex engineering problems and

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design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

Competencies

1. Demonstrate an ability to define a complex, open-ended problem in engineering terms.
2. Demonstrate an ability to generate a diverse set of alternative design solutions.
3. Demonstrate an ability to select the optimal design scheme for further development.
4. Demonstrate an ability to advance an engineering design to the defined end state.

(2) Define Performance Indicators: For each of the competencies identified, define performance Indicators (PIs) that are explicit statements of expectations of the student learning. They can act as measuring tools in assessment to understand the extent of attainment of outcomes. They can also be designed to determine the appropriate achievement level or competency of each indicator so that instructors can target and students can achieve the acceptable level of proficiency.

Example:

For the Competency -2

Demonstrate an ability to generate a diverse set of alternative design solutions

Performance Indicators:

1. Apply formal idea generation tools to develop multiple engineering design solutions
2. Build models, prototypes, algorithms to develop a diverse set of design solutions
3. Identify the functional and non-functional criteria for evaluation of alternate design solutions.

It should be noted that, when we consider the program outcome, it looks like, it can be achieved only in the Capstone project. But if we consider the competencies and performance indicators, we start seeing the opportunities of addressing them (and hence PO) in various courses of the program.

Once the above process is completed for the program, the assessment of COs for all the courses is designed by connecting assessment questions (used in various assessment tools) to the PIs. By following this process, where examination questions map with PIs, we get clarity and better resolution for the assessment of COs and POs. The pictorial representation of the process is given in Fig. 1

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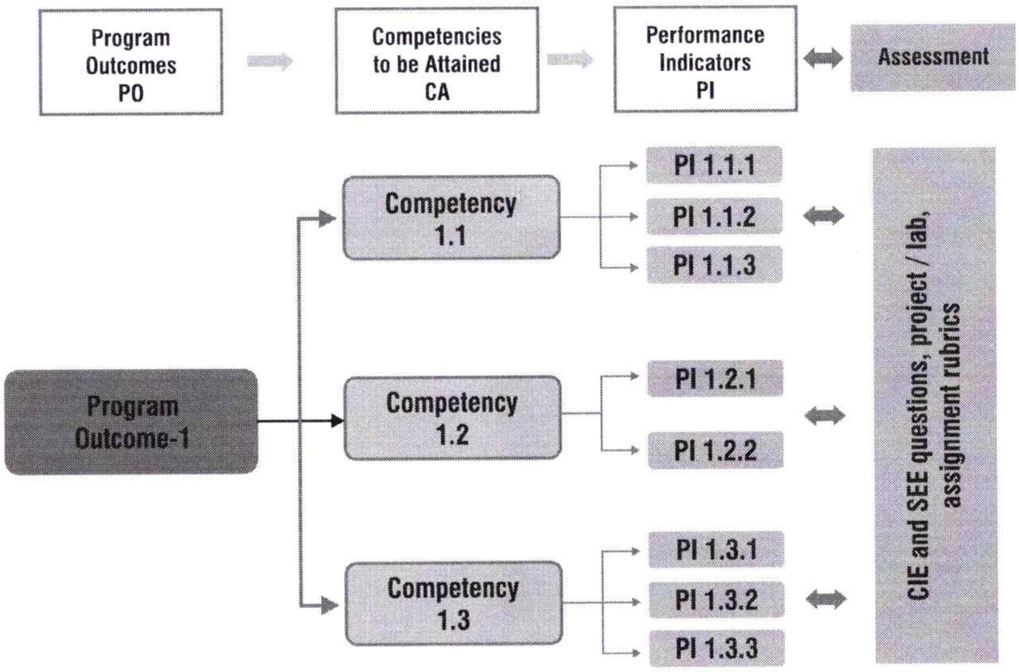

Fig. 1: Connecting POs to Assessment

3. Program Outcomes – Competencies – Performance Indicators

Following table gives the suggestive list of competencies and associated performance indicators for each of the PO in Mechanical Engineering Program.

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

Competency		Indicators	
1.1	Demonstrate competence in mathematical modelling	1.1.1	Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems
		1.1.2	Apply advanced mathematical techniques to model and solve mechanical engineering problems
1.2	Demonstrate competence in basic sciences	1.2.1	Apply laws of natural science to an engineering problem
1.3	Demonstrate competence in engineering fundamentals	1.3.1	Apply fundamental engineering concepts to solve engineering problems
1.4	Demonstrate competence in specialized engineering knowledge to the program	1.4.1	Apply Mechanical engineering concepts to solve engineering problems.

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Competency		Indicators	
2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.1.1	Articulate problem statements and identify objectives
		2.1.2	Identify engineering systems, variables, and parameters to solve the problems
		2.1.3	Identify the mathematical, engineering and other relevant knowledge that applies to a given problem

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2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1 Reframe complex problems into interconnected sub-problems 2.2.2 Identify, assemble and evaluate information and resources. 2.2.3 Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions 2.2.4 Compare and contrast alternative solution processes to select the best process.
2.3 Demonstrate an ability to formulate and interpret a model	2.3.1 Combine scientific principles and engineering concepts to formulate model/s (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy. 2.3.2 Identify assumptions (mathematical and physical) necessary to allow modeling of a system at the level of accuracy required.
2.4 Demonstrate an ability to execute a solution process and analyze results	2.4.1 Apply engineering mathematics and computations to solve mathematical models 2.4.2 Produce and validate results through skilful use of contemporary engineering tools and models 2.4.3 Identify sources of error in the solution process, and limitations of the solution. 2.4.4 Extract desired understanding and conclusions consistent with objectives and limitations of the analysis

PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

Competency	Indicators
3.1 Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.1.1 Recognize that need analysis is key to good problem definition 3.1.2 Elicit and document, engineering requirements from stakeholders 3.1.3 Synthesize engineering requirements from a review of the state-of-the-art 3.1.4 Extract engineering requirements from relevant engineering Codes and Standards such as ASME, ASTM, BIS, ISO and ASHRAE. 3.1.5 Explore and synthesize engineering requirements considering health, safety risks, environmental, cultural and societal issues 3.1.6 Determine design objectives, functional requirements and arrive at specifications
3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1 Apply formal idea generation tools to develop multiple engineering design solutions 3.2.2 Build models/prototypes to develop a diverse set of design solutions 3.2.3 Identify suitable criteria for the evaluation of alternate design solutions
3.3 Demonstrate an ability to select an optimal design scheme for further development	3.3.1 Apply formal decision-making tools to select optimal engineering design solutions for further development 3.3.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.4 Demonstrate an ability to advance an engineering design to defined end state	3.4.1 Refine a conceptual design into a detailed design within the existing constraints (of the resources) 3.4.2 Generate information through appropriate tests to improve or revise the design

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Competency	Indicators
4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1 Define a problem, its scope and importance for purposes of investigation 4.1.2 Examine the relevant methods, tools and techniques of experiment design, system calibration, data acquisition, analysis and presentation 4.1.3 Apply appropriate instrumentation and/or software tools to make measurements of physical quantities 4.1.4 Establish a relationship between measured data and underlying physical principles.

Competency	Indicators
4.2 Demonstrate an ability to design experiments to solve open-ended problems	4.2.1 Design and develop an experimental approach, specify appropriate equipment and procedures 4.2.2 Understand the importance of the statistical design of experiments and choose an appropriate experimental design plan based on the study objectives
4.3 Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1 Use appropriate procedures, tools and techniques to conduct experiments and collect data 4.3.2 Analyze data for trends and correlations, stating possible errors and limitations 4.3.3 Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions 4.3.4 Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Competency	Indicators
5.1 Demonstrate an ability to identify/ create modern engineering tools, techniques and resources	5.1.1 Identify modern engineering tools such as computer-aided drafting, modeling and analysis; techniques and resources for engineering activities 5.1.2 Create/adapt/modify/extend tools and techniques to solve engineering problems
5.2 Demonstrate an ability to select and apply discipline-specific tools, techniques and resources	5.2.1 Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs. 5.2.2 Demonstrate proficiency in using discipline-specific tools
5.3 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1 Discuss limitations and validate tools, techniques and resources 5.3.2 Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Competency	Indicators
6.1 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1 Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level
6.2 Demonstrate an understanding of professional engineering regulations, legislation and standards	6.2.1 Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

Competency	Indicators
7.1 Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.1.1 Identify risks/impacts in the life-cycle of an engineering product or activity 7.1.2 Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability

7.2	Demonstrate an ability to apply principles of sustainable design and development	7.2.1	Describe management techniques for sustainable development
		7.2.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Competency		Indicators	
8.1	Demonstrate an ability to recognize ethical dilemmas	8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives
8.2	Demonstrate an ability to apply the Code of Ethics	8.2.1	Identify tenets of the ASME professional code of ethics
		8.2.2	Examine and apply moral & ethical principles to known case studies

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Competency		Indicators	
9.1	Demonstrate an ability to form a team and define a role for each member	9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
		9.1.2	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.
9.2	Demonstrate effective individual and team operations--communication, problem-solving, conflict resolution and leadership skills	9.2.1	Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
		9.2.2	Treat other team members respectfully
		9.2.3	Listen to other members
		9.2.4	Maintain composure in difficult situations
9.3	Demonstrate success in a team-based project	9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

Competency		Indicators	
10.1	Demonstrate an ability to comprehend technical literature and document project work	10.1.1	Read, understand and interpret technical and non-technical information
		10.1.2	Produce clear, well-constructed, and well-supported written engineering documents
		10.1.3	Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.2	Demonstrate competence in listening, speaking, and presentation	10.2.1	Listen to and comprehend information, instructions, and viewpoints of others
		10.2.2	Deliver effective oral presentations to technical and non-technical audiences
10.3	Demonstrate the ability to integrate different modes of communication	10.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations
		10.3.2	Use a variety of media effectively to convey a message in a document or a presentation

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PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	
Competency	**Indicators**
11.1 Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1 Describe various economic and financial costs/benefits of an engineering activity 11.1.2 Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.2 Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.2.1 Analyze and select the most appropriate proposal based on economic and financial considerations.
11.3 Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.3.1 Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks. 11.3.2 Use project management tools to schedule an engineering project, so it is completed on time and on budget.
PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	
Competency	**Indicators**
12.1 Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1 Describe the rationale for the requirement for continuing professional development 12.1.2 Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
12.2 Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current 12.2.2 Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
12.3 Demonstrate an ability to identify and access sources for new information	12.3.1 Source and comprehend technical literature and other credible sources of information 12.3.2 Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

The above table can be used for most of the engineering programs. However, for Computer Science & Engineering/ Information Technology programs it requires some modifications.

A suggestive list of competencies and associated performance indicators for Computer Science & Engineering/ Information Technology **Programs is given in Appendix- A.**

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IMPROVING STRUCTURE AND QUALITY OF ASSESSMENTS

For improving the structure and quality of assessment in various engineering programs following points need to be remembered:

1. In Indian engineering education system, written examinations play a major role in assessing the learning and awarding of grades to the student. Universities and colleges give highest weightage to the outcomes of the written examinations in overall grading. Questions raised in the examination/test papers play an important role in defining the level of learning the student is expected to achieve in the courses and hence in the program. Since assessment drives learning, the design of question papers needs to go beyond the mere test of memory recall. They also need to test higher-order abilities and skills.

2. Written examinations assess a very limited range of outcomes and cognitive levels. Particularly in the courses, where course outcomes (COs) cover a broad range of expectations, written examinations alone will not be sufficient to make valid judgements about student learning. A wide range of assessment methods (e.g., term papers, open-ended problem-solving assignments, course/lab project rubrics, portfolios etc.) need to be employed to ensure that assessment methods match with learning outcomes.

3. It is advisable to formulate assessment plans for each of the course in the program that brings clarity to the following:

    a. Alignment of assessment with learning outcome of the course

    b. Level of learning (cognitive) student is expected to achieve

    c. Assessment method to be adapted

The method to align examination questions/assessment to COs and hence POs was discussed in the section-1. The following sections discuss the application of Bloom's taxonomy framework to create the optimal structure of examination papers to test the different cognitive skills.

1. Bloom's Taxonomy for Assessment Design

Bloom's Taxonomy provides an important framework to not only design curriculum and teaching methodologies but also to design appropriate examination questions belonging to various cognitive levels. Bloom's Taxonomy of Educational Objectives developed in 1956 by Benjamin Bloom [6] was widely accepted by educators for curriculum design and assessment. In 2001, Anderson and Krathwohl modified Bloom's taxonomy [7] to make it relevant to the present-day requirements. It attempts to divide learning into three types of domains (cognitive, affective, and behavioural) and then defines the level of performance for each domain. Conscious efforts to map the curriculum and assessment to these levels can help the programs to aim for higher-level abilities which go beyond remembering or understanding, and require application, analysis, evaluation or creation.

Revised Bloom's taxonomy in the cognitive domain includes thinking, knowledge, and application of knowledge. It is a popular framework in engineering education to structure the assessment as it characterizes complexity and higher-order abilities. It identifies six levels of competencies within the cognitive domain (Fig. 2) which are appropriate for the purposes of engineering educators.

According to revised Bloom's taxonomy, the levels in the cognitive domain are as follows:

Level	Descriptor	Level of attainment
1	Remembering	Recalling from the memory of the previously learned material
2	Understanding	Explaining ideas or concepts
3	Applying	Using the information in another familiar situation
4	Analysing	Breaking information into the part to explore understandings and relationships
5	Evaluating	Justifying a decision or course of action
6	Creating	Generating new ideas, products or new ways of viewing things

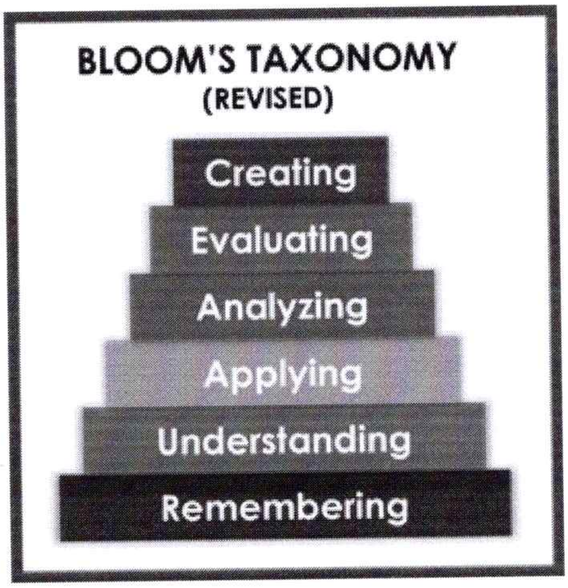

Fig. 2: Revised Bloom's Taxonomy

Bloom's taxonomy is hierarchical, meaning that learning at the higher level requires that skills at a lower level are attained.

2. Action Verbs for Assessment

Choice of action verbs in constructing assessment questions is important to consider. Quite often, the action verbs are indicators of the complexity (level) of the question. Over time, educators have come up with a taxonomy of measurable verbs corresponding to each of the Bloom's cognitive levels [8]. These verbs help us not only to describe and classify observable knowledge, skills and abilities but also to frame the examination or assignment questions that are appropriate to the level we are trying to assess.

Suggestive list of skills/ competencies to be demonstrated at each of the Bloom's level and corresponding cues/ verbs for the examination/ test questions is given below:

Level	Skill Demonstrated	Question cues / Verbs for tests
1. Remember	• Ability to recall of information like facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria • ability to recall methodology and procedures, abstractions, principles, and theories in the field • knowledge of dates, events, places • mastery of subject matter	list, define, tell, describe, recite, recall, identify, show, label, tabulate, quote, name, who, when, where
2. Understand	• understanding information • grasp meaning • translate knowledge into new context • interpret facts, compare, contrast • order, group, infer causes • predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss
3. Apply	• use information • use methods, concepts, laws, theories in new situations • solve problems using required skills or knowledge • Demonstrating correct usage of a method or procedure	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify
4. Analyse	• break down a complex problem into parts • Identify the relationships and interaction between the different parts of a complex problem • identify the missing information, sometimes the redundant information and the contradictory information, if any	classify, outline, break down, categorize, analyze, diagram, illustrate, infer, select
5. Evaluate	• compare and discriminate between ideas • assess value of theories, presentations • make choices based on reasoned argument • verify value of evidence • recognize subjectivity • use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate
6. Create	• use old ideas to create new ones • Combine parts to make (new) whole, • generalize from given facts • relate knowledge from several areas • predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

It may be noted that some of the verbs in the above table are associated with multiple Bloom's Taxonomy levels. These verbs are actions that could apply to different activities. We need to keep in mind that it's the skill, action or activity we need students to demonstrate that will determine the contextual meaning of the verb used in the assessment question.

3. Assessment Planning

While using Bloom's taxonomy framework in planning and designing of assessment of student learning, following points need to be considered:

1. Normally the first three learning levels; remembering, understanding and applying and to some extent fourth level analysing are assessed in the Continuous Internal Evaluation (CIE) and Semester End

Examinations (SEE), where students are given a limited amount of time. And abilities; analysis, evaluation and creation can be assessed in extended course works or in a variety of student works like course projects, mini/ minor projects, internship experience and final year projects.

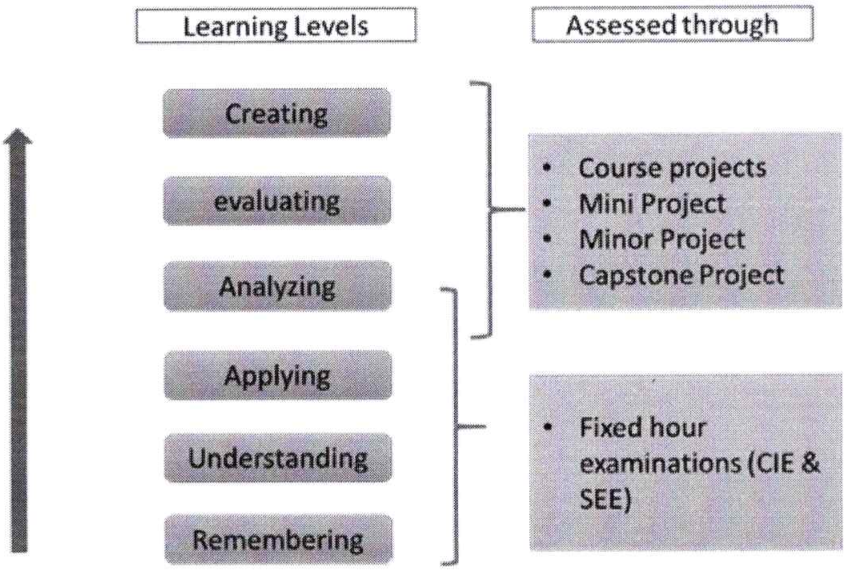

Fig. 3: Assessment methods for different Bloom's cognitive levels

2. Before adopting this framework for reforms in examination system of a University/Institution, it is worthwhile to study the present pattern of assessment in each of the course in the program to gain insight about:

   a) Alignment of assessment questions with course learning outcomes

   b) Whether all the learning outcomes are tested; sometimes some learning outcomes are over tested at the expense of others which may be not tested at all.

   c) Overall weightage in the assessment, to each of Bloom's learning levels

   d) Assessment methods used to adequately assess the content and desired learning outcomes

   Based on the study, improvement priorities for each of the above factors need to be arrived at. The reform process needs to be well planned and implemented through institutional strategy and communicated to all stakeholders particularly to the students.

3. A good and reasonable examination paper must consist of various difficulty levels to accommodate the different capabilities of students. Bloom's taxonomy framework helps the faculty to set examination papers that are well balanced, testing the different cognitive skills without a tilt towards a tough or easy paper perception. If the present examination questions are more focused towards lower cognitive skills, conscious efforts need to be made to bring in application skills or higher cognitive skills in the assessment. It is recommended that at institution/ University level, upper limit need to be arrived for lower order skills (for example, no more than 40% weightage for knowledge-oriented questions). It is important to note that, as nature of every course is different, the weightage for different cognitive levels in the question papers can also vary from course to course.

   • Examples of typical questions for each of Bloom's cognitive level are given in Appendix-B

   • Model Question Papers are given in Appendix- C

ASSESSING HIGHER-ORDER ABILITIES & PROFESSIONAL SKILLS

In the 21st century, professional skills (also known as soft skills, generic skills or transferable skills) have emerged as important attributes of a graduate engineer. Studies show that Industry/ employers around the world value these abilities more than the disciplinary knowledge. This is also reflected in the NBA graduate attributes wherein six out of twelve attributes belong to this category, viz. (1) communication, (2) teamwork, (3) understanding ethics and professionalism, (4) understanding global and societal contexts, (5) lifelong learning, and (6) knowledge of contemporary issues. Further, higher-order cognitive abilities like critical thinking, problem-solving and making informed decisions are also crucial for a graduate to succeed in the emerging world. Though the employers consider these professional skills and higher abilities as important, students are weak in them. The main challenge surrounding them is that they are difficult to assess through existing conventional examination system.

1. Innovative Educational Experiences to Teach and Assess

One of the main obstacles in addressing these outcomes is the limitation of educational experience we create within our engineering programs. Most of the coursework in our programs are oriented towards teaching technical knowledge and skills; hence, the assessment is limited to those abilities. However, acquiring the professional outcomes may not result simply from participation in a particular class or set of classes. Rather, these outcomes are more often acquired or influenced through sources both in and outside the classroom [4].

To address these challenges, comprehensive reforms are needed in the way we design our curriculum, student learning experiences and assessment of the outcomes. Worldwide several attempts are being made to address these challenges. Following are the few educational experiences that are recommended to teach and assess professional outcomes and higher-order cognitive abilities:

- Course projects
- Open-ended experiments in laboratories
- Project-based learning modules
- MOOCs
- Co-Curricular experiences
- Mini / Minor projects
- Final year projects
- Internship experiences
- E-portfolios of student works

2. Using Scoring Rubrics as Assessment Tool

To evaluate the above, student works for attainment of course outcomes and hence POs, it is of

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utmost importance to have reliable methods / proper assessment tools. Rubrics provide a powerful tool for assessment and grading of student work. They can also serve as a transparent and inspiring guide to learning. Rubrics are scoring, or grading tool used to measure a students' performance and learning across a set of criteria and objectives. Rubrics communicate to students (and to other markers) your expectations in the assessment, and what you consider important.

There are three components within rubrics namely (i) criteria / performance Indicator: the aspects of performance that will be assessed, (ii) descriptors: characteristics that are associated with each dimension, and (iii) scale/level of performance: a rating scale that defines students' level of mastery within each criterion.

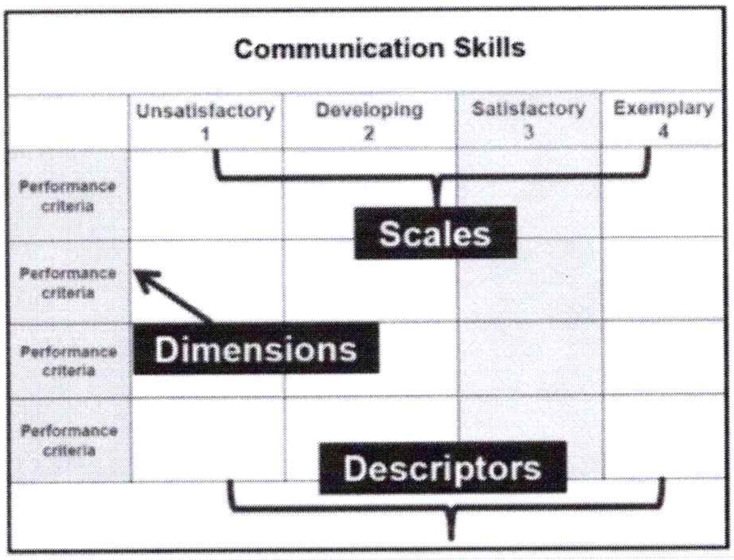

Fig. 4: Examples of Rubrics (Accessed from Rogers 2010)

3. Open-Book Examinations

In the earlier sections it was noted that the traditional written examinations have a significant weakness that they tend to encourage rote learning and more superficial application of knowledge. This deficiency can be overcome by "open-book examination". Open-book examination is similar to time constrained written examinations but designed in a way that allows students to refer to either class notes, textbooks, or other approved material while answering questions. They are particularly useful if you want to test skills in application, analysis and evaluation, i.e. higher levels of Bloom's taxonomy. However, in a program, the courses or the curriculum areas that are best suited to an open-book exam are to be carefully chosen.

Advantages of open-book examinations

1. Less demanding on memory and hence less stressful
2. Questions can emphasise more on problem-solving, application of knowledge and higher-order thinking rather than simple recall of facts.
3. Assessment questions can reflect real-life situations that require comprehension, information retrieval and synthesising skills of the students to solve.

Designing a good open-book examination

- Set questions that require students to do things with the information available to them, rather than to merely locate the correct information and then summarize or rewrite it.
- The questions in open-book exam must take advantage of the format, and give more weightage

to the application of knowledge, critical thinking and use of resources for solving real complex engineering problems.

- As the nature of questions is complex, it is to be ensured that the students get enough time. Open book test questions typically take longer time compared to traditional examinations. It is advisable either to set less number of questions that encompass 2 or 3 concepts taught or allocate longer duration of time for the examinations.

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APPENDIX

Competencies and Performance Indicators (PIs)
Computer Science & Engineering/Information Technology Programs

Appendix-A

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

Competency		Indicators	
1.2	Demonstrate competence in mathematical modelling	1.2.1	Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems
		1.2.2	Apply the concepts of probability, statistics and queuing theory in modeling of computer-based system, data and network protocols.
1.5	Demonstrate competence in basic sciences	1.5.1	Apply laws of natural science to an engineering problem
1.6	Demonstrate competence in engineering fundamentals	1.6.1	Apply engineering fundamentals
1.7	Demonstrate competence in specialized engineering knowledge to the program	1.7.1	Apply theory and principles of computer science and engineering to solve an engineering problem

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Competency		Indicators	
2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.5.1	Evaluate problem statements and identifies objectives
		2.5.2	Identify processes/modules/algorithms of a computer-based system and parameters to solve a problem
		2.5.3	Identify mathematical algorithmic knowledge that applies to a given problem
2.6	Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.6.1	Reframe the computer-based system into interconnected subsystems
		2.6.2	Identify functionalities and computing resources.
		2.6.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions
		2.6.4	Compare and contrast alternative solution/methods to select the best methods
		2.6.5	Compare and contrast alternative solution processes to select the best process.
2.7	Demonstrate an ability to formulate and interpret a model	2.7.1	Able to apply computer engineering principles to formulate modules of a system with required applicability and performance.
		2.7.2	Identify design constraints for required performance criteria.
2.8	Demonstrate an ability to execute a solution process and analyze results	2.8.1	Applies engineering mathematics to implement the solution.
		2.8.2	Analyze and interpret the results using contemporary tools.
		2.8.3	Identify the limitations of the solution and sources/causes.
		2.8.4	Arrive at conclusions with respect to the objectives.

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PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.	
Competency	**Indicators**
3.5 Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.5.1 Able to define a precise problem statement with objectives and scope. 3.5.2 Able to identify and document system requirements from stake- holders. 3.5.3 Able to review state-of-the-art literature to synthesize system requirements. 3.5.4 Able to choose appropriate quality attributes as defined by ISO/IEC/IEEE standard. 3.5.5 Explore and synthesize system requirements from larger social and professional concerns. 3.5.6 Able to develop software requirement specifications (SRS).
3.6 Demonstrate an ability to generate a diverse set of alternative design solutions	3.6.1 Able to explore design alternatives. 3.6.2 Able to produce a variety of potential design solutions suited to meet functional requirements. 3.6.3 Identify suitable non-functional requirements for evaluation of alternate design solutions.
3.7 Demonstrate an ability to select optimal design scheme for further development	3.7.1 Able to perform systematic evaluation of the degree to which several design concepts meet the criteria. 3.7.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.8 Demonstrate an ability to advance an engineering design to defined end state	3.8.1 Able to refine architecture design into a detailed design within the existing constraints. 3.8.2 Able to implement and integrate the modules. 3.8.3 Able to verify the functionalities and validate the design.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	
Competency	**Indicators**
4.4 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.4.1 Define a problem for purposes of investigation, its scope and importance 4.4.2 Able to choose appropriate procedure/algorithm, dataset and test cases. 4.4.3 Able to choose appropriate hardware/software tools to conduct the experiment.
4.5 Demonstrate an ability to design experiments to solve open-ended problems	4.5.1 Design and develop appropriate procedures/methodologies based on the study objectives
4.6 Demonstrate an ability to analyze data and reach a valid conclusion	4.6.1 Use appropriate procedures, tools and techniques to collect and analyze data 4.6.2 Critically analyze data for trends and correlations, stating possible errors and limitations 4.6.3 Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions 4.6.4 Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions

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PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Competency		Indicators	
5.4	Demonstrate an ability to identify/create modern engineering tools, techniques and resources	5.4.1	Identify modern engineering tools, techniques and resources for engineering activities
		5.4.2	Create/adapt/modify/extend tools and techniques to solve engineering problems
5.5	Demonstrate an ability to select and apply discipline-specific tools, techniques and resources	5.5.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
		5.5.2	Demonstrate proficiency in using discipline-specific tools
5.6	Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.6.1	Discuss limitations and validate tools, techniques and resources
		5.6.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Competency		Indicators	
6.3	Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.3.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level
6.4	Demonstrate an understanding of professional engineering regulations, legislation and standards	6.4.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

Competency		Indicators	
7.3	Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.3.1	Identify risks/impacts in the life-cycle of an engineering product or activity
		7.3.2	Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability
7.4	Demonstrate an ability to apply principles of sustainable design and development	7.4.1	Describe management techniques for sustainable development
		7.4.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Competency		Indicators	
8.3	Demonstrate an ability to recognize ethical dilemmas	8.3.1	Identify situations of unethical professional conduct and propose ethical alternatives

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8.4	Demonstrate an ability to apply the Code of Ethics	8.4.1 Identify tenets of the ASME professional code of ethics 8.4.2 Examine and apply moral & ethical principles to known case studies
PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.		
	Competency	**Indicators**
9.4	Demonstrate an ability to form a team and define a role for each member	9.4.1 Recognize a variety of working and learning preferences; appreciate the value of diversity on a team 9.4.2 Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.
9.5	Demonstrate effective individual and team operations--communication, problem-solving, conflict resolution and leadership skills	9.5.1 Demonstrate effective communication, problem-solving, conflict resolution and leadership skills 9.5.2 Treat other team members respectfully 9.5.3 Listen to other members 9.5.4 Maintain composure in difficult situations
9.6	Demonstrate success in a team-based project	9.6.1 Present results as a team, with smooth integration of contributions from all individual efforts
PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions		
	Competency	**Indicators**
10.4	Demonstrate an ability to comprehend technical literature and document project work	10.4.1 Read, understand and interpret technical and non-technical information 10.4.2 Produce clear, well-constructed, and well-supported written engineering documents 10.4.3 Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.5	Demonstrate competence in listening, speaking, and presentation	10.5.1 Listen to and comprehend information, instructions, and viewpoints of others 10.5.2 Deliver effective oral presentations to technical and non-technical audiences
10.6	Demonstrate the ability to integrate different modes of communication	10.6.1 Create engineering-standard figures, reports and drawings to complement writing and presentations 10.6.2 Use a variety of media effectively to convey a message in a document or a presentation
PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.		
	Competency	**Indicators**
11.4	Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.4.1 Describe various economic and financial costs/benefits of an engineering activity 11.4.2 Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.5	Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.5.1 Analyze and select the most appropriate proposal based on economic and financial considerations.

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11.6	Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.6.1 Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks. 11.6.2 Use project management tools to schedule an engineering project, so it is completed on time and on budget.
PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.		
Competency		**Indicators**
12.4	Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.4.1 Describe the rationale for the requirement for continuing professional development 12.4.2 Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
12.5	Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.5.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current 12.5.2 Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
12.6	Demonstrate an ability to identify and access sources for new information	12.6.1 Source and comprehend technical literature and other credible sources of information 12.6.2 Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

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Appendix-B

SAMPLES QUESTIONS FOR BLOOMS TAXONOMY LEVELS:

1. REMEMBER

Skill Demonstrated	Question Ques / Verbs for tests
• Ability to recall of information like, facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria • ability to recall methodology and procedures, abstractions, principles, and theories in the field • knowledge of dates, events, places • mastery of subject matter	list, define, describe, state, recite, recall, identify, show, label, tabulate, quote, name, who, when, where, etc.

Sample Questions:

1. State Ohm's law
2. List the physical and chemical properties of silicon
3. List the components of A/D converter
4. List the arithmetic operators available in C in increasing order of precedence.
5. Define the purpose of a constructor.
6. Define the terms: Sensible heat, Latent heat and Total heat of evaporation
7. List the assembler directives.
8. Describe the process of galvanisation and tinning
9. Write truth table and symbol of AND, OR, NOT, XNOR gates
10. Define the terms: Stress, Working stress and Factor of safety.
11. What is the difference between declaration and definition of a variable/function?
12. List the different storage class specifiers in C.
13. What is the use of local variables?
14. What is a pointer to a pointer?
15. What are the valid places for the keyword "break" to appear?
16. What is a self-referential structure?

2. UNDERSTAND

Skill Demonstrated	Question Ques / Verbs for tests
• understanding information • grasp meaning • translate knowledge into new context • interpret facts, compare, contrast • order, group, infer causes • predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss

Sample Questions:

1. Explain the importance of sustainability in Engineering design
2. Explain the behaviour of PN junction diode under different bias conditions
3. Describe the characteristics of SCR and transistor equivalent for a SCR
4. Explain the terms: Particle, Rigid body and Deformable body giving two examples for each.
5. How many values of the variable num must be used to completely test all branches of the following code fragment?

```
if (num>0)
    if (value<25)
{
        value=10*num;
        if(num<12)
                value=value/10;
}
else
        Value=20*num;
else
        Value=30*num
```

6. Discuss the effect of Make in India initiative on the Indian manufacturing Industry.
7. Summarise the importance of ethical code of conduct for engineering professionals
8. Explain the syntax for 'for loop'.
9. What is the difference between including the header file with-in angular braces < > and double quotes " "?
10. What is the meaning of base address of the array?
11. What is the difference between actual and formal parameters?
12. Explain the different ways of passing parameters to the functions.
13. Explain the use of comma operator (,).
14. Differentiate between entry and exit controlled loops.
15. How is an array different from linked list?

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3. APPLY

Skill Demonstrated	Question Ques / Verbs for tests
• use information • use methods, concepts, laws, theories in new situations • solve problems using required skills or knowledge • Demonstrating correct usage of a method or procedure	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify

Sample Questions:

1. Model and realize the following behaviors using diodes with minimum number of digital inputs.

    (i) Turning on of a burglar alarm only during night time when the locker door is opened.

    (ii) Providing access to an account if either date of birth or registered mobile number or both are correct.

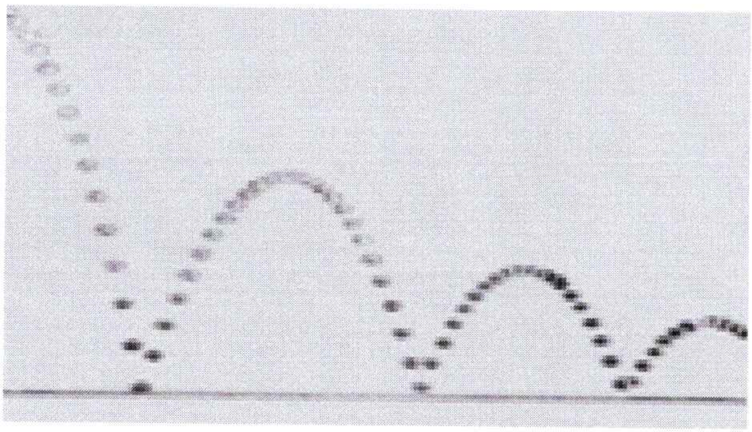
    (iii) Updating the parking slot empty light in the basement of a shopping mall.

2. One of the resource persons needs to address a huge crowd (nearly 400 members) in the auditorium. A system is to be designed in such a way that everybody attending the session should be able to hear properly and clearly without any disturbance. Identify the suitable circuit to boost the voice signal and explain its functionality in brief.

3. A ladder 5.0 m long rests on a horizontal ground & leans against a smooth vertical wall at an angle 20^0 with the vertical. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750 N stands on a rung 1.5 m from the bottom of the ladder. Calculate the coefficient of friction between the ladder & the floor.

4. A ball is dropped from 6 meters above a flat surface. Each time the ball hits the surface after falling a distance h, it rebounds a distance rh. What will be the total distance the ball travels in each of the following cases.

    (a) $r>1$ (b) $0<r<1$ (c) $r=1$



5. The region bounded by the curves y=e ^ ((-1)□x),y=0,x=1, and x=5 is rotated about the x-axis. Use Simpson's Rule with n=8 to estimate the volume of the resulting solid.

6. An electric train is powered by machine which takes the supply from 220 V DC rail running above the train throughout. Machine draws current of 100 A from the DC rail to account for high torque during starting and runs at 700 r.p.m initially. Calculate the new speed of the train once it picks up the speed

where the torque output required is only 70% of starting torque. Assume the motor has a resistance of 0.1Ω across its terminals.

7. Write an algorithm to implement a stack using queue.
8. A single array A[1..MAXSIZE] is used to implement two stacks. The two stacks grow from opposite ends of the array. Variables top1 and top2 (topl< top2) point to the location of the topmost element in each of the stacks. What is the condition for "stack full", if the space is to be used efficiently.
9. Consider the following table of arrival time and burst time for three processes P0, P1 and P2.

Process	Arrival time	Burst Time
P0	0 ms	9 ms
P1	1 ms	4 ms
P2	2 ms	9 ms

The pre-emptive shortest job first scheduling algorithm is used. Scheduling is carried out only at arrival or completion of processes. What is the average waiting time for the three processes?

10. A CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 128-page table entries and is 4-way set associative. What is the minimum size of the TLB tag?

4. ANALYZE

Skill Demonstrated	Question Ques / Verbs for tests
• break down a complex problem into parts. • Identify the relationships and interaction between the different parts of complex problem	classify, outline, break down, categorize, analyse, diagram, illustrate, infer, select

Sample Questions:

1. A class of 10 students consists of 5 males and 5 females. We intend to train a model based on their past scores to predict the future score. The average score of females is 60 whereas that of male is 80. The overall average of the class is 70. Give two ways of predicting the score and analyse them for fitting model.
2. Suppose that we want to select between two prediction models, M1 and M2. We have performed 10 rounds of 10-fold cross-validation on each model, whereas the same data partitioning in round one is used for both M1 and M2. The error rates obtained for M1 are 30.5, 32.2, 20.7, 20.6, 31.0, 41.0, 27.7, 26.0, 21.5, 26.0. The error rates for M2 are 22.4, 14.5, 22.4, 19.6, 20.7, 20.4, 22.1, 19.4, 16.2, 35.0. Comment on whether one model is significantly better than the other considering a significance level of 1%.
3. Return statement can only be used to return a single value. Can multiple values be returned from a function? Justify your answer.
4. Bob wrote a program using functions to find sum of two numbers whereas Alex wrote the statements to find the sum of two numbers in the main() function only. Which of the two methods is efficient in execution and why?
5. Carly wants to store the details of students studying in 1st year and later on wishes to retrieve the

information about the students who score the highest marks in each subject. Specify the scenario where the data can be organized as a single 2-D array or as multiple 1-D arrays.

6. Dave is working on a Campus Management Software but is unable to identify the maximum number of students per course. He decided to implement the same using arrays but discovered that there is memory wastage due to over-provisioning. Which method of memory storage should be used by Dave and how it can be implemented using C?

7. Albert is working on a 32-bit machine whereas Julie is working on a 64-bit machine. Both wrote the same code to find factorial of a number but Albert is unable to find factorial of a number till 9 whereas Julie is able to find the factorial of higher number. Identify the possible reason why Albert is unable to find the factorial. Suggest some changes in the code so that Albert can handle bigger inputs.

8. While writing a C code, the problem faced by the programmers is to find if the parenthesis is balanced or not. Write an algorithm to check if the parenthesis in C code are balanced. Initially your code should work for balanced { and } braces.

9. Swapping of the data in a linked list can be performed by swapping the contents in the linked list. Can the contents of a linked list be swapped without actually swapping the data?

5. EVALUATE

Skill Demonstrated	Question Ques / Verbs for tests
• compare and discriminate between ideas • assess value of theories, presentations • make choices based on reasoned argument • verify value of evidence • recognize subjectivity • use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate

6. CREATE

Skill Demonstrated	Question Ques / Verbs for tests
• use old ideas to create new ones • Combine parts to make (new) whole, • generalize from given facts • relate knowledge from several areas • predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

Both higher order cognitive skills 'Evaluate' and 'Create' are difficult to assess in time-limited examinations. These need to be assessed in variety of student works like projects, open ended problem-solving exercises etc. Typical examples of problem statements or need statements which need higher order abilities to solve are given below

Sample Problem / Need statements:

1. Automatic tethering of milking machine to the udder of a cow. A milk diary wants to automate the milking process. The milking process involves attaching the milking cups to the teats. Design a system for the same.

2. An electric vehicle uses LIoN batteries. The batteries have to be charged and get discharged during use.

The batteries require continuous monitoring during charging and discharging so that they remain healthy and yield a long life. Design a system to monitor and manage the health of the batteries.

3. A Biotech industry needs automation for filling its product into 20 ltr bottles. Design a system to meter the flow into the bottles so that each bottle has 20 ltr of the liquid. There will be more than one filling station and the system has to monitor all the filling stations as well as keep count of the total production on a daily basis.

4. Microwave Doppler radar with a range of 9m are available for motion detection. Design a surround view monitoring system for a 3 wheeler to detect human obstacles while the vehicle is in motion.

5. Design a system to assist the driver by using cameras to detect lane markers and pedestrians while the vehicle is in motion.

6. Develop a small size USB 2.0 / 3.0 CMOS camera system which can be used for industrial inspection, medical applications, microscopy, etc. The system should be able to capture the image quickly and be able to process the captured image and then store it also

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APPENDIX
Model Question Papers

Appendix-C

MODEL QUESTION PAPER

Course: Programming for Problem solving (ESC 103)
Maximum Marks :100; Duration: 03 hours

<table>
<tr><th>Q.No</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th><th>PI</th></tr>
<tr><td>1(a)</td><td>Explain the steps involved in solving a problem using computer.</td><td>08</td><td>CO1</td><td>L2</td><td>1.4.1</td></tr>
<tr><td>1(b)</td><td>Write an algorithm to find roots of a quadratic equation ax2 + bx +c = 0 reading the values of a, b and c.</td><td>12</td><td>CO2</td><td>L3</td><td>1.4.1</td></tr>
<tr><td>2(a)</td><td>Compare if-else-if and switch statement giving examples for their relevant use.</td><td>08</td><td>CO2</td><td>L2</td><td>1.4.1</td></tr>
<tr><td>2b</td><td>Write a C program that reads a given integer number and checks whether it a palindrome. A palindrome is a number that has same value even when it is reversed. Eg: 12321 is a palindrome.</td><td>12</td><td>CO3</td><td>L3</td><td>1.4.1</td></tr>
<tr><td>3a</td><td>Compare the working of three looping constructs of C language giving their syntax.</td><td>08</td><td>CO3</td><td>L2</td><td>1.4.1</td></tr>
<tr><td>3b</td><td>What does the following program do?
#include <stdio.h>
int main()
{
char ch;
int vcnt = 0, ccnt=0;
for (ch = getchar(); ch != '\n'; ch=getchar()){
if(ch=='a' || ch=='e' || ch=='i' || ch=='o' || ch=='u' ||
ch=='A' || ch=='E' || ch=='I' || ch=='O' || ch=='U')
vcnt++;
else if((ch >= 'a' && ch <= 'z') || (ch >= 'A' && ch <= 'Z'))
ccnt++;
}
printf(" %d %d\n", vcnt, ccnt);
}
Rewrite the above program using while and switch constructs.</td><td>12</td><td>CO4</td><td>L4</td><td>1.4.1</td></tr>
<tr><td>4a</td><td>Compare call by value and call by reference with relevant examples.</td><td>8</td><td>CO3</td><td>L2</td><td>1.4.1</td></tr>
<tr><td>4b</td><td>Write a C function to find the largest and smallest in a given list of integers of size n using call by reference:
void minmax(int list[ ], int n, int *min, int *max);</td><td>12</td><td>CO3</td><td>L3</td><td>1.4.1</td></tr>
<tr><td>5a</td><td>Explain at least four file handling operations available in C language giving their syntax.</td><td>4</td><td>CO3</td><td>L2</td><td>1.4.1</td></tr>
<tr><td>5b</td><td>Identify the bug in the following function written to return the swapped values of two integer variables given:</td><td></td><td></td><td></td><td></td></tr>
</table>

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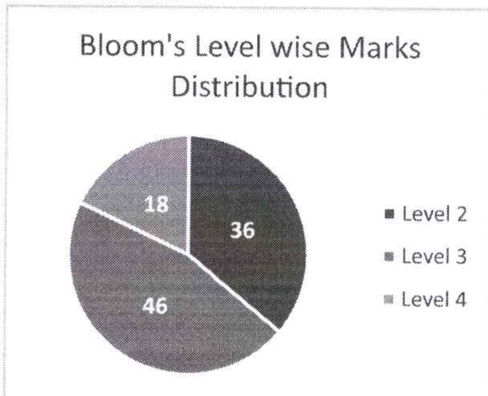
	int swap(int *x, int *y)
	{
	  int *temp;
	  temp = x, x=y, y = temp;
	}
		6	CO5	L4	1.4.1

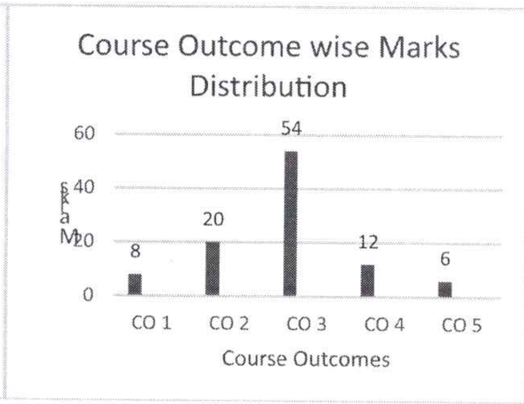
5c	Define a structure to store time with three components hours, mins and seconds. Write a modular C program to compute the time taken by an athlete to complete a marathon reading the start and end time of his run.	10	CO3	L3	1.4.1

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)

CO – Course Outcomes

PO – Program Outcomes; PI Code – Performance Indicator Code





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MODEL QUESTION PAPER FOR END SEMESTER EXAMINATION

Course Name: Programming for Problem Solving
Duration: 3 hrs. ; Max. Marks: 100

Instructions:

a. Attempt five questions selecting ONE from each section. Question 9 (Section E) is compulsory.

b. All the questions carry equal marks.

c. Draw neat diagrams wherever applicable.

Q. No	Question	Marks	BL	CO	PO	PI Code
	Section-A					
1.	a. What is an algorithm? Explain the characteristics of an algorithm.	2+6	1,2	2	1	1.4.1
	b. Write an algorithm to find angle between hour and minute hands of a clock at a given time.	7	3	3	1	1.4.1
	c. Is it mandatory to declare main() function with return type as void or int. What will be the effect if there is no return type declared for main() function?	3+2	4	3	1	1.4.1
	OR					
2.	a. What is the difference between definition and declaration in C? When a user writes "int x;" is it treated as declaration or definition in C.	3+2	2,4	3	1	1.4.1
	b. Write a program in C to find largest of 3 positive integer numbers using conditional operators.	7	3	3	1,2	1.4.1, 2.2.4
	c. What is meant by iterative statements? What are the different types of iterative statements in C?	8	1,2	3	1	1.4.1
	Section-B					
3.	a. Bob has placed N objects in a row which are marked with a number equal to their weight in Kg. He wants to check whether the objects are in increasing order of their weights or not. Write a C program to help Bob.	12	3	3,6,7	1,2	1.4.1, 2.2.4
	b. Differentiate between Big-O and Big-Omega notation.	4	2	3	1	1.4.1
	c. What is the role of index in an array? How are the elements of a 2D array accessed in C?	2+2	2	3	1	1.4.1
	OR					
4.	a. Ram is conducting a study which is based on counting the number of cars crossing the highway. Every hour he generates a random string containing sequence of characters <rbwbwr...>, where r represents red color, w denotes white color and b denotes blue color cars. The string is forwarded to Shyam for analysis who computes the number of red, blue and white color cars crossing Ram every hour. Assume that Ram works for 5 hours in a day, help Shyam generate a daily report containing the following: i. Total number of different colour cars crossing Ram in an hour. ii. Total number of different colour cars crossing Ram in a day. iii. Total number of cars crossing Ram in a day.	4+4+4	3	3,6,7	1,2	1.4.1, 2.2.4

	b. What is a variable? Explain the ways to declare scope of a variable.	2+6	1,2	3	1	1.4.1
	Section-C					
5.	a. Write a program which will read positive integer numbers from the users and compute the sum if the number can be expressed as power of 2. The test whether a number can be expressed as power of 2 will be done using a function power_of_two(int a).	12	3	3,6,7	1,2	1.4.1
	b. What is recursion? Differentiate between homogeneous and heterogeneous recursion with the help of an example.	2+3+3	2	3	1	1.4.1
	OR					
6.	a. What are the different ways to pass parameters to a function? Explain with the help of a suitable example.	4+4	2	3,5	1	1.4.1
	b. Is it possible to return multiple values from a function? Justify the statement with the help of an example.	4+8	3	3,6,7	1,2	1.4.1
	Section-D					
7.	a. What is a structure? What is the benefit offered by using a structure over multiple arrays?	2+6	2	5	1	1.4.1
	b. Ram is working on a project which requires returning multiple values from a function. He observed that a return statement can only be used to return a single value from a function. How the function should be implemented so that multiple values can be returned by Ram?	12	4	5	1	1.4.1
	OR					
8.	a. Write a program that reads a number as input from the user. The entered number is written to a file "even.txt" if the input is even else it is written to "odd.txt". Write a C code to perform the desired task.	12	3	5	1	1.4.1
	b. What are the different methods to open a file? Explain each with the help of a C program.	3+5	2	5	1	1.4.1
	Section-E (Compulsory Question)					
9.	a. What is a compiler? List names of any 2 compilers.	2 ½	1	1	1	1.4.1
	b. What are the benefits of designing a flowchart for solving a problem?	2 ½	4	2	1	1.4.1

	c. What is the output of the following code?
	int main(){
	int x=10;
	int y=sizeof(x/2);
	printf("%d",y); }
		2 ½	3	4	1	1.4.1

	d. What is the difference between creating constant using #define macro and const keyword?	2 ½	3	3	1	1.4.1
	e. What is the role of function prototype? When is it required in C?	2 ½	2	3	1	1.4.1
	f. Which of the following are unary operators in C? State reason for your answer. a. ! b. sizeof c. ~ d. &&	2 ½	2	3	1	1.4.1

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	g. Which of the following special symbol allowed in a variable name? State reason for your answer. a. * (asterisk) b. | (pipeline) c. - (hyphen) d. _ (underscore)	2 ½	2	3	1	1.4.1
	h. In which header file is the NULL macro defined? State reason for your answer. a. stdio.h b. stddef.h c. stdio.h and stddef.h d. math.h	2 ½	2	3	1	1.4.1

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CO – Course Outcomes

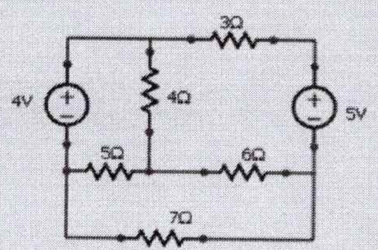
PO – Program Outcomes; PI Code – Performance Indicator Code

MODEL QUESTION PAPER

Total Duration (H:M): 3:00

Course : Basic Electrical Engineering (ESC101)

Maximum Marks :100

Q.No	Questions	Marks	CO	BL	PI
1(a)	Calculate current through 4 Ω resistor using Kirchoff's Laws? Verify the same using Superposition Theorem. 	12	CO1	L3	1.3.1
1(b)	Derive the expression for the transient current in a series 'R-L' circuit when a 'dc' voltage of V volts is applied. Sketch time variation of current in the circuit.	8	CO1	L2	1.3.1
2(a)	Two impedances Z1=15+j12Ω and Z2=8-j5 Ω are connected in parallel. If the potential difference across one of the impedance is 250 V, calculate i) total current and branch currents ii) total power and power consumed in each branch iii) overall p.f. IV) draw the phasor diagram	12	CO2	L3	1.3.1
2b	It is desired to operate a 100 W, 120 V, electric bulb at its rated current on a 240 V, 50 Hz supply. The simplest arrangement is to use either (a) a resistor, or (b) a capacitor or (c) an inductor having 10 Ω resistance in series with the electric bulb so as to drop the excess voltage. Determine the value of the component used, the total power consumed and the power factor in each case. Giving reasons, state which alternative is the best.	8	CO2	L4	1.3.1

3a	A single phase 25 kVA 1000/2000 V, 50 Hz transformer has maximum efficiency of 98% at full load upf. Determine its efficiency at, (a) 3/4th full load, unity power factor (b) 3/4th full load 0.8 power factor	12	CO3	L3	1.3.1
3b	Explain the working of a practical transformer with relevant phasor diagram. and define voltage regulation.	8	CO3	L2	1.3.1
4a	A two pole 3 phase 50 Hz induction motor is running on load with a slip of 4%. Calculate the actual speed and the synchronous speed of the machine. Sketch the speed/ load characteristic of the machine.	8	CO4	L2	1.3.1
4b	A wireless battery powered drilling machine operates on 24 V DC with constant speed and negligible field current. Initially when the machine is powered it runs at 1200 rpm and draws 0.5 A from the battery. Further when the drill bit starts drilling the hole, the speed reduces to 1120 rpm. Determine power requirement from the battery for drilling if the resistance of the armature is 0.2Ω. What is the power drawn initially?	12	CO4	L4	1.3.1
5a	Explain the working principle of a single phase pulse width modulated voltage source inverter with relevant circuit diagram and draw the output voltage wave form.	8	CO5	L2	1.3.1
5b	To protect an expensive circuit component from being delivered too much power, you decide to incorporate a fast blowing fuse into the design. Knowing that the circuit component is connected to 12 V, its minimum power consumption is 12 watts and the maximum power it can safely dissipate is 100 watts, which of the three available fuse ratings should you select: 1A , 4A or 10 A? Give reasons.	6	CO6	L4	1.3.1
5c	Calculate the i) ampere-hour and ii) watt-hour efficiency of a secondary cell which is discharged at a uniform rate of 30 A for 6 hours at an average terminal voltage of 2 V. It is then charged at a uniform rate of 40 A for 5 hours to restore it to its original condition. The terminal voltage during charging is 2.5 V.	6	CO6	L3	1.3.1

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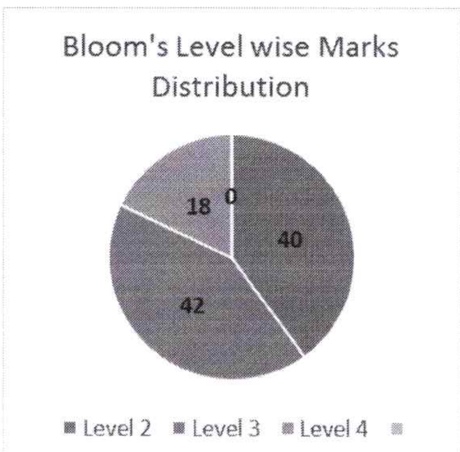

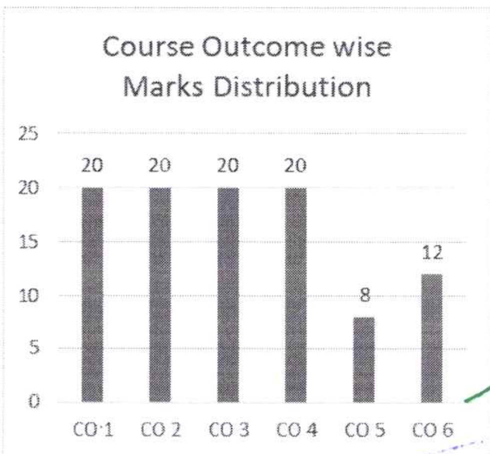

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Appendix-D

RUBRICS FOR COMMUNICATION (WRITTEN & ORAL)

Component	Proficient	Acceptable	Needs Improvements
Written Communication	Report is well organized and clearly written. The underlying logic is clearly articulated and easy to follow. Words are chosen that precisely express the intended meaning and support reader comprehension. Diagrams or analyses enhance and clarify presentation of ideas. Sentences are grammatical and free from spelling errors.	Report is organized and clearly written for the most part. In some areas the logic or flow of ideas is difficult to follow. Words are well chosen with some minor exceptions. Diagrams are consistent with the text. Sentences are mostly grammatical and only a few spelling errors are present but they do not hinder the reader.	Report lacks an overall organization. Reader has to make considerable effort to understand the underlying logic and flow of ideas. Diagrams are absent or inconsistent with the text. Grammatical and spelling errors make it difficult for the reader to interpret the text in places.
Presentation Visual Aids	Slides are error-free and logically present the main components of the process and recommendations. Material is readable and the graphics highlight and support the main ideas.	Slides are error-free and logically present the main components of the process and recommendations. Material is mostly readable and graphics reiterate the main ideas.	Slides contain errors and lack a logical progression. Major aspects of the analysis or recommendations are absent. Diagrams or graphics are absent or confuse the audience.
Oral Presentation	Speakers are audible and fluent on their topic, and do not rely on notes to present or respond. Speakers respond accurately and appropriately to audience questions and comments.	Speakers are mostly audible and fluent on their topic, and require minimal referral to notes. Speakers respond to most questions accurately and appropriately.	Speakers are often inaudible or hesitant, often speaking in incomplete sentences. Speakers rely heavily on notes. Speakers have difficulty responding clearly and accurately to audience questions.
Body Language	Body language, as indicated by appropriate and meaningful gestures (e.g., drawing hands inward to convey contraction, moving arms up to convey lift, etc.) eye contact with audience, and movement, demonstrates a high level of comfort and connection with the audience.	Body language, as indicated by a slight tendency to repetitive and distracting gestures (e.g., tapping a pen, wringing hands, waving arms, clenching fists, etc.) and breaking eye contact with audience, demonstrates a slight discomfort with the audience.	Body language, as indicated by frequent, repetitive and distracting gestures, little or no audience eye-contact, and /or stiff posture and movement, indicate a high degree of discomfort interacting with audience.

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RUBRICS FOR ASSESSMENT OF DESIGN PROJECTS

Category	Needs Improvements	Acceptable	Proficient
Purpose of the Project	Does not clearly explain the intended outcome of the project or provides little information about the problem that was being solved, the need being met, or why the project was selected	Provides a description of the intended outcome of the project which includes information about the problem that was being solved or the need being met, and why the project was selected	Provides a detailed intended outcome of the project which includes information about the problem that was being solved or the need being met, and clearly articulates the reasons and decision-making process used to select the project
Research	Lacks awareness of similar work done by others in an unacceptable literary form	Reflects awareness of similar work done by others and presents it in an acceptable literary format	•Reflects thorough understanding of similar work done by others and presents it in an acceptable literary format
Choices	Lacks justification of choices with little or no references to functional, aesthetic, social, economic, or environmental considerations	Justifies choices made with reference to functional, aesthetic, social, economic, or environmental considerations	Demonstrates sophisticated justification of choices with reference to functional, aesthetic, social, economic, or environmental consideration
Alternative Designs	Only one design presented or clearly infeasible alternative given. Serious deficiencies in exploring and identifying alternative designs.	Alternative approaches identified to some degree.	Final design achieved after review of reasonable alternatives.
Application of Engineering Principles	No or erroneous application of engineering principles yielding unreasonable solution. Serious deficiencies in proper selection and use of engineering principles.	Effective application of engineering principles resulting in reasonable solution.	Critical selection and application of engineering principles ensuring reasonable results.
Final Design	Not capable of achieving desired objectives.	Design meets desired objectives.	Design meets or exceeds desired objectives.
Interpretation of Results	No or erroneous conclusions based on achieved results. Serious deficiencies in support for stated conclusions.	Sound conclusions reached based on achieved results.	Insightful, supported conclusions and recommendations.

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Rubrics can also be used effectively to design the continuous assessment of the student projects. The Performance Indicators referred to in the previous sections can be used measurement criteria in the rubric. In the following example, we can see that for different phases of the students projects, we can design the rubrics keeping in mind the deliverables of the project at that particular stage.

5 - SEMESTER MINI PROJECT

RUBRICS FOR REVIEW – I

PI Code	PI	Marks	Very Poor Up to 20%	Poor Up to 40%	Average Up to 60%	Good Up to 80%	Very good Up to 100%
2.1.1	Articulate problem statements and identify objectives - GA	02	Problem statement and objectives are not identified	Problem statement and objectives are not clear	Problem statement is clear and objectives are not in line with problem statement	Problem statement is clear and objectives are not completely defined.	Problem statement is clear and objectives are completely defined
2.1.2	Identify engineering systems, variables, and parameters to solve the problems - IA	02	Engineering systems are not identified. Variables, and parameters to solve the problems are not defined	Engineering systems are identified but not clear. Variables, and parameters to solve the problems are not defined	Engineering systems are clear. Variables, and parameters to solve the problems are not defined	Engineering systems are identified. Variables, and parameters to solve the problems are partially defined	Engineering systems are identified. Variables, and parameters to solve the problems are completely defined
2.2.3	Identify existing processes/ solution methods for solving the problem, including forming justified approximations and assumptions - GA	02	Not able to identify existing solution for solving the problem. The assumptions, approximations and justifications are also not identified.	Not able to identify existing solution for solving the problem. The assumptions, approximations and justifications are identified but not clear	Not able to identify existing solution for solving the problem. But assumptions and approximations are aligned to the objectives.	Able to identify existing solution for solving the problem. Assumptions, and approximations are clear	Able to identify existing solution for solving the problem. But assumptions, approximations and justifications are clear
2.2.4	Compare and contrast alternative solution processes to select the best process - GA	02	Not able to identify alternative solution processes	Not able to compare alternative solution processes	Able to compare alternative solution processes but could not contrast clearly	Able to compare alternative solution processes and contrast clearly but not able to select best process	Able to compare alternative solution processes, contrast it and also able to select best process
10.1.1	Read, understand and interpret technical and non-technical information - GA	02	Not able to identify technical and non-technical information	Able to identify non-technical information	Able to read technical and non-technical information, but could not understand and interpret	Able to read, understand technical and non-technical information, but could not interpret	Able to read, understand and interpret technical and non-technical information

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GA – Group Assessment IA – Individual Assessment

RUBRICS FOR REVIEW – II

PI Code	PI	Marks	Very Poor Up to 20%	Poor Up to 40%	Average Up to 60%	Good Up to 80%	Very good Up to 100%
3.2.1	Apply formal idea generation tools to develop multiple engineering design solutions - GA	02	Not able to identify tools to develop solutions	Able to identify but not able to use it effectively	Able to use the tool but not able to generate engineering designs	Able to generate engineering designs but not able to justify	Able to generate engineering designs with justification
3.2.3	Identify suitable criteria for evaluation of alternate design solutions - GA	02	Not able to identify criteria	Able to identify criteria but not able to use them	Able to use criteria but not able to compare alternatives	Not able to justify the comparison with criteria	Able to justify the comparison with criteria
3.3.1	Apply formal decision-making tools to select optimal engineering design solutions for further development - GA	02	Not able to identify decision-making tools	Able to identify but not able to choose optimum one	Able to identify optimum one but not able to use it	Able to use optimum one but not able to justify	Able to use optimum one with justification
3.2.2	Build models/ prototypes to develop diverse set of design solutions - IA	02	Not able to identify tool to build model/ prototype	Able to choose the tool but not able to use it effectively	Able to use the tool but not able to generate alternatives	Able to generate alternatives but not able to justify the best solution	Able to generate and justify the best solution
13.1.1	Develop 2D drawings of components/ systems using modern CAD tools - IA	02	Not able to identify CAD tools	Able to identify but not able to use CAD tool	Able to use CAD tool but not able to generate drawings	Able to generate drawings but not able to follow drawing standards	Able to generate drawings with standards
13.1.2	Develop 3D models of components/systems using modern CAD tools - IA	03	Not able to identify CAD tools	Able to identify but not able to use CAD tool	Able to use CAD tool but not able to generate 3D models	Able to generate models but not able to follow standards	Able to generate models with standards
13.1.3	Apply GD&T principles as per ASME standards to manufacturing drawings, with all relevant data like material, hardness, surface finish, and tolerances - IA	02	Not able to extract GD&T principles from ASME standards	Able to extract but not able to understand them	Able to understand but not able to apply GD&T standards	Able to apply GD&T standards to drawings but not able to justify	Able to apply and justify GD&T standards to drawings

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GA – Group Assessment IA – Individual Assessment

RUBRICS FOR REVIEW – III

PI Code	PI	Marks	Very Poor Up to 20%	Poor Up to 40%	Average Up to 60%	Good Up to 80%	Very good Up to 100%
3.4.2	Generate information through appropriate tests to improve or revise design - GA	02	Not able to identify suitable tests to be done	Able to identify but not able to follow testing procedure	Able to follow testing procedures but not able to collect information	Able to collect information but not able to apply it for improvement	Able to apply information for the improvement
4.3.1	Use appropriate procedures, tools and techniques to conduct experiments and collect data - GA	04	Not able to identify tools, techniques and procedures	Able to identify but not able to conduct experiments	Able to conduct experiments but not able to follow procedure	Able to follow procedure but not able to collect data	Able to collect data as per the standards
4.3.2	Analyze data for trends and correlations, stating possible errors and limitations - GA	03	Not able to understand data	Able to understand but not able to analyze data	Able to analyze data but not able to correlate them	Able to correlate but not able to identify errors and limitations	Able to identify errors and limitations
10.2.2	Deliver effective oral presentations to technical and non-technical audiences - IA	03	Could not deliver effective presentations.	Could not deliver presentation, but presentation was prepared and attempted.	Able to deliver fair presentation but not able to answer to the audiences	Deliver effective presentations but able to answer partially to the audience queries.	Deliver effective presentation and able to answer all queries of the audience.
9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts – GA + IA	03	No Contribution from an individual to a team	Contributions from an individual to a team is minimal	Contributions from an individual to a team is moderate	A contribution from an individual to a team is good but not well groomed in team.	Contribution from an individual to a team is good and results in an integrated team presentation.

GA – Group Assessment IA – Individual Assessment

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AICTE COMMITTEE ON EXAMINATION REFORMS

Members of the Committee

1. **Prof. Ashok S. Shettar, Chairman**
   Vice Chancellor, KLE Technological University, Hubballi, Karnataka
2. **Prof. Rama Krishna Challa,**
   Head, Dept. of Computer Science and Engineering, NITTTR, Chandigarh
3. **Prof. Sanjay Agrawal**
   Dept. of Computer Engineering and Applications, NITTR, Bhopal (M.P)
4. **Prof. Upendra Pandel**
   Dept. of Metallurgical & Material Engineering, MNIT, Jaipur

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by State Act No. 30 of 2008)

Kukatpally, Hyderabad, Telangana (India).

- **Academic requirements**

  The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.**6.**

- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (26 marks out of 75 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject/ course.

- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Industrial Oriented Mini Project/Summer Internship and seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he (i) does not submit a report on Industrial Oriented Mini Project/Summer Internship, or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar as required in the IV year I Semester, or (iii) secures less than 40% marks in Industrial Oriented Mini Project/Summer Internship and seminar evaluations.

- A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it isscheduled.

- **Promotion Rules**

S. No.	Promotion	Conditions to be fulfilled
1	**First year first semester to first year second semester**	**Regular course of study of first year first semester.**
2	**First year second semester to second year first semester**	**(i) Regular course of study of first year second semester.**

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		(ii) Must have secured at least 18 credits out of 37 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	**Second year first semester to second year second semester**	**Regular course of study of second year first semester.**
4	**Second year second semester to third year first semester**	**(i) Regular course of study of second year second semester.** **(ii) Must have secured at least 47 credits out of 79 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
5	**Third year first semester to third year second semester**	**Regular course of study of third year first semester.**
6	**Third year second semester to fourth year first semester**	**(i) Regular course of study of third year second semester.** **(ii) Must have secured at least 73 credits out of 123 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
7	**Fourth year first semester to fourth year second semester**	**Regular course of study of fourth year first semester.**

- A student (i) shall register for all courses/subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA $\geq$ 5.0 (in each semester), and CGPA (at the end of each successive semester) $\geq$ 5.0, (iv) **passes all the mandatory courses,** to successfully complete the under graduate programme. The performance of the student in these 160 credits shall be taken into account for the calculation of 'the final CGPA **(at the end of under graduate programme)**, and shall be indicated in the grade card of IV year II semester.

- If a student registers for **'extra subjects'** (in the parent department or other

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departments/branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his department, the performances in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be taken into account while calculating the SGPA and CGPA. For such '**extra subjects'** registered, percentage of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1 – 7.4 above.

- A student eligible to appear in the semester end examination for any subject/ course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.
- A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements**. The academic regulations under which a student has been readmitted shall be applicable. However, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which the student has beendetained.
- student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which the student has been readmitted shall be applicable to him.
- **Evaluation - Distribution and Weightage of marks**
  - The performance of a student in every subject/course (including practical's and Project Stage – I & II) will be evaluated for 100 marks each, with 25 marks allotted for CIE (Continuous Internal Evaluation) and 75 marks for SEE (Semester End-Examination).
  - For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of one objective paper, one descriptive paper and one assignment. The objective paper and the descriptive paper shall be for 10 marks each with a total duration of 1 hour 20 minutes (20 minutes for objective and 60 minutes for descriptive paper). The objective paper is set with 20 multiple choice, fill-
  - in the blanks and matching type of questions for a total of 10 marks. The descriptive paper shall contain 4 full questions out of which, the student has to answer 2 questions, each carrying 5 marks. While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus. Five marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted

before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The total marks secured by the student in each mid-term examination are evaluated for 25 marks, and the average of the two mid-term examinations shall be taken as the final marks secured by each student in Continuous Internal Evaluation. If any student is absent from any subject of a mid-term examination, an on-line test will be conducted for him by the University. The details of the end semester question paper pattern are as follows:

- The semester end examinations (SEE) will be conducted for 75 marks consisting of two parts viz. i) **Part- A** for 25 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question consisting of ten sub-questions. The first five sub-questions are from each unit and carry 2 marks each. The next five sub-questions are one from each unit and carry 3 marks each.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

➢ For subjects like **Engineering Graphics/Engineering Drawing,** the SEE shall consist of five questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions. There shall be no Part – A, and Part – B system.

➢ For subjects like **Machine Drawing Practice/Machine Drawing**, the SEE shall be conducted for 75 marks consisting of two parts viz. (i) Part – A for 30 marks. 3 out of 4 questions must be answered, (ii) Part – B for 45 marks. Part – B is compulsory.

➢ For the Subject **Estimation, Costing and Project Management**, the SEE paper should consist of Part- A, Part-B and Part C. (i) Part – A – 1 out of 2 questions from Unit – I for 30 Marks, (ii) Part – B – 1 out of 2 questions from Unit – II for 15 Marks, (iii) Part – C – 3 out of 5 questions from Units – III, IV, V for 30 Marks.

➢ For subjects **Structural Engineering – I & II (RCC & STEEL),** the SEE will be conducted for 75 marks consisting of 2 parts viz. (i) Part – A for 15 marks and, (i) Part – B for 60 marks. Part – A is a compulsory question consisting of ten sub-questions. The first five sub-questions are from each unit relating to design theory and codal provisions and carry 2 marks each. The next five sub-questions are from each unit and carry 1 mark each. Part – B consists of 5 questions (numbered 2 to 6) carrying 12 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there is either or choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

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- **8.3** For practical subjects there shall be a continuous internal evaluation during the semester for 25 marks and 75 marks for semester end examination. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for
- 15 marks and internal practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned. The semester end examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the clusters of colleges which are decided by the examination branch of the University.
- **8.4** For the subject having design and/or drawing, (such as engineering graphics, engineering drawing, machine drawing, machine drawing practice and estimation), the distribution shall be 25 marks for continuous internal evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for semester end examination. There shall be two internal tests in a semester and the average of the two shall be considered for the award of marks for internal tests.
- **8.5** There shall be an Industrial Oriented Mini Project/Summer Internship, in collaboration with an industry of their specialization. Students will register for this immediately after III year II semester examinations and pursue it during summer vacation. Industrial Oriented Mini Project/Summer Internship shall be submitted in a report form and presented before the committee in IV year I semester. It shall be evaluated for 100 external marks. The committee consists of an external examiner, Head of the Department, supervisor of the Industrial Oriented mini project/Summer Internship and a senior faculty member of the department. There shall be no internal marks for Industrial Oriented Mini Project/Summer Internship.
- There shall be a seminar presentation in IV year I semester. For the seminar, the student shall collect the information on a specialized topic, prepare a technical report, and submit it to the department. It shall be evaluated by the departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 100 internal marks. There shall be no semester end examination for the seminar.
- UG project work shall be carried out in two stages: Project Stage – I during IV Year I Semester, Project Stage – II during IV Year II Semester. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester. First report includes project work carried out in IV Year I semester and second report includes project work carried out in IV Year I & II Semesters. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.
- For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall evaluate the project
- work for 75 marks and project supervisor shall evaluate for 25 marks. The student

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is deemed to have failed, if he (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

- For Project Stage – II, the external examiner shall evaluate the project work for 75 marks and the project supervisor shall evaluate it for 25 marks. The topics for industrial oriented mini project, seminar and Project Stage – I shall be different from one another. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

  For conducting viva-voce of project stage – II, University selects an external examiner from the list of experts in the relevant branch submitted by the Principal of the College.

  A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

- The laboratory marks and the internal marks awarded by the college are subject to scrutiny and scaling by the University wherever necessary. In such cases, the internal and laboratory marks awarded by the college will be referred to a committee. The committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective institutions as per the University rules and produced before the committees of the University as and when asked for.

- For mandatory courses of Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for passing the subject/course. **These marks should also be uploaded along with the internal marks of other subjects.**

- No marks or letter grades shall be allotted for mandatory/non-credit courses. Only Pass/Fail shall be indicated in Grade Card.

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Department of EEE

Teaching Faculty Work Load I SEM for the Academic year 2022-23

S.No	Name of the faculty	Subjects & Labs	Class/ Branch	No of periods	Total Workload
1	Dr.T. Kranti Kumar	ECA	II EEE	5	16
		ECA-I	I-EEE	5	
		EC LAB	II EEE	6	
2	E. Prasanna	HVDC T	IV EEE	5	16
		EMF	II EEE	5	
		BEE LAB	I CSD	6	
3	M.Satish Kumar	CS	III ECE-A&B	10	16
		EC LAB	II EEE	6	
5	M.Ragini	PSS LAB	III EEE	6	17
		BEE	I CSE-A	5	
		BEE LAB	I CSE-A	6	
5	M.Shankar	PS-II	III EEE	5	16
		BEE	I CSE-B	5	
		BEE LAB	I CSE-B	6	
6	K. Chandrashekar	NATL	II ECE A&B	10	16
		EM-I LAB	II EEE	6	
7	B. Srikanth	BEE LAB	I CSE-A	6	14
		BEE LAB	I CSE-B	6	
		EEEE	I EEE	2	
8	Dr.M. Surender Reddy	EHV	IV EEE	5	14
		SEMIANR	IV EEE	4	
		IOMP	IV EEE	5	

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9	D.Nageshwar Rao	EM-I	II EEE	5	17
		BEE LAB	I CSD	6	
		EM-I LAB	II EEE	6	
10	K. Madhavi	BEE	I CSE-C	5	17
		PE LAB	III EEE	6	
		BEE LAB	I CSE-C	6	
11	Dr.S. Srikanth Reddy	PE	III EEE	5	16
		IOMP	IV EEE	5	
		PE LAB	III EEE	6	
12	G. Pavan Kumar	HVE	III EEE	5	17
		BEE LAB	I CSE-C	6	
		M&I LAB	III EEE	6	
13	P. Sarawathi	SEMINAR	IV EEE	4	17
		BEE	CSD	5	
		E&ED LAB	IV EEE	6	
14	U. Ganesh	M&I	III EEE	5	17
		E&ED LAB	IV EEE	6	
		M&I LAB	III EEE	6	

HOD

Head of the Department
Electrical & Electronics Engineering
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Department of Mechanical Engineering

Teaching Faculty Work Load I SEM for the Academic year 2022-23

S.No	Name of the Faculty	Subjects	Class	No of periods	Total Workload
1	Dr. Y. Ramesh Babu	EG	I CSE-A	6	14
		TE-II LAB	III YEAR	3	
		POE	IV YEAR	5	
2	Dr G Ramachandra Reddy	EG	I CSE-B	6	8
		SEMINAR	IV YEAR	2	
3	Dr A Siva Kumar	TD	II YEAR	5	18
		R&AC	IV YEAR	5	
		CAEG	I EEE	6	
		EME	I MECH	2	
4	A. Shankar	MOS	II YEAR	5	21
		AMT	IV YEAR	5	
		EM	II EEE	5	
		IOMP	IV YEAR	6	
5	M. Venkateswarlu	EG CSD	I YEAR	6	17
		MD	II YEAR	3	
		DOM	III YEAR	5	
		KOM/DOM LAB	III YEAR	3	
6	V. Hari Nayak	MS&MOS LAB	II YEAR	3	20
		DMM-I	III YEAR	5	
		EW	I MECH	6	
		EG	I CSE-C	6	

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7	A.Swathi	MS&M	II YEAR	5	16
		TE-II	III YEAR	5	
		EW	I ECE-B	6	
		CAEG	I CSD	6	
8	R.V Prahlad	PT	II YEAR	5	19
		PT LAB	II YEAR	3	
		EW	I CSM	6	
		PPE	IV YEAR	5	
9	K. Sumanth	MT&M	III YEAR	5	19
		MT&M LAB	III YEAR	3	
		EW	I ECE-A	6	
		TB	IV YEAR	5	

HOD
Head of the Department
Mechanical Engineering
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Gunthapally (Vill), Abdullapur Met (Mdl),
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Department of Electronics & Communication Engineering

Teaching Faculty Work Load I SEM for the Academic year 2022-23

S.No	Name of the faculty	Subjects	Class	No of periods	Total Workload
1	Dr.G.SAIKUMAR	MWOC	IV-ECE-A	5	15
		MWOC LAB	IV-ECE-A	6	
		SEMINAR	IV-ECE-A	2	
		SEMINAR	IV-ECE-B	2	
2	G.SRINIVAS	EDC	II-ECE-A	5	17
		EDC LAB	II-ECE-A	6	
		PROJECT	IV-ECE-B	6	
3	P V RAJU	DSD	II-ECE-A	5	17
		DSD LAB	III-ECE-A	6	
		IOMP	IV-ECE-A	6	
4	V.GURAVAIAH	MPMC	III-ECE-A	5	17
		MPMC LAB	III-ECE-A	6	
		ADE LAB	II-CSE-A	6	
5	D.SURYAPRAKASH	DIP	IV-ECE-A	5	12
		AE LAB	II EEE	6	
6	S.SAGAR	ADE	II CSE-A	5	17
		ADE LAB	II CSE-A	6	
		DCN LAB	III-ECE-B	6	
7	M.YAMANI	SS	II-ECE-A	5	17
		BS LAB	II-ECE-A	6	
		MPMC LAB	III-ECE-A	6	

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8	E.NAGEASH	ADE LAB	II-CSE-B	6	12
		DSD LAB	II-ECE-A	6	
9	K.SHILPA	SEMINAR	IV-ECE-B	2	14
		MWOC LAB	IV-ECE-B	6	
		MPMC LAB	III ECE-B	6	
10	G.NAGU NAIK	DIP	IV-ECE-B	5	11
		EDC LAB	II-ECE-A	6	
11	K.SONY	DCN	III-ECE-A	5	13
		DCN LAB	III-ECE-A	6	
		EECE	I-ECE-A	2	
12	Dr.G CHANDRASHEKAR	EMI	III-ECE-A	5	17
		DCN LAB	III-ECE-A	6	
		DSD LAB	II-ECE-B	6	
13	B.KALPANA	MPMC	III-ECE-B	5	17
		MPMC LAB	III-ECE-B	6	
		EDC LAB	II-ECE-B	6	
14	M.SWATHI	SS	II-ECE-B	5	13
		BS LAB	II-ECE-B	6	
		EECE	I-ECE-B	2	
15	V.NAGASWATHI	EDC	II-ECE-B	5	17
		EDC LAB	II-ECE-B	6	
		ADE LAB	II-CSE-C	6	
16	B.VENKATESHWARLU	DSD	II-ECE-B	5	17
		DSD LAB	II-ECE-B	6	
		MWOC LAB	IV ECE-B	6	

17	K.ARUNA	NSCY	IV-ECE-A	5	14
		BS LAB	II-ECE-A	6	
		DSDFPGA LAB	I VLSI	3	
18	J.RAJKUMAR	CB&I	I VLSI	5	14
		EDC LAB	II ECE-B	6	
		CMOSICAD LAB	II VLSI	3	
19	M.SAI KRISHNA	DCN	III-ECE-B	5	13
		DCN LAB	III-ECE-B	6	
		SEMINAR	IV-ECE-A	2	
20	G.DILEEP	MT	I VLSI	5	17
		BS LAB	II ECE-A	6	
		MINI PROJECT	IV-ECE-A	6	
21	B DASHARATHA	PTSP	II ECE-B	5	17
		DSD LAB	II ECE-A	6	
		MWOC LAB	IV-ECE-A	6	
22	P.GEETHA	PTSP	II-ECE-A	5	17
		BS LAB	II-ECE-B	6	
		PROJECT STAGE-1	IV-ECE-B	6	
23	D.NEELAKANASWARAO	EMI	III-ECE-B	5	17
		MPMC LAB	III-ECE-B	6	
		AE LAB	II-EEE	6	
24	O.MOUNIKA	NSCY	IV-ECE-B	5	17
		EDC LAB	II ECE-A	6	
		MWOC LAB	IV-ECE-A	6	

25	P.PADMAVATHI	MWOC	IV-ECE-B	5	17
		MWOC LAB	IV ECE-B	6	
		EDC LAB	II ECE-A	6	
26	S.SAIDIREDDY	ADE	II-CSE-C	5	17
		ADE LAB	II-CSE-C	6	
		DSD LAB	II ECE-B	6	
27	Dr J B SIDDARTHA	ADE	II CSE-B	5	17
		ADE LAB	II CSE-B	6	
		DCN LAB	III ECE-B	6	
28	Dr S KISHORE REDDY	DSDFPGA	I VLSI	5	14
		DSDFPGA LAB	I VLSI	3	
		DISSERTATION	II VLSI	6	
29	Dr V NAGARAJU	AE	II EEE	5	20
		AE LAB	II EEE	6	
		AUDIT COURSE-I	I VLSI	3	
		DISSERTATION	II VLSI	6	
30	Dr M SATYANARAYANA	CMOSAICD	I VLSI	5	20
		CMOSAICD LAB	I VLSI	3	
		SEMINAR	II VLSI	6	
		MPMC LAB	III ECE-A	6	
31	R LAXMIKANTH	ADE LAB	II CSE-A	6	14
		RM&IPR	I VLSI	2	
		DISSERTATION	II VLSI	6	

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32	MOUNIKA CHOUHAN	WTE	II VLSI	5	17
		ADE LAB	II CSE-B	6	
		DCN LAB	III ECE-A	6	
33	V SRAVANTHI	PP	II VLSI	5	17
		ADE LAB	II-CSE-C	6	
		BS LAB	II ECE-A	6	

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Head of the Department
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Department of CSE, CSE(DS)&CSE(AL&ML)
Teaching Faculty work load I Sem for Academic Year 2022-23

S.No	Name of the faculty	Subjects & Labs	Class/ Branch	No of periods	Total Workload
1	Dr Shaik Shakeerbasha	SE	III CSE-A, B	10	16
		SE LAB	III CSE-A, B	6	
2	Alla Sravani	CN	III CSE- A, B	10	16
		CN&WT LAB	III CSE-A, B	6	
3	Balakrishna Goud Gardulla	ITW LAB	II CSE-A, B	12	21
		PPS LAB	I CSE-A, B, C	9	
4	Banda Jainabbi	DDB	III CSE-A, B	10	15
		PPS	I CSE-C	5	
5	Bomaraboina Shailaja	ITW LAB	II CSE-A, B	12	22
		CPE	I ECE - A	5	
		PPS	I CSM	5	
6	Devendla Vijayakrishna	PP LAB	II CSM, CSD	6	14
		CPE	I ECE-B	5	
		CPE LAB	I ECE-B	3	
7	Doti Nagaraju	CPDS	I EEE	5	13
		CPDS LAB	I EEE	3	
		CC	IV CSE- C	5	
8	Dr Abdul Ahad Afroz	PP	II CSM, CSD	10	16
		PP LAB	II CSM, CSD	6	
9	Dr Hameeda Shaik	PPS	I CSE-A, B	10	20
		PYTHON	IV ECE A,B	10	

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10	Dr J Sridatta Venkata Sastry	CNS	IV CSE-A	5	**16**
		PROJECT STAGE-1	IV CSE-A	6	
		MFCS	I-M.TECH	5	
11	Dr Prasad Rao Mandala	CNS	IV CSE-B	5	**16**
		PROJECT STAGE-1	IV CSE-B	6	
		CC	I-M.TECH	5	
12	Dr Shahebaz Ahmed Khan	COA	II CSM, CSD	10	**13**
		ML LAB	III-CSM	3	
13	Dr Suribabu Korada	ML	I M TECH	5	**13**
		ML LAB	I M TECH	4	
		SEMINAR	IV CSE B,C	4	
14	Dr T Lalitha Saroja	CNS	IV CSE-C	5	**17**
		DWR-II	II M TECH	12	
15	Duggirala Sai Suman Ravi Teja	IP	III CSM	5	**13**
		IDS	III CSD	5	
		PPS LAB	I CSD	3	
16	Gosala Subhashini	WT	III CSE-A, B	10	**16**
		WT LAB	III CSE-A, B	6	
17	Joolu Spandana	DM	IV CSE-A, B	10	**13**
		DS LAB	II -CSM	3	
18	Kanchanapalli Swathi	DM	IV CSE-C	5	**17**
		WT LAB	III CSE-A, B	6	
		ECSE	I CSE A,B	6	
19	Lavakumar Gande	PPS	I CSD	5	**14**
		SE LAB	III CSE-A, B	6	
		DS LAB	II-CSD	3	

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20	Lavudya Shivashankar	COA	II CSE-A, B, C	15	**15**
21	Mohd Aziz Ur Rahman	DS LAB	II CSE-A, B, C	9	**14**
		CPDS	I MECH	5	
22	Mushan Srinath	MINI PROJECT	IV CSE-A, B, C	15	**15**
23	Nagaraj Devatha	CNS LAB	IV CSE-A, B, C	9	**15**
		ECSE	I CSM	3	
		CPDS LAB	I MECH	3	
24	Nallabolu Pavani	CNS LAB	IV CSE-A, B, C	9	**12**
		PPS LAB	I CSE-A	3	
25	Nenevat Mangan	ECSE	I EEE, ECE	10	**13**
		PPS LAB	I CSE-B	3	
26	Panthangi Haimavathi	CC	IV CSE- B,C	10	**13**
		PPS LAB	I CSE-C	3	
27	Peteri Ashwanth Kumar	CD	III CSM	5	**12**
		CPDS LAB	I MECH	3	
		ADS	I M.TECH	4	
28	Raghu Salla	SPPM	IV CSE-A, B	10	**13**
		CPE LAB	I ECE-A	3	
29	Rangani Himabindhu	SEMINAR	IV CSE-A, B, C	6	**15**
		OOPS LAB	II CSE-A, B, C	9	
30	Shirisha Meka	FLAT	III CSE-A, B	10	**16**
		PROJECT STAGE-1	IV CSE-C	6	
31	Siddagoni Rohini	OOPS LAB	II CSE-A, B, C	9	**12**
		CPDS LAB	I EEE	3	

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32	Silveri Rajender	OOPS	II CSE-A, B	10	**16**
		OOPS LAB	II CSE-A, B	6	
33	Sirikonda Vasantha	OOPS	II CSE-C	5	**13**
		OOPS LAB	II CSE-C	3	
		SEMINAR	IV-CSE-A	2	
		CPE LAB	I ECE-B	3	
34	Souda Sravanvardhan	DS	II CSE-C	5	**14**
		DS LAB	II CSE-A, B, C	9	
35	Uddagiri Uma	DAA	III CSM, CSD	10	**13**
		DS LAB	II CSE-C	3	
36	Yenaganti Satish Kumar	DS	II CSE-A, B	10	**16**
		DS LAB	II CSE-A, B	6	
37	G Nikhilareddy	IRS	III CSM, CSD	10	**22**
		IT WORKSHOP LAB	II-CSE-A,C	12	
38	Naveen Kumar Badugu	IP	III CSD	5	**17**
		IT WORKSHOP LAB	II-CSE-C	6	
		DM LAB	III CSD	3	
		ECSE	I CSD	3	
39	Shaik Subhan Abdul	ML	III CSM	5	**14**
		ML LAB	III CSM	3	
		SE LAB	III CSE-B	3	
		PPS LAB	I CSM	3	
40	Subhan Ali Shaik	IP	III CSE-A, B	10	**13**
		SE LAB	III CSE-A	3	

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41	Udayabhanu Mankena	CN	III CSM	5	**14**
		CN LAB	III CSM	3	
		PPS LAB	I CSM	3	
		CPE LAB	I ECE-A	3	
42	Digajarla Prasad	DS	II CSM, CSD	10	**16**
		DS LAB	II CSM, CSD	6	
43	Neelakantam Kalagoni	CN	III CSD	5	**12**
		CN LAB	III CSD	3	
		ML LAB	I M TECH	4	
44	Pampana Tulasi	CC	IV CSE-A	5	**17**
		ITW LAB	II CSE - C	6	
		CN LAB	III CSD, IIICSD	6	
45	Praveen Arukula	DL	II MTECH	5	**13**
		ADS	I M TECH	5	
		ML LAB	III CSM	3	
46	Rajobha Satheesh Kumar	RM & IPR	I M TECH	2	**17**
		DM LAB	III CSD	3	
		PPS LAB	I CSE-C	3	
		ECSE	ICSC -C	3	
		IT WORKSHOP	II-CSE-C	6	
47	Sridevi Oruganti	DM	III CSD	5	**13**
		DM LAB	III CSD	3	
		PPS LAB	I CSD	3	
		AC-I	I M TECH	2	

HOD **PRINCIPAL**

Head of the Department
Computer Science & Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl)
Ranga Reddy District. Telangana.

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www.aietg.ac.in email: principal.avanthi@gmail.com

Department of H&S

Teaching Faculty Work Load I SEM for the Academic year 2022-23

S.No	Name of the Faculty	Subjects	Class	No of periods	Total Workload
1	Dr Kotte Shailaja	EC	I CSE-A,B	10	22
		EC LAB	I CSE-A,B	12	
2	Kapa Reddy Raja Manohar	EC	I CSE-C	5	17
		EC LAB	I CSE-C,CSD	18	
3	Pittala Venkatswamy	EC	I CSD,I EEE	10	14
		ES	I MECH	2	
		ES	I ECE-A	2	
4	Srilakshmi Damerla	EC LAB	I EEE	6	22
		ES	I CSM	2	
		ES	I ECE-B	2	
		GS LAB	II CSE - A,B,C,CSM,CSD,EEE	12	
5	Chatharasupalli Sunanda	ACS LAB	III ECE-A,B,EEE	18	18
6	Dr Sundeep Pally	ESE	I CSM,MECH	10	16
		ELCS LAB	I CSM	6	
7	Appala Gatteshwar Roy	ESE	I ECE-A	5	17
		ELCS LAB	I ECE-A,MECH	12	
8	Ramesh Narige	ESE	I ECE-B	5	17
		ELCS LAB	I ECE-B	6	
		ACS LAB	III CSD	6	
9	Swarupa Kumari	ACS LAB	III CSE-A,B,CSM	18	18
10	Nagaraju Kurella	MC	I CSM,I EEE	10	20
		MSF	II CSM,CSD	10	

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11	Sesha Giri Rao Kalluri	MC	I MECH	5	25
		PSCV	II MECH	5	
		COSM	II CSE A,B,C	15	
12	Sarwani Karlapalem	MC	I CSD,I ECE-B	10	20
		DM	I CSM,CSD	10	
13	A Anjaneyulu	MC	I CSE-A,B,C,ECE-A	20	20
13	Gogikar Laxminarayana	AP	I ECE-A, MECH	10	16
		AP LAB	I ECE-A	6	
14	Ravi Eslavath	AP	I ECE-B	5	17
		AP LAB	I ECE-B, MECH	12	
15	Swamyrao Kulkarni	AP	I CSM	5	11
		AP LAB	I CSM	6	

HOD
Head of the Department
Humanities & Sciences
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

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Department of MBA
Teaching Faculty Work Load I SEM for the Academic year 2022-23

S.No	Name of the Faculty	Subjects	Class	No of periods	Total Workload
1	Mankala Naresh	SAPM	II MBA-A	5	17
		SAPM	II MBA-C	5	
		COI	II MECH	2	
		PRLE	IV ECE-A	5	
2	Y Jaya Pradha	FRA	I MBA-A	5	15
		OR	III MECH	5	
		FRA	I MBA-B	5	
3	D. Manikanta	BE	I MBA-B	5	15
		TPM	II MBA-C	5	
		RMSA	I MBA-A	5	
4	Kasaramoni Sharath	LBE	I MBA-A	5	15
		PRLE	IV ECE-B	5	
		POM	II MBA-A	5	
5	Venkata Veera Narayana	LD	II-MBA B	5	14
		CCM	I MBA-A	5	
		SDA Lab	I MBA-A	2	
		COA	II ECE-A	2	
6	A.Naresh	BE	I MBA-A	5	19
		DA	II MBA-B	5	
		BC Lab	I MBA-A	2	
		TPM	II MBA-A	5	
		IPR	III ECE-A	2	

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7	Medipally Sudhakar	POM	II MBA-C	5	17
		BEFA	II EEE	5	
		MOB	I MBA-A	5	
		SDA Lab	I MBA -B	2	
8	G.Lingaiah	MOB	I MBA -B	5	15
		BE	I MBA -C	5	
		DA	II MBA-A	5	
9	K.Sabitha	LBE	I MBA -B	5	15
		POM	II MBA-C	5	
		LBE	I MBA -C	5	
10	R. Srilatha	CCM	I MBA -B	5	16
		CCM	I MBA -C	5	
		IPR	III CSM, III CSD	6	
11	K.Sindhuri	MOB	I MBA -C	5	20
		BEFA	III MECH	5	
		MIS	II MBA-A	5	
		MIS	II MBA-C	5	
12	A Ramesh Goud	FRA	I MBA -C	5	15
		SDA Lab	I MBA -C	2	
		IPR	III MECH	3	
		POM	II MBA-B	5	
13	Morri Sharadha	RMSA	I MBA -C	5	17
		RMFD	II MBA-C	5	
		SAPM	II MBA-B	5	
		IPR	III ECE-B	2	

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
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14	Siliveru Rambabu	LD	II MBA-A	5	17
		RMFD	II MBA-B	5	
		FOM	IV EEE	5	
		BC LAB	I MBA -C	2	
15	Nageshwer Rao Mothukuri	RMFT	II MBA-A	5	18
		RMSA	I MBA -B	5	
		IPR	III EEE	3	
		MIS	II MBA-B	5	
16	Oruganti Venkatesh	TPM	II MBA-B	5	14
		COA	II ECE-B	2	
		DA	II MBA-C	5	
		BC Lab	I MBA -B	2	
17	Dr. B. Nayeema	LD	II MBA-C	5	15
		POE	IV CSE-A&B	10	
18	N.Ramana Reddy	BEFA	II CSM &CSD	10	20
		BEFA	III ECE-A	5	
		FOM	IV EEE	5	
19	Ashraf Hussain	IPR	III CSE-A,B	6	21
		BEFA	III ECE-B	5	
		POE	IV CSE-C, EEE	10	

HOD

Head of the Department
MBA
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapurmet (Mdl),
Ranga Reddy District.

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Department of EEE

Teaching Faculty Work Load II SEM for the Academic year 2022-23

S.No	Name of the faculty	Subjects & Labs	Class/ Branch	No of periods	Total Workload
1	Dr.T. Kranti Kumar	PSP	III EEE	5	16
		PROJECT STAGE-II	IV-EEE	6	
		BPE	IV-CSE	5	
2	E. Prasanna	PS-I	II EEE	5	16
		BEE	I CSM	5	
		BEE LAB	I CSM	6	
3	M.Satish Kumar	CS	II EEE	5	16
		PSD	III EEE	5	
		CS LAB	III EEE	6	
5	M.Ragini	EM-II	II EEE	5	16
		EM-II LAB	II EEE	6	
		BEEE	II MECH	5	
5	M.Shankar	BPE	IV ECE-A	5	17
		BEE LAB	I CSM	6	
		ECA LAB	I-EEE	6	
6	K. Chandrashekar	PSOC	III EEE	5	16
		ECA-II	I EEE	5	
		BEE LAB	I ECE-B	6	
7	B. Srikanth	BPE	IV CSE-B	5	18
		BEE LAB	I ECE-A	6	
		EM-II LAB	II EEE	6	

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8	Dr.M. Surender Reddy	EDS	IV EEE	5	16
		BEE	I ECE-B	5	
		CS LAB	II EEE	6	
9	D.Nageshwar Rao	PROJECT STAGE-II	IV-EEE	6	17
		BPE	IV ECE-A	5	
		BEE LAB	I ECE-A	6	
10	K. Madhavi	ECA-II	I EEE	5	17
		CS LAB	II EEE	6	
		PS LAB	III EEE	6	
11	Dr.S. Srikanth Reddy	NCES	III EEE	5	16
		BEE	I ECE-A	5	
		BEE LAB	I ECE-A	6	
12	G. Pavan Kumar	PQ&FACTS	IV EEE	5	17
		BEEE LAB	II MECH	6	
		ECA LAB	I EEE	6	
13	P. Sarawathi	NCSE	IV EEE	5	17
		BEEE LAB	II MECH	6	
		PS LAB	III EEE	6	
14	U. Ganesh	PS LAB	III EEE	6	17
		EM-II LAB	II EEE	6	
		BPE	IV CSE-A	5	

HOD
Head of the Department
Electrical & Electronics Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
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Department of Mechanical Engineering

Teaching Faculty Work Load II SEM for the Academic year 2022-23

S.No	Name of the Faculty	Subjects	Class	No of periods	Total Workload
1	Dr. Y. Ramesh Babu	ICS	II MECH	5	16
		IR	IV MECH	5	
		EW	I CSE-A	6	
2	Dr G Ramachandra Reddy	PROJECT STAGE -II	IV MECH	6	15
		CAEG	I CSM	6	
3	Dr A Siva Kumar	DMM-II	III MECH	5	17
		PROJECT STAGE -II	IV MECH	6	
		CAEG	I ECE-A	6	
4	A. Shankar	TE-I	II MECH	5	19
		HT	III MECH	5	
		HT LAB	III MECH	3	
		EW	I CSE-B	6	
5	M. Venkateswarlu	FEM	III MECH	5	17
		ICS LAB	II MECH	6	
		CAG	I MECH	6	
6	V. Hari Nayak	TQM	IV MECH	5	19
		EMT	I MECH	5	
		FLL LAB	I MECH	3	
		CAEG	I ECE-B	6	
7	A.Swathi	KOM	II MECH	5	16
		UMP	III MECH	5	
		EW	I CSE-C	6	

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8	R.V Prahlad	FM&HM	II MECH	5	19
		IM	IV MECH	5	
		FM&HM LAB	II MECH	6	
		EW	I EEE	3	
9	K. Sumanth	CAD&CAM	III MECH	5	19
		CAD&CAM LAB	III MECH	3	
		EM	I MECH	5	
		EW	I CSD	6	

HOD
Head of the Department
Mechanical Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
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AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
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Department of Electronics & Communication Engineering

Teaching Faculty Work Load II SEM for the Academic year 2022-23

S.No	Name of the faculty	Subjects	Class	No of periods	Total Workload
1	Dr.G.SAIKUMAR	PS-II	IV ECE-B	14	17
		SEMINAR	IV ECE-B	3	
2	G.SRINIVAS	ECA	II ECE-A	5	15
		ECA LAB	II ECE-A	6	
		MPS	I VLSI	4	
3	P V RAJU	A&DC	II ECE-A	5	16
		A&DC LAB	II ECE-A	6	
		SOC	IV ECE-A	5	
4	V.GURAVAIAH	DE	II EEE	5	16
		DELAB	II EEE	6	
		ESD	III ECE-A	5	
5	D.SURYAPRAKASH	EDC	I CSE-A	5	14
		LICA LAB	II ECE-A	6	
		SEMINAR	IV ECE-A	3	
6	S.SAGAR	S&S	III EEE	5	17
		S&S LAB	III EEE	6	
		ECAD & VLSI LAB	III ECE-A	6	
7	M.YAMANI	A&DC	II ECE-B	5	15
		A&DC LAB	III ECE-A	6	
		MPS	I VLSI	4	
8	E.NAGEASH	DSP	III ECE-A	5	17
		DSP LAB	III ECE-A	6	
		S&S LAB	III EEE	6	

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
GUNTHAPALLY (V)
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9	K.SHILPA	EMFW	II ECE-B	5	17
		LICA LAB	II ECE-B	6	
		SL LAB	III ECE-A	6	
10	G.NAGU NAIK	SEMINAR	IV ECE-A	3	14
		ECA LAB	II ECE-A	6	
		SOC	IV ECE-B	5	
11	K.SONY	SC	IV ECE-A	5	17
		SL LAB	III ECE-A	6	
		ECA LAB	II ECE-A	6	
12	Dr.G CHANDRASHEKAR	PS-II	IV ECE-B	14	20
		SL LAB	III ECE-B	6	
13	B.KALPANA	DSP	III ECE-B	5	17
		DSP LAB	III ECE-B	6	
		LICA LAB	II ECE-B	6	
14	M.SWATHI	VLSID	III ECE-B	5	17
		ECAD & VLSI LAB	III ECE-B	6	
		ECE LAB	II ECE-B	6	
15	V.NAGASWATHI	ECA	II ECE-B	5	16
		ECA LAB	II ECE-B	6	
		AWP	III ECE-B	5	
16	B.VENKATESHWARLU	ESD	III ECE-B	5	16
		VLSID	III ECE-A	5	
		A&DC LAB	II ECE-B	6	
17	K.ARUNA	PS-II	IV ECE-A	14	14

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18	J.RAJKUMAR	MP&MC LAB	III EEE	6	16
		DVV	II VLSI	10	
19	M.SAI KRISHNA	LICA	II ECE-B	5	18
		SEMINAR	IV ECE-A	3	
		DVV	II VLSI	10	
20	G.DILEEP	EDC	I CSE-B	5	11
		SL LAB	III ECE-B	6	
21	B DASHARATHA	AWP	III ECE-A	5	11
		E CAD& VLSI LAB	III ECE-A	6	
22	P.GEETHA	SC	IV ECE-B	5	14
		SEMINAR	IV ECE-B	3	
		DSP LAB	II ECE-A	6	
23	D.NEELAKANASWARAO	PS-II	IV ECE-B	14	14
24	O.MOUNIKA	EDC	I CSE-C	5	19
		PS-II	IV ECE-A	14	
25	P.PADMAVATHI	EDC	I CSD	5	15
		SCTP-UVM LAB	I VLSI	4	
		E CAD& VLASI LAB	III ECE-B	6	
26	S.SAIDIREDDY	EDC	I CSM	5	15
		SCTP-UVM LAB	I VLSI	4	
		DSP LAB	III ECE-B	6	
27	Dr J B SIDDARTHA	EMFW	II ECE-A	5	19
		PS-II	IV ECE-A	14	
28	Dr S KISHORE REDDY	DW-III	II VLSI	12	19
		VLSIAPD	I VLSI	5	

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29	Dr V NAGARAJU	LICA	II ECE-A	5	19
		LICA LAB	II ECE-A	6	
		DVV	II VLSI	8	
30	Dr M SATYANARAYANA	MP&MC	III EEE	5	16
		MP&MC LAB	III EEE	6	
		SVTBUVM	I VLSI	5	
31	R LAXMIKANTH	SOCD	I VLSI	5	14
		DELAB	II EEE	6	
		SEMINAR	IV ECE-B	3	
32	MOUNIKA CHOUHAN	EDC	I ECE-A	5	14
		D-MOD	I VLSI	5	
		VLSIAPD LAB	I VLSI	4	
33	V SRAVANTHI	EDC	I ECE-B	5	13
		VLSIAPD LAB	I VLSI	4	
		DM	I VLSI	4	

HOD

Head of the Department
Electronics & Communication Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

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AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
GUNTHAPALLY (V)
ABDULLAPURMET (M)
R.R. DISTRICT.

Department of CSE, CSE(DS)&CSE(AL&ML)
Teaching Faculty work load II Sem for Academic Year 2022-23

S.No	Name of the faculty	Subjects & Labs	Class/ Branch	No of periods	Total Workload
1	Dr Shaik Shakeerbasha	OS	II CSE-A	5	16
		FLAT	II CSM	5	
		OS LAB	II CSE-A	6	
2	Alla Sravani	OS	II CSE-C	5	17
		OS LAB	II CSE-C	6	
		ML LAB	III CSE-A	6	
3	Balakrishna Goud Gardulla	HCI	IV CSE-A	5	17
		COI	II CSM,CSD	6	
		CD LAB	III CSE-A	6	
4	Banda Jainabbi	AI	III CSM	5	17
		AI/NLP LAB	III CSM	6	
		DVT LAB	III CSD	6	
5	Bomaraboina Shailaja	NLP	III CSM	5	14
		AI/NLP LAB	III CSM	6	
		COI	II CSE-A	3	
6	Devendla Vijayakrishna	C&NS	III CSM	5	17
		C&NS LAB	III CSM	6	
		PS-II	IV CSE-B	6	
7	Doti Nagaraju	OS	II CSE-B	5	17
		OS LAB	II CSE-B	6	
		STM LAB	III CSE-A	6	

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8	Dr Abdul Ahad Afroz	DBMS	II CSM	5	**17**
		DBMS LAB	II CSM	6	
		PS-II	IV CSE-A	6	
9	Dr Hameeda Shaik	PYTHON LAB	I CSE-A,B,C	9	**20**
		PS-II	IV CSE-C	6	
		HCI	IV CSE-B	5	
10	Dr J Sridatta Venkata Sastry	DVV	II M TECH	14	**23**
		ACM	I M TECH	5	
		ML LAB	III CSE-B	6	
11	Dr Prasad Rao Mandala	DVV	II M TECH	14	**21**
		RPA	I M TECH	5	
		MPS	I M TECH	4	
12	Dr Shahebaz Ahmed Khan	OS	II CSM	5	**17**
		OS LAB	II CSM	6	
		PS-II	IV CSE-B	6	
13	Dr Suribabu Korada	DWR-III	II M TECH	12	**20**
		AA	I M TECH	5	
		DM	I M TECH	3	
14	Dr T Lalitha Saroja	DWR-III	II M TECH	12	**17**
		ACA	I M TECH	5	
15	Duggirala Sai Suman Ravi Teja	HCI	IV CSE-C	5	**15**
		AA LAB	I M TECH	4	
		PS-II	IV CSE-A	6	
16	Gosala Subhashini	DEVOPS	III CSM	5	**14**
		DEVOPS LAB	III CSM	6	
		SEMINAR	IV CSE-A	3	

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17	Joolu Spandana	ML	III CSE-A	5	**14**
		ML LAB	III CSE-A	6	
		SEMINAR	IV CSE-B	3	
18	Kanchanapalli Swathi	ML	III CSD	5	**17**
		ML LAB	III CSD	6	
		PS-II	IV ECE-A	6	
19	Lavakumar Gande	PYTHON LAB	I CSD,CSM,MECH	9	**14**
		CD	III CSD	5	
20	Lavudya Shivashankar	JAVA	II CSM	5	**17**
		JAVA LAB	II CSM	6	
		CD LAB	III CSE-B	6	
21	Mohd Aziz Ur Rahman	PS-II	IV CSE-B	6	**16**
		STM LAB	III CSE-B	6	
		ACN LAB	I M TECH	4	
22	Mushan Srinath	BDA	III CSD	5	**14**
		BDA LAB	III CSD	6	
		SEMINAR	IV CSE-C	3	
23	Nagaraj Devatha	PYTHON LAB	I CSE-A,B,C	9	**14**
		QABD	III CSD	5	
24	Nallabolu Pavani	PYTHON LAB	I ECE A,B,EEE	9	**14**
		QABD	III CSM	5	
25	Nenevat Mangan	DVT	III CSD	5	**11**
		DVT LAB	III CSD	6	
26	Panthangi Haimavathi	CD	III CSE-B	5	**17**
		CD LAB	III CSE-B	6	
		JAVA LAB	II CSD	6	

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27	Peteri Ashwanth Kumar	JAVA	II CSD	5	17
		JAVA LAB	II CSD	6	
		DEVOPS	III CSM	6	
28	Raghu Salla	ITW LAB	I CSE-A,B,C	9	18
		DBMS LAB	II CSD	6	
		SEMINAR	IV CSE-C	3	
29	Rangani Himabindhu	DAA	III CSE-B	5	14
		OS LAB	II CSD	6	
		SEMINAR	IV CSE-B	3	
30	Shirisha Meka	CD	III CSE-A	5	17
		CD LAB	III CSE-A	6	
		JAVA LAB	II CSM	6	
31	Siddagoni Rohini	ITW LAB	I CSE-A,B,C	9	18
		DBMS LAB	II CSM	6	
		SEMINAR	IV CSE-C	3	
32	Silveri Rajender	JAVA	II CSE-A,B	10	22
		JAVA LAB	II CSE-A,B	12	
33	Sirikonda Vasantha	PYTHON LAB	I CSD,CSM,MECH	9	18
		OS LAB	II CSM	6	
		SEMINAR	IV CSE-A	3	
34	Souda Sravanvardhan	QABD	III CSE-A	5	16
		QABD	III CSE-B	5	
		JAVA LAB	II CSE-C	6	
35	Uddagiri Uma	DAA	III CSE-A	5	14
		SEMINAR	IV CSE-A	3	
		DBMS LAB	II CSE-C	6	

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36	Yenaganti Satish Kumar	DBMS	II CSE-A,B	10	**22**
		DBMS LAB	II CSE-A,B	12	
37	G Nikhilareddy	STM	III CSE-A	5	**17**
		STM LAB	III CSE-A	6	
		OS LAB	II CSE-C	6	
38	Naveen Kumar Badugu	OS	II CSD	5	**17**
		OS LAB	II CSD	6	
		CNS LAB	III CSM	6	
39	Shaik Subhan Abdul	DBMS	II CSD	5	**17**
		DBMS LAB	II CSD	6	
		ML LAB	III CSD	6	
40	Subhan Ali Shaik	SE	II CSM	5	**16**
		SE	II CSD	5	
		JAVA LAB	II CSE-B	6	
41	Udayabhanu Mankena	FLAT	II CSD	5	**14**
		SEMINAR	IV CSE-B	3	
		DBMS LAB	II CSE-B	6	
42	Digajarla Prasad	PYTHON LAB	I ECE A,B,EEE	9	**14**
		JAVA	II CSE-C	5	
43	Neelakantam Kalagoni	DBMS	II CSE-C	5	**17**
		DBMS LAB	II CSE-C	6	
		BDA LAB	III CSD	6	
44	Pampana Tulasi	ITW LAB	I CSD,CSM	6	**18**
		PS-II	IV CSE-C	6	
		OS LAB	II CSE-B	6	

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45	Praveen Arukula	ML	III CSE-B	5	**17**
		ML LAB	III CSE-B	6	
		JAVA LAB	II CSE-A	6	
46	Rajobha Satheesh Kumar	STM	III CSE-B	5	**17**
		STM LAB	III CSE-B	6	
		DBMS LAB	II CSE-A	6	
47	Sridevi Oruganti	ITW LAB	I CSD,CSM	6	**18**
		PS-II	IV CSE-C	6	
		OS LAB	II CSE-A	6	

HOD

Head of the Department
Computer Science & Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl)
Ranga Reddy District. Telangana.

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Department of H&S

Teaching Faculty Work Load II SEM for the Academic year 2022-23

S.No	Name of the faculty	Subjects	Class	No of periods	Total Workload
1	Dr Kotte Shailaja	EC	I CSM	5	19
		EC LAB	I CSM, I ECE-A	12	
		GS LAB	II ECE-A,B	2	
2	Kapa Reddy Raja Manohar	ES	I CSE-B,C	4	17
		EC	I ECE-A, I MECH	10	
		EC	I MECH	3	
3	Pittala Venkatswamy	ES	I CSE(DS)	2	21
		EC	I ECE-B	5	
		EC LAB	I ECE-B, ICSM	12	
		GS LAB	II ECE-B	2	
4	Srilakshmi Damerla	ES	I CSE-A, I EEE	4	18
		GS LAB	II MECH	2	
		EC LAB	I ECE-A,B	12	
5	Chatharasupalli Sunanda	ESE	I CSE-A	4	16
		ELCS LAB	I CSE-A,B	12	
6	Dr Sundeep Pally	ESE	I CSE C	4	20
		ELCS LAB	I CSE C, DS	12	
7	Appala Gatteshwar Roy	ESE	I CSE-B	5	16
		ELCS LAB	I CSE-A,B	12	
8	Ramesh Narige	ELCS LAB	I EEE	4	14
		ELCS LAB	I EEE	3	
		ACS LAB	II MECH	3	
		ESE	I CSD	4	

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9	Swarupa Kumari	ELCS LAB	I CSE C, DS	12	15
		ACS LAB	III MECH	3	
10	Nagaraju Kurella	OD&VC	I ECE-B, I EEE	10	20
		LNCV	II ECE-A,B	10	
11	Sesha Giri Rao Kalluri	OD&VC	I ECE-A	5	20
		DM	II CSE-A,B,C	15	
12	Sarwani Karlapalem	OD&VC	I CSE-C, DS, MECH	15	20
		LNCV	II EEE	5	
13	A Anjaneyulu	OD&VC	I CSE-A,B	10	15
		OD&VC	I ECE-A	5	
13	Gogikar Laxminarayana	AP	I CSE-B	5	19
		AP	I EEE	5	
		AP LAB	I EEE	3	
		APLAB	I CSE-B	6	
14	Ravi Eslavath	AP	I CSE-A	5	17
		APLAB	I CSE-A, DS	12	
15	Swamyrao Kulkarni	AP	I CSE-C, DS	10	16
		APLAB	I CSE-A	6	

HOD

Head of the Department
Humanities & Sciences
Avanthi Institute of Engineering & Technology
Gunthapally (VIII), Abdullapur Met (Mdl),
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GUNTHAPALLY (V)
ABDULLAPURMET (M)
R.R. DISTRICT.

Department of MBA

Teaching Faculty Work Load II SEM for the Academic year 2022-23

S.No	Name of the faculty	Subjects	Class	No of periods	Total Workload
1	Mankala Naresh	LSCM	I MBA-A	5	19
		RMFD	II MBA-C	5	
		RMFD	II MBA-B	5	
		ESS/MA	II MBA -C	4	
2	Y Jaya Pradha	LCM	II MBA-B	5	20
		IHRM	II MBA-C	5	
		OB	IV- CSE-A,B	10	
3	D. Manikanta	LSCM	I MBA-B	5	20
		CRM	II MBA-A,B&C	15	
4	Kasaramoni Sharath	FM	I MBA-B	5	20
		QABD	I MBA-C	5	
		STM	II MBA-C	5	
		IFM	II MBA-B	5	
5	N Venkata Veera Narayana	RM	I MBA-A	5	20
		RM	I MBA-B	5	
		IM	II MBA-A	5	
		SIFD	II MBA-C	5	
6	A.Naresh	MM	I MBA-A	5	18
		MM	I MBA-B	5	
		TKM	II MBA-C	5	
		COI	II CSE-B	3	

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7	Medipally Sudhakar	HRM	I MBA-A	5	20
		EDT	I MBA-B	5	
		LSCM	I MBA-C	5	
		IFM	II MBA-B	5	
8	G.Lingaiah	FM	I MBA-A	5	18
		EDT	I MBA-C	5	
		IFM	II MBA-A	5	
		COI	II CSE-C	3	
9	K.Sabitha	RM	I MBA-C	5	19
		IM	II MBA-B	5	
		LCM	II MBA-C	5	
		SEMINAR	II MBA-B	4	
10	R. Srilatha	EDT	I MBA-A	5	16
		IHRM	II MBA-A	5	
		MPVV	II MBA-B	6	
11	K.Sindhuri	SIFD	II MBA-A	5	19
		SIFD	II MBA-B	5	
		IFM	II MBA-C	5	
		SEMINAR	II MBA-C	4	
12	A Ramesh Goud	IHRM	II MBA-B	5	18
		RMFD	II MBA-A	5	
		SEMINAR	II MBA-A,B	8	
13	Morri Sharadha	HRM	I MBA-C	5	16
		ESS/MA	II MBA-A	6	
		IM	II MBA-C	5	

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
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14	Siliveru Rambabu	FM	I MBA-C	5	20
		ESS/MA	II MBA-B	6	
		COI	II EEE	3	
		ESS	II MBA-B	6	
15	Nageshwer Rao Mothukuri	TKM	II MBA-A	5	20
		TKM	II MBA-B	5	
		MPVV	II MBA-C	6	
		SEMINAR	II MBA-C	4	
16	Oruganti Venkatesh	MM	I MBA-C	5	19
		STM	II MBA-A	5	
		SEMINAR	II MBA -A	4	
		STM	II MBA-B	5	
17	Dr. B. Nayeema	QABD	I MBA-B	5	16
		MPVV	II MBA -A	6	
		LCM	II MBA-A	5	
18	Dr N.Ramana Reddy	QABD	I MBA-A	5	20
		BEFA	II-CSE A, B,C	15	
19	Ashraf Hussain	HRM	I MBA-B	5	20
		FOM	IV ECE-A&B	10	
		FOM	III MECH	5	

HOD

Head of the Department
MBA
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapurmet (Mdl),
Ranga Reddy District.

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A.Y 2022-23 TIME TABLE

II B. Tech EEE I- SEM W.E. F:28-11-2022 COLLEGE TIMINGS: 09.30AM –03.50PM

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	EM	ECA	EM-I	AE	Lunch Break	EMF	SPORTS	
TUE	ECA	EM	EM-I LAB/EC LAB			EM	EMF	AE
WED	AE	EM-I	ECA	DAA		AE	EM-I	ECA
THU	EC LAB/AE LAB		EMF	EM		COU	EM-I	EMF
FRI	EM-I	ECA	AE LAB/EM-I LAB			GS LAB		DAA
SAT	EMF	AE	EM	LIB		EM	LIB	AW

Subject Name	Faculty Name	Designation
Engineering Mechanics (EM)	A SHANKAR	Assistant Professor
Electrical Circuit Analysis (ECA)	Dr.T. KRANTHI UMAR	Associate Professor
Analog Electronics (AE)	Dr V NAGARAJU	Associate Professor
Electrical Machines - I (EM-I)	D.NAGESHWAR RAO	Assistant Professor
Electromagnetic Fields (EMF)	E. PRASANNA	Assistant Professor
Electrical Machines Lab - I (EM-I LAB)	D.NAGESHWAR RAO/K.CHANDRASHEKAR	Assistant Professor
Analog Electronics Lab (AE LAB)	Dr V NAGARAJU/ D.NEELAKANASWARAO/D SURYAPRAKASH	Assistant Professor
Electrical Circuits Lab (ECLAB)	Dr.T. KRANTHI KUMAR/M.SATISH KUMAR	Assoc/Assistant Professor
Gender Sensitization Lab (GS LAB)	D.SRILAXMI	Assistant Professor

HOD

Head of the Department
Electrical & Electronics Engineering
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A.Y 2022-23 TIME TABLE

III B. Tech I- SEM **W.E. F:09-09-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	PE	M&I	PS-II	BEFA	Lunch Break	ACS LAB/ PE LAB		IPR
TUE	PS-II	PE	PSS LAB/ M&I LAB			M&I	BEFA	SPORTS
WED	M&I	PS-II	HVE	IPR		IPR	PE	DAA
THU	BEFA	HVE	BEFA	LIB		PSS LAB/ M&I LAB		PE
FRI	HVE	PS-II	ACS LAB/ PE LAB			HVE	M&I	LIB
SAT	IPR	BEFA	PE	HVE		PS-II	M&I	SPORTS

Subject Name	Faculty Name	Designation
Power Electronics (PE)	Dr.S. SRIKANTH REDDY	Assistant Professor
Power System-II (PS-II)	M.SHANKAR	Assistant Professor
Measurements and Instrumentation (M&I)	U. GANESH	Assistant Professor
High Voltage Engineering (HVE)	GUDIPALLY PAVAN KUMAR	Assistant Professor
Business Economics and Financial Analysis (BEFA)	MEDIPALLY SUDHAKAR	Assistant Professor
Power System Simulation Lab (PSS LAB)	M.RAGINI	Assistant Professor
Power Electronics Lab (PE LAB)	Dr.S. SRIKANTH REDDY/K.MADHAVI	Assistant Professor
Measurements and Instrumentation Lab (M&I LAB)	U. GANESH/G PAVAN KUMAR	Assistant Professor
Advanced Communication Skills Lab (ACS LAB)	CH SUNANDA	Assistant Professor
Intellectual Property Rights (IPR)	NAGESHWER RAO MOTHUKURI	Assistant Professor

HOD

Head of the Department
Electrical & Electronics Engineering
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A.Y 2022-23 TIME TABLE

IV B. Tech EEE I- SEM **W.E. F:29-08-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	FOM	POE	HVDCT	EHV	Lunch Break	EED LAB/IOMP		
TUE	POE	EED LAB/IOMP				DAA	EHV	LIB
WED	EHV	FOM	HVDCT	HVDCT		CRT		
THU	HVDCT	EHV	POE	FOM		SPORTS		POE
FRI	EHV	POE	FOM	HVDCT		COU	SEMINAR	
SAT	FOM	POE	EHV	LIB		SEMINAR		

Subject Name	Faculty Name	Designation
Principles of Entrepreneurship (POE)	MD.ASHRAF HUSSAIN	Assistant Professor
Electrical and Hybrid Vehicles (EHV)	Dr MANDADI SURENDER REDDY	Associate Professor
HVDC Transmission (HVDC T)	E. PRASANNA	Assistant Professor
Fundamentals of Management for Engineers (FOM)	S RAMBABU	Associate Professor
Electrical & Electronics Design Lab (E&ED LAB)	P. SARASWATHI/U.GANESH	Assistant Professor
Industrial Oriented Mini Project/ Summer Internship(IOMP)	Dr MANDADI SURENDER REDDY/S.SRIKANTH REDDY	Assoc/Assistant Professor
Seminar	P. SARASWATHI/ Dr MANDADI SURENDER REDDY	Assistant Professor /Assoc prof

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Head of the Department
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A.Y 2022-23 TIME TABLE

II B. Tech MECH I- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	PS&CV	MOS	TD	MS&M	Lunch Break	PT	TD	COI
TUE	MOS	PT	PS&CV	MS&M		PT LAB		
WED	MS&M	PS&CV	MOS	TD		MD LAB		
THU	PT	MS&M	MOS	TD		PS&CV	PT	LIBRARY
FRI	TD	MS&M	PT	COI		MOS	PS&CV	SPORTS
SAT	PT	MOS	MS&M	PS&CV		MS&M LAB		

Subject Name	Faculty Name	Designation
PROBABILITY AND STATISTICS & COMPLEX VARIABLES	SESHAGIRI RAO	ASSISTANT PROFESSOR
MECHANICS OF SOLIDS	A SHANKAR	ASSISTANT PROFESSOR
MATERIAL SCIENCE AND METALLURGY	A.Swathi	ASSISTANT PROFESSOR
PRODUCTION TECHNOLOGY	R.V. PRAHALAD	ASSISTANT PROFESSOR
THERMO DYNAMICS	Dr SHIVA KUMAR	PROFESSOR
PRODUCTION TECHNOLOGY LAB	R.V. PRAHALAD	ASSISTANT PROFESSOR
MATERIAL SCIENCE AND MECHANICS OF SOLIDS LAB	V. HARI NAYAK	ASSISTANT PROFESSOR
MACHINE DRAWING PRACTICE	M. VENKATESWARLU	ASSISTANT PROFESSOR
CONSTITUTION OF INDIA	M.NARESH	ASSISTANT PROFESSOR

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MON	OR	MMT	IPR	DOM	Lunch Break	MMT LAB		
TUE	BEFA	DMM-I	OR	DOM		TE LAB		
WED	OR	DMM-I	MMT	TE-II		BEFA	MMT	LIBRARY
THU	TE-II	BEFA	DOM	DMM-I		KOM/DOM LAB		
FRI	DOM	OR	DMM-I	MMT		TE-II	IPR	MMT
SAT	DMM-I	OR	BEFA	TE-II		DOM	IPR	TE-II

Subject Name	Faculty Name	Designation
THERMAL ENGINEERING-II	A.SWATHI	ASSISTANT PROFESSOR
DESIGN OF MACHINE MEMBERS-I	V. HARI NAYAK	ASSISTANT PROFESSOR
DYNAMICS OF MACHINERY	M.VENKATESWARLU	ASSISTANT PROFESSOR
MACHINE TOOLS AND METROLOGY	K.SUMANTH	ASSISTANT PROFESSOR
OPERATION RESEARCH	Y JAYAPRADA	ASSISTANT PROFESSOR
BEFA	K.SINDHURI	ASSISTANT PROFESSOR
KOM/DOM LAB	M.VENKATESWARLU	ASSISTANT PROFESSOR
THERMAL ENGINEERING-II LAB	Dr. Y. RAMESH BABU	ASSOCIATE PROFESSOR
MACHINE TOOLS AND METROLOGY LAB	K.SUMANTH	ASSISTANT PROFESSOR
Intellectual Property Rights	A.RAMESH GOUD	ASSISTANT PROFESSOR

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A.Y 2022-23 TIME TABLE

IV B. Tech MECH I- SEM **W.E. F:29-08-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	R&AC	POE	AMT	TBM	Lunch Break	PPE	LIBRARY	
TUE	AMT	PPE	POE	TBM		IOMP		
WED	PPE	AMT	POE	R&AC		IOMP		
THU	POE	R&AC	PPE	TBM		TBM	AMT	TBM
FRI	TBM	PPE	CRT			PPE	R&AC	AMT
SAT	AMT	TBM	R&AC	POE		POE	SEMINAR	

Subject Name	Faculty Name	Designation
POWER PLANT ENGINEERING	R.V. PRAHALAD	ASSISTANT PROFESSOR
TURBO MACHINARY	K. SUMANTH	ASSISTANT PROFESSOR
REFRIGERATION AND AIR CONDITIONING	Dr A SIVA KUMAR	PROFESSOR
ADDITIVE MANUFACTURING	A SHANKAR	ASSISTANT PROFESSOR
PRINCIPLES OF ENTERPRENEURSHIP	Dr. Y. RAMESH BABU	ASSOCIATE PROFESSOR
MIMI PROJECT SEMINAR	A SHANKAR	ASSISTANT PROFESSOR
IOMP	A SHANKAR	ASSISTANT PROFESSOR

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II B. Tech ECE-A I- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

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MON	DSD	S&S	EDC	NATL	Lunch Break	PTSP	COI	
TUE	EDC	DSD	S&S	NATL		EDC LAB /DSD LAB		
WED	NATL	S&S	PTSP	EDC		DSD	PTSP	LIBRARY
THU	EDC	PTSP	NATL	DSD		DSD LAB /BS LAB		
FRI	DSD	PTSP	EDC	NATL		BS LAB /EDC LAB		
SAT	EDC	DSD	S&S	NATL		PTSP	S&S	SPORTS

Subject Name	Faculty Name	Designation
Electronic Devices and Circuits	G.SRINIVAS	Assistant Professor
Signals and Systems	M.YAMINI	Assistant Professor
Digital System Design	P V. RAJU	Assistant Professor
Probability Theory and Stochastic Processes	P.GEETHA	Assistant Professor
Network Analysis and Transmission Lines	K CHANDRASHEKAR	Assistant Professor
Electronic Devices and Circuits Lab	G.SRINIVAS/G NAGU NAIK/O MOUNIKA	Assistant Professor
Digital System Design Lab	B DASHARATHA /PV .RAJU / E. NAGESH	Assistant Professor
Basic Simulation Lab	G DILEEP/M.YAMINI/ K.ARUNA	Assistant Professor
Constitution of India	N V V NARAYANA REDDY	Assistant Professor

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MON	EDC	DSD	SS	PTSP	Lunch Break	NATL	SS	DSD
TUE	DSD	NATL	EDC	SS		NATL	PTSP	PTSP
WED	SS	EDC LAB/DSD LAB				EDC	DSD	NATL
THU	NATL	EDC	DSD	EDC		SS	PTSP	LIB
FRI	PTSP	DSD LAB/BS LAB				EDC	SS	SPORTS
SAT	EDC	BS LAB/EDC LAB				DSD	COI	

Subject Name	Faculty Name	Designation
Electronic Devices and Circuits	V.NAGASWATHI	Assistant Professor
Signals and Systems	M.SWATHI	Assistant Professor
Digital System Design	B.VENKATESHWARLU	Assistant Professor
Probability Theory and Stochastic Processes	B.DASHARATHA	Assistant Professor
Network Analysis and Transmission Lines	K.CHANDRASHEKAR	Assistant Professor
Electronic Devices and Circuits Lab	V.NAGASWTHI/B.KALAPANA/J RAJKUMAR	Assistant Professor
Digital System Design Lab	Dr.G CHANDRASHEKAR/ B.VENKATESHWARLU/S SAIDI REDDY	Assistant Professor
Basic Simulation Lab	M.SWATHI /P.GEETHA/V SRAVANTHI	Assistant Professor
Constitution of India	O.VENKATESH	Assistant Professor

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MON	AWP	DSP	ESD	VLSI	Lunch Break	FOM	DSP	ESD
TUE	VLSI	VLSI	FOM	AWP		FOM	CRT CLASSES	
WED	ESD	DSP	AWP	VLSI		DSP/E- CAD&VLSI LAB		
THU	AWP	E-CAD&VLSI/SCRIPTING LAB				ESD	IPR	
FRI	DSP	ESD	AWP	VLSI		SCRIPTING /DSP LAB		
SAT	FOM	AWP	DSP	FOM		SEMINAR	LIB	SPORTS

Subject Name	Faculty Name	Designation
Microprocessors & Microcontrollers	V.GURAVAIAH	Assistant Professor
Data Communications and Networks	K.SONY	Assistant Professor
Control Systems	M.SATISH KUMAR	Assistant Professor
Business Economics & Financial Analysis	Dr. RAMANNA REDDY	Assistant Professor
Electronic Measurements and Instrumentation	Dr.G CHANDRASHEKAR	Assistant Professor
Microprocessors & Microcontrollers Lab	Dr M SATYANARAYANA/ V.GURAVAIAH/ M.YAMINI	Assistant Professor
Data Communications and Networks Lab	Dr.G CHANDRASHEKAR /K.SONY/MOUNIKA	Assistant Professor
Advanced Communication Skills Lab	CH SUNANDA	Assistant Professor
Intellectual Property Rights	A NARESH	Assistant Professor

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MON	AWP	DSP	VLSI	ESD	Lunch Break	VLSI	IPR	
TUE	DSP	SCRIPTING LAB/DSP LAB				AWP	FOM	SEMINAR
WED	VLSI	DSP	ESD	FOM		ESD	AWP	LIB
THU	ESD	VLSI	CRT CLASSES			DSP	ESD	SPORTS
FRI	FOM	AWP	ESD	AWP		E-CAD&VLSI/SCRIPTING LAB		
SAT	FOM	VLSI	DSP	AWP		DSP LAB/E-CAD&VLSI LAB		

Subject Name	Faculty Name	Designation
Microprocessors & Microcontrollers	B. KALPANA	Assistant Professor
Data Communications and Networks	M.SAIKRISHNA	Assistant Professor
Control Systems	M.SATISH KUMAR	Assistant Professor
Business Economics & Financial Analysis	ASHRAF HUSSAIN	Assistant Professor
Electronic Measurements and Instrumentation	D.NEELAKANTASWARAO	Assistant Professor
Microprocessors & Microcontrollers Lab	B.KALAPANA/D.NEELAKANTASWARAO / K SHILPA	Assistant Professor
Data Communications and Networks Lab	Dr JB SIDDARTHA /M.SAIKRISHNA/S.SAGAR	Assoc/Assistant Professor
Advanced Communication Skills Lab	CH SUNANDA	Assistant Professor
Intellectual Property Rights	M.SHARADHA	Assistant Professor

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MON	PPLE	DIP	DAA	PYTHON	Lunch Break	NS&CY	MW&OC	LIB
TUE	NS&CY	PPLE	MW&OC	DIP		MW&OC	PPLE	NS&CY
WED	DIP	SEMINAR		PYTHON		CRT		NS&CY
THU	MW&OC	PYTHON	CRT			PPLE	SPORTS	
FRI	NS&CY	MW&OC	DIP	PPLE		MW&OC LAB/IOMP		
SAT	PYTHON	DIP	NS&CY	MW&OC		IOMP/MW&OC		

Subject Name	Faculty Name	Designation
MICROWAVE AND OPTICAL COMMUNICATIONS	Dr.G.SAIKUMAR	Associate Professor
PE-III: DIGITAL IMAGE PROCESSING	D SURYAPRAKASH	Assistant Professor
PE-IV: NETWORK SECURITY AND CRYPTOGRAPHY	K.ARUNA	Assistant Professor
PYTHON PROGRAMMING	Dr. HAMEEDA	Associate Professor
PROFESSIONAL PRACTICE, LAW & ETHICS	M NARESH	Assistant Professor
MICROWAVE AND OPTICAL COMMUNICATIONS LAB	Dr G SAIKUMAR/B.DASHARATHA/ O.MOUNIKA	Assoc/Assistant Professor
INDUSTRIAL ORIENTED MINI PROJECT	PV. RAJU/DILEEP	Assistant Professor
SEMINAR	Dr.G.SAIKUMAR/M SAI KRISHNA	Assoc/Associate Professor

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MON	DIP	PYTHON	PPLE	MW&OC	Lunch Break	MW&OC	PPLE	NS&CY
TUE	MW&OC	PYTHON	NS&CY	DIP		NS&CY	MW&OC	PPLE
WED	DIP	NS&CY	CRT			PPLE	SPORTS	
THU	NS&CY	PYTHON	CRT			PYTHON	NS&CY	PPLE
FRI	MW&OC	MW&OC / IOMP				LIB	PYTHON	DIP
SAT	PYTHON	DIP	SEMINAR			IOMP/MW&OC		

Subject Name	Faculty Name	Designation
MICROWAVE AND OPTICAL COMMUNICATIONS	P.PADMAVATHI	Assistant Professor
PE-III: DIGITAL IMAGE PROCESSING	G.NAGU NAIK	Assistant Professor
PE-IV: NETWORK SECURITY AND CRYPTOGRAPHY	O.MOUNIKA	Assistant Professor
PYTHON PROGRAMMING	Dr. HAMEEDA	Assistant Professor
PROFESSIONAL PRACTICE, LAW & ETHICS	K SHARATH	Associate Professor
MICROWAVE AND OPTICAL COMMUNICATIONS LAB	P PADMAVATHI/K.SHILPA/B VENKATESHWARLU	Assistant Professor
INDUSTRIAL ORIENTED MINI PROJECT	G.SRINIVAS/P.GEETHA	Assistant Professor
SEMINAR	Dr.G.SAIKUMAR /K SHILPA	Assoc/Associate Professor

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II B. Tech CSE-A I-SEM **W.E. F: 28-11-2022** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50- 01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	DS	OOPS	COA	COSM	Lunch Break	ADE LAB / IT WORK SHOP LAB		
TUE	OOPS C++ LAB			ADE		COA	DS	SPORTS
WED	COSM	ADE	OOPS	COA		DS LAB		
THU	DS	OOPS	COSM	COA		ADE	COSM	LIB
FRI	ADE	ADE LAB / IT WORK SHOP LAB				OOPS	DS	COSM
SAT	OOPS	COSM	ADE	DS		COA	GS LAB	

Subject Name	Faculty Name	Designation
Analog and Digital Electronics (ADE)	SAGAR SABBINENI	ASSISTANT PROFESSOR
Data Structures (DS)	YENAGANTI SATISH KUMAR	ASSISTANT PROFESSOR
Computer Oriented Statistical Methods (COSM)	SESHA GIRI RAO KALLURI	ASSISTANT PROFESSOR
Computer Organization and Architecture (COA)	LAVUDYA SHIVASHANKAR	ASSISTANT PROFESSOR
Object Oriented Programming using C++ (OOPS)	SILVERI RAJENDER	ASSISTANT PROFESSOR
Analog and Digital Electronics (ADE) Lab	SAGAR SABBINENI/R LAXMIKANTH/V GURAVAIAH	ASSISTANT PROFESSOR
Data Structures (DS) Lab	YENAGANTI SATISH KUMAR /AZIZ UR RAHMAN/S SRAVANVARDHAN	ASSISTANT PROFESSOR
IT Workshop Lab	BOMARABOINA SHAILAJA/ BALAKRISHNA GOUD/G NIKHILA REDDY	ASSISTANT PROFESSOR
OOPS C++ Programming Lab	SILVERI RAJENDER/S ROHINI/R HIMABINDU	ASSISTANT PROFESSOR
Gender Sensitization (GS) Lab	SRILAKSHMI DAMERLA	ASSISTANT PROFESSOR

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MON	COSM	DS	ADE	OOPS	Lunch Break	COA	GS LAB	
TUE	COSM	DS LAB				OOPS	ADE	LIB
WED	COA	COSM	ADE	DS		OOPS LAB		
THU	COSM	ADE	DS	OOPS		ADE LAB / IT WORK SHOP LAB		
FRI	DS	COA	COSM	OOPS		ADE LAB / IT WORK SHOP LAB		
SAT	ADE	OOPS	OOPS	COA		DS	COSM	SPORTS

Subject Name	Faculty Name	Designation
Analog and Digital Electronics (ADE)	Dr J B SIDDARTHA	ASSOC PROFESSOR
Data Structures (DS)	YENAGANTI SATISH KUMAR	ASSISTANT PROFESSOR
Computer Oriented Statistical Methods (COSM)	SESHA GIRI RAO KALLURI	ASSISTANT PROFESSOR
Computer Organization and Architecture (COA)	LAVUDYA SHIVASHANKAR	ASSISTANT PROFESSOR
Object Oriented Programming using C++ (OOPS)	SILVERI RAJENDER	ASSISTANT PROFESSOR
Analog and Digital Electronics (ADE) Lab	Dr J B SIDDARTHA/MOUNIKA CHOUHAN/E NAGESH	ASSOC/ASSISTANT PROFESSOR
Data Structures (DS) Lab	YENAGANTI SATISH KUMAR /AZIZ UR RAHMAN/ S SRAVANVARDHAN	ASSISTANT PROFESSOR
IT Workshop Lab	BOMARABOINA SHAILAJA/ BALAKRISHNA GOUD/NAVEEN KUMAR BADUGU	ASSISTANT PROFESSOR
OOPS C++ Programming Lab	SILVERI RAJENDER/S ROHINI/R HIMABINDU	ASSISTANT PROFESSOR
Gender Sensitization (GS) Lab	SRILAKSHMI DAMERLA	ASSISTANT PROFESSOR

HOD

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A.Y 2022-23 TIME TABLE

II B. Tech CSE-C I-SEM **W.E. F: 28-11-2022** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	COA	DS LAB			Lunch Break	OOPS	ADE	LIB
TUE	DS	COSM	ADE	OOPS		ADE LAB / IT WORK SHOP LAB		
WED	OOPS	ADE	DS	COSM		COA	GS LAB	
THU	OOPS	COA	COSM	DS		ADE	DS	SPORTS
FRI	COA	OOPS	DS	ADE		ADE LAB / IT WORK SHOP LAB		
SAT	DS	COA	COSM	ADE		OOPS LAB		

Subject Name	Faculty Name	Designation
Analog and Digital Electronics (ADE)	SEELAM SAIDI REDDY	ASSISTANT PROFESSOR
Data Structures (DS)	S SRAVANVARDHAN	ASSISTANT PROFESSOR
Computer Oriented Statistical Methods (COSM)	SESHA GIRI RAO KALLURI	ASSISTANT PROFESSOR
Computer Organization and Architecture (COA)	LAVUDYA SHIVASHANKAR	ASSISTANT PROFESSOR
Object Oriented Programming using C++ (OOPS)	SIRIKONDA VASANTHA	ASSISTANT PROFESSOR
Analog and Digital Electronics (ADE) Lab	SEELAM SAIDI REDDY/V SRAVANTHI/V NAGASWATHI	ASSISTANT PROFESSOR
Data Structures (DS) Lab	S SRAVANVARDHAN /AZIZ UR RAHMAN/ UDDAGIRI UMA	ASSISTANT PROFESSOR
IT Workshop Lab	P TULASI /R SATEESH KUMAR / G NIKHILA	ASSISTANT PROFESSOR
OOPS C++ Programming Lab	SIRIKONDA VASANTHA /S ROHINI/R HIMABINDU	ASSISTANT PROFESSOR
Gender Sensitization (GS) Lab	SRILAKSHMI DAMERLA	ASSISTANT PROFESSOR

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A.Y 2022-23 TIME TABLE

II B. Tech CSM I-SEM **W.E. F: 28-11-2022** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	DS	COA	PP	BEFA	Lunch Break	MSF	DM	LIB
TUE	MSF	COA	BEFA	DM		DS LAB		
WED	DS	PP	COA	PP		BEFA	DM	SPORTS
THU	DS	COA	BEFA	MSF		PP LAB		
FRI	DM	COA	BEFA	PP		BEFA	GS LAB	
SAT	DM	COA	DM	BEFA		DS	DS	MSF

Subject Name	Faculty Name	Designation
Discrete Mathematics (DM)	K SARWANI	ASSISTANT PROFESSOR
Data Structures (DS)	DIGAJARLA PRASAD	ASSISTANT PROFESSOR
Mathematical and Statistical Foundations (MSF)	NAGARAJU KURELLA	ASSISTANT PROFESSOR
Computer Organization and Architecture (COA)	Dr. SHAHEBAZ AHMED KHAN	ASSISTANT PROFESSOR
Python Programming (PP)	Dr ABDUL AHAD AFROZ	ASSOC PROFESSOR
Business Economics & Financial Analysis (BEFA)	Dr. NARU RAMANA REDDY	ASSISTANT PROFESSOR
Data Structures (DS) Lab	DIGAJARLA PRASAD /J SPANDANA	ASSISTANT PROFESSOR
Python Programming (PP) Lab	Dr ABDUL AHAD AFROZ/ D VIJAY KRISHNA	ASSOC/ASSISTANT PROFESSOR
Gender Sensitization (GS) Lab	SRILAKSHMI DAMERLA	ASSISTANT PROFESSOR

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A.Y 2022-23 TIME TABLE

II B. Tech CSD I-SEM W.E. F: 28-11-2022 COLLEGE TIMINGS: 09:30AM – 03:50PM

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	COA	MSF	BEFA	DM	Lunch Break	DS LAB		
TUE	DS	COA	PP	MSF		DM	BEFA	LIB
WED	COA	MSF	BEFA	DM		DM	PP	DS
THU	BEFA	MSF	PP	PP		DM	DS	SPORTS
FRI	COA	PP	DS	MSF		PP LAB		
SAT	COA	DS	GS LAB			BEFA	MSF	DM

Subject Name	Faculty Name	Designation
Discrete Mathematics (DM)	K SARWANI	ASSISTANT PROFESSOR
Data Structures (DS)	DIGAJARLA PRASAD	ASSISTANT PROFESSOR
Mathematical and Statistical Foundations (MSF)	NAGARAJU KURELLA	ASSISTANT PROFESSOR
Computer Organization and Architecture (COA)	Dr. SHAHEBAZ AHMED KHAN	ASSISTANT PROFESSOR
Python Programming (PP)	Dr ABDUL AHAD AFROZ	ASSOC PROFESSOR
Business Economics & Financial Analysis (BEFA)	Dr. NARU RAMANA REDDY	ASSISTANT PROFESSOR
Data Structures (DS) Lab	DIGAJARLA PRASAD /G LAVA KUMAR	ASSISTANT PROFESSOR
Python Programming (PP) Lab	Dr ABDUL AHAD AFROZ/D VIJAY KRISHNA	ASSOC/ASSISTANT PROFESSOR
Gender Sensitization (GS) Lab	SRILAKSHMI DAMERLA	ASSISTANT PROFESSOR

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A.Y 2022-23 TIME TABLE

III B. Tech CSE-A I-SEM **W.E. F: 09-09-2022** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	FLAT	CN & WT LAB			Lunch Break	DDB	CRT	CRT
TUE	SE	WT	IP	IP		FLAT	CN	IPR
WED	CN	SE	FLAT	IP		ACES LAB		LIB/SPORTS
THU	WT	CN	DDB	SE		IP	FLAT	IPR
FRI	IP	SE LAB				CN	WT	DDB
SAT	DDB	FLAT	CN	SE		WT	IPR	SE

Subject Name	Faculty Name	Designation
Formal Languages & Automata Theory (FLAT)	SHIRISHA MEKA	ASSISTANT PROFESSOR
Software Engineering (SE)	Dr. SHAIK SHAKEERBASHA	ASSISTANT PROFESSOR
Computer Networks (CN)	ALLA SRAVANI	ASSISTANT PROFESSOR
Web Technologies (WT)	GOSALA SUBHASHINI	ASSISTANT PROFESSOR
Image Processing (IP)	SUBHAN ALI SHAIK	ASSISTANT PROFESSOR
Distributed Databases (DDB)	BANDA JAINABBI	ASSISTANT PROFESSOR
Software Engineering (SE) Lab	Dr. SHAIK SHAKEERBASHA/G LAVA KUMAR/ SUBHAN ALI SHAIK	ASSISTANT PROFESSOR
Computer Networks & Web Technologies (CN&WT) Lab	ALLA SRAVANI/ GOSALA SUBHASHINI/K SWATHI	ASSISTANT PROFESSOR
Advanced Communication Skills (ACS) Lab	SWARUPA KUMARI	ASSISTANT PROFESSOR
Intellectual Property Rights (IPR)	ASHRAF HUSSAIN	ASSISTANT PROFESSOR

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A.Y 2022-23 TIME TABLE

III B. Tech CSE-B I-SEM **W.E. F: 09-09-2022** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50- 01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	DDB	SE LAB			Lunch Break	SE	IPR	IP
TUE	IP	CN	CRT	CRT		CN	DDB	FLAT
WED	WT	CN & WT LAB				FLAT	SE	IPR
THU	CN	ACES LAB		IP		DDB	WT	SE
FRI	SE	WT	CN	IP		FLAT	DDB	LIB/SPORTS
SAT	FLAT	DDB	IP	IPR		SE	CN	FLAT

Subject Name	Faculty Name	Designation
Formal Languages & Automata Theory (FLAT)	SHIRISHA MEKA	ASSISTANT PROFESSOR
Software Engineering (SE)	Dr. SHAIK SHAKEERBASHA	ASSISTANT PROFESSOR
Computer Networks (CN)	ALLA SRAVANI	ASSISTANT PROFESSOR
Web Technologies (WT)	GOSALA SUBHASHINI	ASSISTANT PROFESSOR
Image Processing (IP)	SUBHAN ALI SHAIK	ASSISTANT PROFESSOR
Distributed Databases (DDB)	BANDA JAINABBI	ASSISTANT PROFESSOR
Software Engineering (SE) Lab	Dr. SHAIK SHAKEERBASHA/G LAVA KUMAR/ SHAIK SUBHAN ABDUL	ASSISTANT PROFESSOR
Computer Networks & Web Technologies (CN&WT) Lab	ALLA SRAVANI/ GOSALA SUBHASHINI/K SWATHI	ASSISTANT PROFESSOR
Advanced Communication Skills (ACS) Lab	SWARUPA KUMARI	ASSISTANT PROFESSOR
Intellectual Property Rights (IPR)	ASHRAF HUSSAIN	ASSISTANT PROFESSOR

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A.Y 2022-23 TIME TABLE

III B. Tech CSM I-SEM **W.E. F: 09-09-2022** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50- 01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	ML	CD	CRT	CRT	Lunch Break	DAA	IRS	IPR
TUE	ML	CD	CN	DAA		ML LAB		
WED	CD	ML	IP	IPR		IDS	CN	IP
THU	ML	ACES LAB				DAA	IP	IRS
FRI	ML	C D	IRS	CN		DAA	IP	LIB/SPORTS
SAT	DAA	CN LAB				CN	IRS	CN

Subject Name	Faculty Name	Designation
Design and Analysis of Algorithms (DAA)	UDDAGIRI UMA	ASSISTANT PROFESSOR
Machine Learning (ML)	SHAIK SUBHAN ABDUL	ASSISTANT PROFESSOR
Computer Networks (CN)	UDAYABHANU MANKENA	ASSISTANT PROFESSOR
Compiler Design (CD)	PETERI ASHWANTH KUMAR	ASSISTANT PROFESSOR
Image Processing (IP)	DUGGIRALA SAI SUMAN RAVI TEJA	ASSISTANT PROFESSOR
Information Retrieval Systems (IRS)	G NIKHILA REDDY	ASSISTANT PROFESSOR
Machine Learning (ML)Lab	Dr SHEBAZ AHMED KHAN/SHAIK SUBHAN ABDUL/A PRAVEEN	ASSISTANT PROFESSOR
Computer Networks (CN) Lab	UDAYABHANU MANKENA/ P TULASI	ASSISTANT PROFESSOR
Advanced Communication Skills (ACS) Lab	SWARUPA KUMARI	ASSISTANT PROFESSOR
Intellectual Property Rights (IPR)	SRILATHA RAVVI	ASSISTANT PROFESSOR

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A.Y 2022-23 TIME TABLE

III B. Tech CSD I-SEM **W.E. F: 09-09-2022** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	DM	IDS	CRT		Lunch Break	DAA	IPR	IRS
TUE	IDS	DM	CN	DAA		ACES LAB		LIB/SPORTS
WED	DM	IDS	IPR	CN		DAA	IRS	IP
THU	IP	CN LAB				IDS	CN	IP
FRI	DM	IDS	DM	IDS		DAA	IP	IPR
SAT	DAA	DM LAB				CN	IRS	CN

Subject Name	Faculty Name	Designation
Design and Analysis of Algorithms (DAA)	UDDAGIRI UMA	ASSISTANT PROFESSOR
Introduction to Data Science (IDS)	DUGGIRALA SAI SUMAN RAVI TEJA	ASSISTANT PROFESSOR
Computer Networks (CN)	NEELAKANTAM KALAGONI	ASSISTANT PROFESSOR
Data Mining (DM)	SRIDEVI ORUGANTI	ASSISTANT PROFESSOR
Image Processing (IP)	NAVEEN KUMAR BADUGU	ASSISTANT PROFESSOR
Information Retrieval Systems (IRS)	G NIKHILA REDDY	ASSISTANT PROFESSOR
Data Mining (DM) Lab	SRIDEVI ORUGANTI/ NAVEEN KUMAR BADUGU/R SATEESH KUMAR	ASSISTANT PROFESSOR
Computer Networks (CN) Lab	/NEELAKANTAM KALAGONI/P TULASI	ASSISTANT PROFESSOR
Advanced Communication Skills (ACS) Lab	N.RAMESH	ASSISTANT PROFESSOR
Intellectual Property Rights (IPR)	SRILATHA RAVVI	ASSISTANT PROFESSOR

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A.Y 2022-23 TIME TABLE

IV B. Tech CSE-A I-SEM **W.E. F: 29-08-2022** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	SPPM	DM	POE	CC	Lunch Break	C&NS	Mini Project	
TUE	POE	CC	DM	C&NS		SPPM	CRT/CERTIFICATION COURSE	
WED	CC	DM	POE	SPPM		C&NS	Project Stage - I	
THU	SPPM	CC	Project Stage - I			C&NS LAB		
FRI	POE	CC	C&NS	DM		SPPM	SEMINAR	
SAT	SPPM	CC	POE	C&NS		Project Stage - I		SPORTS

Subject Name	Faculty Name	Designation
Cryptography & Network Security (C&NS)	Dr J S V SASTRY	ASSISTANT PROFESSOR
Data Mining (DM)	JOOLU SPANDANA	ASSISTANT PROFESSOR
Cloud Computing (CC)	P TULASI	ASSISTANT PROFESSOR
Software Process & Project Management (SPPM)	RAGHU SALLA	ASSISTANT PROFESSOR
Principles of Entrepreneurship (POE)	Dr BAJJIS NAYEEMA	ASSOC PROFESSOR
Cryptography & Network Security (C&NS) Lab	NALLABOLU PAVANI/D NAGARAJU	ASSISTANT PROFESSOR
Industrial Oriented Mini Project/ Summer Internship	MUSHAN SRINATH	ASSISTANT PROFESSOR
Seminar	RANGANI HIMABINDHU/SIRIKONDA VASNTHA	ASSISTANT PROFESSOR
Project Stage - I	Dr J S V SASTRY	ASSISTANT PROFESSOR

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MON	POE	CC	DM	C&NS	Lunch Break	SPPM	CRT/CERTIFICATION COURSE	
TUE	CC	DM	POE	SPPM		C&NS LAB		
WED	SPPM	CC	Project Stage - I			C&NS	SEMINAR	
THU	POE	DM	SPPM	C&NS		CC	Project Stage - I	
FRI	CC	POE	DM	SPPM		C&NS	Project Stage - I	
SAT	DM	CC	C&NS	POE		Mini Project		SPORTS

Subject Name	Faculty Name	Designation
Cryptography & Network Security (C&NS)	Dr M PRASADA RAO	ASSOC PROFESSOR
Data Mining (DM)	JOOLU SPANDANA	ASSISTANT PROFESSOR
Cloud Computing (CC)	PANTHANGI HYMAVATHI	ASSISTANT PROFESSOR
Software Process & Project Management (SPPM)	RAGHU SALLA	ASSISTANT PROFESSOR
Principles of Entrepreneurship (POE)	Dr BAJJIS NAYEEMA	ASSOC PROFESSOR
Cryptography & Network Security (C&NS) Lab	NALLABOLU PAVANI/D NAGARAJU	ASSISTANT PROFESSOR
Industrial Oriented Mini Project/ Summer Internship	MUSHAN SRINATH	ASSISTANT PROFESSOR
Seminar	Dr K SURIBABU/RANGANI HIMABINDHU	ASSOC/ASSISTANT PROFESSOR
Project Stage - I	Dr M PRASADA RAO	ASSOC PROFESSOR

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DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	CC	POE	DM	SPPM	Lunch Break	C&NS LAB		
TUE	DM	CC	C&NS	POE		C&NS	Mini Project	
WED	CC	Project Stage - I		SPPM		SPPM	CRT/CERTIFICATION COURSE	
THU	SPPM	CC	DM	POE		Project Stage - I		SPORTS
FRI	POE	CC	DM	C&NS		C&NS	Project Stage - I	
SAT	POE	DM	SPPM	C&NS		CC	SEMINAR	

Subject Name	Faculty Name	Designation
Cryptography & Network Security (C&NS)	Dr T LALITHA SAROJA	ASSOC PROFESSOR
Data Mining (DM)	K SWATHI	ASSISTANT PROFESSOR
Cloud Computing (CC)	PANTHANGI HAIMAVATHI	ASSISTANT PROFESSOR
Software Process & Project Management (SPPM)	DOTI NAGARAJU	ASSISTANT PROFESSOR
Principles of Entrepreneurship (POE)	ASHRAF HUSSAIN	ASSISTANT PROFESSOR
Cryptography & Network Security (C&NS) Lab	NALLABOLU PAVANI/D NAGARAJU	ASSISTANT PROFESSOR
Industrial Oriented Mini Project/ Summer Internship	MUSHAN SRINATH	ASSISTANT PROFESSOR
Seminar	Dr K SURIBABU /RANGANI HIMABINDHU	ASSOC/ASSISTANT PROFESSOR
Project Stage - I	MEKA SHIREESHA	ASSISTANT PROFESSOR

HOD

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A.Y 2022-23 TIMETABLE

I B. Tech CSE-A I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	MC	PPS	PPS	Lunch Break	EC	CAEG		
TUE	EC LAB/ BEE LAB				BEE	MC	BEE	LIBRARY
WED	BEE	PPS	PPS		EC	PPS LAB		
THU	CAEG				MC	EC	LIBRARY	EC
FRI	EC LAB/ BEE LAB				BEE	MC	SPORTS	
SAT	EC	MC	PPS		BEE	ECSE		

Subject Name	Faculty Name	Designation
Matrices And Calculus (Mc)	A.Anjaneyulu	Assistant Professor
Programing For Problem Solving (Pps)	Dr. Hameeda Shaik	Assistant Professor
Basic Electrical Engineering (Bee)	M. Ragini	Assistant Professor
Computer Aided Engineering Graphics (Caeg)	Dr. Y. Ramesh Babu	Associate Professor
Elements Of Computer Science & Engineering (ECSE)	K.Swathi	Assistant Professor
Engineering Chemistry (EC)	Dr. K. Shailaja	Professor
Engineering Chemistry Laboratory (Ec Lab)	Dr. K. Shailaja	Professor
Programming For Problem Solving Laboratory (PPS LAB)	G. Balakrishna /N.Pavani	Assistant Professor
Basic Electrical Engineering Laboratory (Bee Lab)	M. Ragini/B.Srikanth	Assistant Professor

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A.Y 2022-23 TIMETABLE

I B. Tech CSE-B I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	CAEG			Lunch Break	MC	EC	BEE	MC
TUE	MC	PPS	PPS		EC LAB/BEE LAB			EC
WED	PPS LAB				MC	BEE	SPORTS	
THU	BEE	PPS	PPS		CAEG	CAEG		
FRI	MC	LIBRARY	PPS		EC LAB/BEE LAB			EC
SAT	ECSE				EC	BEE	EC	LIBRARY

Subject Name	Faculty Name	Designation
Matrices And Calculus (MC)	A.Anjaneyulu	Assistant Professor
Programing For Problem Solving (PPS)	Dr Hameeda Shaik	Assistant Professor
Basic Electrical Engineering (BEE)	M. Shankar	Assistant Professor
Computer Aided Engineering Graphics (CAEG)	Dr.G.Ramachandra Reddy	Professor
Elements of Computer Science & Engineering (ECSE)	K.Swathi	Assistant Professor
Engineering Chemistry (EC)	Dr. K. Shailaja	Professor
Engineering Chemistry Laboratory (EC LAB)	Dr. K. Shailaja	Professor
Programming for Problem Solving Laboratory (PPS LAB)	G. Bala Krishna/N Mangan	Assistant Professor
Basic Electrical Engineering Laboratory (BEE LAB)	M. Shankar/B.Srikanth	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech CSE-C I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	ECLAB/ BEE LAB			Lunch Break	BEE	PPS	SPORTS	
TUE	BEE	EC	MC		EC	PPS LAB		
WED	MC	PPS	EC		LIBRARY	CAEG		
THU	EC LAB/BEE LAB				PPS	MC	PPS	LIBRARY
FRI	BEE	PPS	EC		MC	ECSE		
SAT	CAEG				BEE	EC	MC	BEE

Subject Name	Faculty Name	Designation
Matrices And Calculus (MC)	A.Anjaneyulu	Assistant Professor
Programing For Problem Solving (PPS)	B.Jainabbi	Assistant Professor
Basic Electrical Engineering (BEE)	K.Madhavi	Assistant Professor
Computer Aided Engineering Graphics (CAEG)	V.Harinayak	Assistant Professor
Elements Of Computer Science & Engineering (ECSE)	R.Sateesh Kumar	Assistant Professor
Engineering Chemistry (EC)	K.Rajamanohar Reddy	Assistant Professor
Engineering Chemistry Laboratory (EC LAB)	K.Rajamanohar Reddy	Assistant Professor
Programming For Problem Solving Laboratory (PPS LAB)	G.Bala Krishna/R Sateesh Kumar/P Hymavathi	Assistant Professor
Basic Electrical Engineering Laboratory (BEE LAB)	K.Madhavi/G.Pavan Kumar	Assistant Professor

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A.Y 2022-23 TIMETABLE

I B. Tech CSE-DS I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	PPS LAB			Lunch Break	EG	EC LAB/BEE LAB		
TUE	PPS	MC	LIBRARY		BEE	EC	SPORTS	
WED	CAEG				BEE	PPS	EG	BEE
THU	MC	PPS	LIBRARY		MC	EC LAB/BEE LAB		
FRI	ECSE				PPS	EC	BEE	MC
SAT	MC	EC	BEE		PPS	CAEG		

Subject Name	Faculty Name	Designation
Matrices And Calculus (MC)	K. Sarwani	Assistant Professor
Programing For Problem Solving (PPS)	G Lava Kumar	Assistant Professor
Basic Electrical Engineering (BEE)	P.Saraswathi	Assistant Professor
Computer Aided Engineering Graphics (CAEG)	A.Swathi	Assistant Professor
Elements of Computer Science & Engineering (ECSE)	B.Naveen Kumar	Assistant Professor
Engineering Chemistry (EC)	P. Venkataswamy	Assistant Professor
Engineering Chemistry Laboratory (EC LAB)	K.Rajamanohar Reddy	Assistant Professor
Programming for Problem Solving Laboratory (PPS LAB)	D Sai Suman Ravi Teja/O Sridevi	Assistant Professor
Basic Electrical Engineering Laboratory (BEE LAB)	D.Nageshwar Rao/E.Prasanna	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech CSE-AI &ML I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	ECSE			Lunch Break	LIBRARY	PPS	MC	ESE
TUE	PPS	MC	AP		PPS	EW LAB/ELCS LAB		
WED	EW LAB/ELCS LAB				AP	MC	ES	ESE
THU	MC	ESE	PPS		PPS LAB/AP LAB			AP
FRI	ESE	AP	MC		AP	LIBRARY	PPS	MC
SAT	PPS LAB/AP LAB				ESE	ES	SPORTS	

Subject Name	Faculty Name	Designation
Matrices And Calculus (Mc)	K.Nagaraju	Assistant Professor
Applied Physics (Ap)	Swamyrao Kulkarni	Assistant Professor
Programing For Problem Solving (Pps)	B.Shailaja	Assistant Professor
Engineering Workshop (Ew)	R V Prahalad	Assistant Professor
English For Skill Enhancement (Ese)	Dr. P. Sundeep	Assistant Professor
Elements Of Electronics And Communication Engineering (Ecse)	Devatha Nagaraju	Assistant Professor
Applied Physics Laboratory	Swamyrao Kulkarni	Assistant Professor
English Language And Communication Skills Laboratory (Elcs)	Dr. P. Sundeep	Assistant Professor
Programming For Problem Solving Laboratory (Pps Lab)	Udayabhanu Mankena/Shaik Subhan Abdul	Assistant Professor
Environmental Science (Es)	B. Srilaxmi	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech ECE-A I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	CPE	MC	ESE	Lunch Break	ESE	AP LAB/CPE LAB		
TUE	EW LAB/ELCS LAB				AP	MC	MC	ESE
WED	CPE	AP	CPE		EECE			ES
THU	AP LAB/CPE LAB				CPE	MC	SPORTS	
FRI	MC	CPE	ESE		ES	EW LAB/ELCS LAB		
SAT	ESE	AP	MC		MC	AP	LIBRARY	CPE

Subject Name	Faculty Name	Designation
Matrices And Calculus (Mc)	A.Anjaneyulu	Assistant Professor
Applied Physics (Ap)	G. Laxminarayana	Assistant Professor
C Programming For Engineers (CPE)	B. Shailaja	Assistant Professor
Engineering Workshop (Ew)	K.Sumanth	Assistant Professor
English For Skill Enhancement (Ese)	A.Gateshwar Roy	Assistant Professor
Elements Of Electronics And Communication Engineering (EECE)	K.Sony	Assistant Professor
Applied Physics Laboratory (Ap Lab)	G. Laxminarayana	Assistant Professor
English Language And Communication Skills Laboratory (ELCS)	A.Gateshwar Roy	Assistant Professor
C Programming For Engineers Laboratory (CPE LAB)	Raghu Salla/Udaya Bhanu	Assistant Professor
Environmental Science (Es)	P. Venktaswamy	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech ECE-B I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	MC	AP	ESE	Lunch Break	PPS	EECE		
TUE	AP LAB/PPS LAB				ESE	AP	AP	MC
WED	MC	PPS	AP		PPS	EW LAB/ELCS LAB		
THU	ESE	MC	LIBRARY		AP	PPS	ES	MC
FRI	AP	ESE	ES		PPS	AP LAB/PPS LAB		
SAT	EW LAB/ELCS LAB				PPS	MC	SPORTS	

Subject Name	Faculty Name	Designation
Matrices And Calculus (MC)	K.Sarwani	Assistant Professor
Applied Physics (AP)	E. Ravi	Assistant Professor
C Programming for Engineers (CPE)	D. Vijay Krishna	Assistant Professor
Engineering Workshop (EW)	A.Swathi	Assistant Professor
English For Skill Enhancement (ESE)	N. Ramesh	Assistant Professor
Elements Of Electronics and Communication Engineering (EECE)	M.Swathi	Assistant Professor
Applied Physics Laboratory (AP LAB)	E. Ravi	Assistant Professor
English Language and Communication Skills Laboratory (ELCS)	N. Ramesh	Assistant Professor
C Programming for Engineers Laboratory (CPE LAB)	D. Vijay Krishna/S Vasantha	Assistant Professor
Environmental Science (ES)	B. Srilaxmi	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech EEE I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	ECLAB/ ECA-I LAB			Lunch Break	ECA-I	CP&DS	SPORTS	
TUE	ECA-I	EC	MC		EC	CP&DS LAB		
WED	MC	CP&DS	EC		LIBRARY	CAEG		
THU	EC LAB/ ECA-I LAB				CP&DS	MC	CP&DS	LIBRARY
FRI	ECA-I	CP&DS	EC		MC	EEEE		
SAT	CAEG				ECA-I	EC	MC	ECA-I

Subject Name	Faculty Name	Designation
Matrices And Calculus (MC)	K. Nagaraju	Assistant Professor
C Programming and Data Structures (CP&DS)	D. Nagaraju	Assistant Professor
Electrical Circuit Analysis – I	Dr.T.Kranthi Kumar	Associate Professor
Computer Aided Engineering Graphics (CAEG)	Dr.A.Siva Kumar	Professor
Elements Of Electrical & Electronics Engineering (EEEE)	B.Srikanth	Assistant Professor
Engineering Chemistry (EC)	P.Venkata Swamy	Assistant Professor
Engineering Chemistry Laboratory (EC LAB)	D Srilaxmi	Assistant Professor
C Programming and Data Structures Laboratory (CP&DS LAB)	D. Nagaraju/S Rohini	Assistant Professor

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A.Y 2022-23 TIMETABLE

I B. Tech MECH I- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	MC	AP	ESE	Lunch Break	CPDS	EME		
TUE	AP LAB/CDS LAB				ESE	AP	AP	MC
WED	MC	CPDS	AP		CPDS	EW LAB/ELCS LAB		
THU	ESE	MC	LIBRARY		AP	PPS	ES	MC
FRI	AP	ESE	ES		CPDS	AP LAB/CDS LAB		
SAT	EW LAB/ELCS LAB				CPDS	MC	SPORTS	

Subject Name	Faculty Name	Designation
Matrices And Calculus (MC)	K.Seshagiri Rao	Assistant Professor
Applied Physics (AP)	G Laxminarayana	Assistant Professor
C Programming for Data Structures (CPDS)	Mohd Aziz Ur Rahman	Assistant Professor
Engineering Workshop (EW)	V Hari Nayak	Assistant Professor
English For Skill Enhancement (ESE)	Dr. P. Sundeep	Assistant Professor
Elements Of Mechanical Engineering (EME)	Dr.A.Siva Kumar	Professor
Applied Physics Laboratory (AP LAB)	E.Ravi	Assistant Professor
English Language and Communication Skills Laboratory (ELCS)	A.Gatteshwar Roy	Assistant Professor
C & Data Structures Laboratory (CDS LAB)	Peteri Ashwanth Kumar	Assistant Professor
Environmental Science (ES)	P. Venkata Swamy	Assistant Professor

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A.Y 2022-23 TIME TABLE

I MBA - A I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	BE	LBE	FRA	MOB	Lunch Break	RMSA	CCM	MGT ACT
TUE	SDA	RMSA	MOB	FRA		LBE	BE	CCM
WED	BC	RMSA	FRA	CCM		MGT ACT	MOB	LBE
THU	LIB/LAB	BE	FRA	MOB		RMSA	CCM	BC
FRI	SDA	BE	RMSA	LBE		BC	MGT ACT/PPT	LIB/LAB
SAT	RMSA	BE	LBE	FRA		CCM	MOB	SPORTS

Subject Name	Faculty Name	Designation
Management and Organizational Behavior	M Sudhakar	Assistant Professor
Business Economics	A.Naresh	Assistant Professor
Financial Reporting & Analysis	Y Jaya pradha	Assistant Professor
Research Methodology and Statistical Analysis	D.Manikanta	Assistant Professor
Legal and Business Environment (LBE)	K Sharath	Assistant Professor
Cross cultural management	N V V Narayana Reddy	Assistant Professor
Business Communication Lab	A.Naresh	Assistant Professor
Statistical Data Analysis Lab	N V V Narayana Reddy	Assistant Professor

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A.Y 2022-23 TIME TABLE

I MBA - B I- SEM **W.E. F:03-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	BC	RMSA	FRA	CCM	Lunch Break	MGT ACT	MOB	LBE
TUE	LIB/LAB	BE	FRA	MOB		RMSA	CCM	BC
WED	BE	LBE	FRA	MOB		RMSA	CCM	MGT ACT
THU	RMSA	BE	LBE	FRA		CCM	MOB	SPORTS
FRI	SDA	RMSA	MOB	FRA		LBE	BE	CCM
SAT	SDA	BE	RMSA	LBE		BC	MGT ACT/PPT	LIB/LAB

Subject Name	Faculty Name	Designation
Management and Organizational Behavior	G.Lingaiah	Assistant Professor
Business Economics	D Manikanta	Assistant Professor
Financial Reporting & Analysis	Y. Jaya Pradha	Assistant Professor
Research Methodology and Statistical Analysis	M Nageshwar rao	Assistant Professor
Legal and Business Environment	K. Sabitha	Assistant Professor
Cross cultural management	R Srilatha	Assistant Professor
Business Communication Lab	O Venkatesh	Assistant Professor
Statistical Data Analysis Lab	M Sudhakar	Assistant Professor

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A.Y 2022-23 TIME TABLE

I MBA - C I- SEM W.E. F:03-11-2022 COLLEGE TIMINGS: 09.30AM –03.50PM

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	LBE	BE	CCM	SDA	Lunch Break	MOB	FRA	SDA
TUE	RMSA	CCM	BC	LIB/LAB		FRA	MOB	BE
WED	SDA	RMSA	MOB	FRA		LBE	BE	CCM
THU	SDA	BE	RMSA	LBE		BC	MGT ACT/PPT	LIB/LAB
FRI	RMSA	BE	LBE	FRA		CCM	MOB	SPORTS
SAT	BE	LBE	FRA	MOB		RMSA	CCM	MGT ACT

Subject Name	Faculty Name	Designation
Management and Organizational Behavior	K.Sindhuri	Assistant Professor
Business Economics	G Lingaiah	Assistant Professor
Financial Reporting & Analysis	A Ramesh Goud	Assistant Professor
Research Methodology and Statistical Analysis	M.Sharadha	Assistant Professor
Legal and Business Environment	K. Sabitha	Assistant Professor
Cross cultural management (ccm)	R.Srilatha	Assistant Professor
Business Communication Lab	S Rambabu	Assistant Professor
Statistical Data Analysis Lab	A Ramesh Goud	Assistant Professor

HOD

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A.Y 2022-23 TIME TABLE

II MBA - A I- SEM **W.E. F:10-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:50	12:50- 01:20	01:20- 02:10	02:10- 03:00	03:00- 03:50
MON	E2	Library	E 1	MIS	Lunch Break	POM	POWER POINT	
TUE	E2	E 3	DA	MIS		E 1	POM	MGT ACT
WED	SOFT SKILLS	E3	DA	MIS		E 1	E 2	POM
THU	DA	E 3	E 2	MIS		Library	E2	SOFT SKILLS
FRI	MGT ACT	E 3	DA	MIS		POM	E2	SPORTS
SAT	E2	E 3	E 1	POM		POWER POINT		

Subject Name	Faculty Name	Designation
Production & Operation Management [Pom]	K Sharath	Assistant Professor
Management Information System [Mis]	K Sindhuri	Assistant Professor
Data Analytics [Da]	G Lingaiah	Assistant Professor
Securty Analysis & Portfolio Management [Sapm]	M Naresh	Assistant Professor
Talent & Performance Management Systems [T&Pm]	A Naresh	Assistant Professor
Risk Management & Financial Derivatives	M Nageshwar rao	Assistant Professor
Learning And Development [L&D]	S Rambabu	Assistant Professor

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A.Y 2022-23 TIME TABLE

II MBA - B I- SEM **W.E. F:10-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	POM	MIS	E 1	Library	Lunch Break	POWER POINT	POM	MGT ACT
TUE	E2	E 3	DA	MIS		E 1	POM	SPORTS
WED	E2	E3	DA	SOFT SKILLS		E 1	E 2	POM
THU	DA	E 3	E 2	MIS		Library	E2	SOFT SKILLS
FRI	MIS	E 3	DA	MGT ACT		POM	E2	SPORTS
SAT	MIS	E 3	E 1	E2		POWER POINT		SPORTS

Subject Name	Faculty Name	Designation
Production & Operation Management [Pom]	A Ramesh Goud	Assistant Professor
Management Information System [Mis]	M Nageshwar rao	Assistant Professor
Data Analytics [Da]	A Naresh	Assistant Professor
Securty Analysis & Portfolio Management [Sapm]	M.Sharadha	Assistant Professor
Talent & Performance Management Systems [T&Pm]	O Venkatesh	Assistant Professor
Risk Management & Financial Derivatives (Rmfd)	S Rambabu	Assistant Professor
Learning And Development [L&D]	N V V Narayana Reddy	Assistant Professor

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MON	E2	E3	DA	SOFT SKILLS	Lunch Break	E 1	E 2	POM
TUE	E2	E 3	DA	MIS		E 1	POM	SPORTS
WED	E2	E 3	DA	MIS		E 1	POM	SPORTS
THU	DA	E 3	E 2	MIS		Library	E2	SPORTS
FRI	MIS	E 3	DA	MGT ACT		POM	E2	SOFT SKILLS
SAT	MIS	E 3	POWER POINT			E 1	E2	SPORTS

Subject Name	Faculty Name	Designation
Production & Operation Management [Pom]	M Sudhakar	Assistant Professor
Management Information System [Mis]	K Sindhuri	Assistant Professor
Data Analytics [Da]	O.Venkatesh	Assistant Professor
Securty Analysis & Portfolio Management [Sapm]	M.Naresh	Assistant Professor
Talent & Performance Management Systems [T&Pm]	D.Manikanta	Assistant Professor
Risk Management & Financial Derivatives	M Sharadha	Assistant Professor
Learning And Development [L&D]	Dr B Nayeema	Associate Professor
Production & Operation Management [Pom]	K Sabitha	Assistant Professor

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A.Y 2022-23 TIME TABLE

II B. Tech EEE II- SEM **W.E. F:01-05-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:50	12:50- 01:20	01:20- 02:10	02:10- 03:00	03:00- 03:50
MON	LN&CV	EM-II	DE	CS	Lunch Break	EM-II LAB/CS LAB		COI
TUE	CS	LN&CV	PS-I	EM-II		DAA	SPORTS	
WED	EM-II	DE	CS LAB /DE LAB			PS-I	CS	LIB
THU	DE	PS-I	DE LAB /EM-II LAB			LIB	LN&CV	COI
FRI	CS	PS-I	COI	EM-II		DE	COU	LN&CV
SAT	PS-I	LN&CV	DE	EM-II		COI	LN&CV	CS

Subject Name	Faculty Name	Designation
Laplace Transforms, Numerical Methods & Complex variables (LNCV)	K. SARWANI	Assistant Professor
Electrical Machines – II (EM-II)	M.RAGINI	Assistant Professor
Digital Electronics (DE)	GURAVAIAH VEMURI	Assistant Professor
Control Systems (CS)	M.SATISH KUMAR	Assistant Professor
Power System - I (PS-I)	E. PRASANNA	Assistant Professor
Digital Electronics Lab (DE LAB)	GURAVAIAH VEMURI/ R LAXMIKANTH	Assistant Professor
Electrical Machines Lab - II (EM-II LAB)	M.RAGINI/ U.GANESH/ B.SRIKANTH	Assistant Professor
Control Systems Lab (CS LAB)	M.SATISH KUMAR / K.MADHAVI/	Assistant Professor
Constitution of India (COI)	S. RAMBABU	Assistant Professor

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A.Y 2022-23 TIME TABLE

III B. Tech EEE II- SEM **W.E. F:13-02-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	SS	MP&MC	PSOC	PSP	Lunch Break	PSD	NCES	DAA
TUE	PSOC	PSP	MPMC LAB/SS LAB			SS	MP&MC	PSD
WED	MP&MC	SS	PSOC	NCES		PSP	CRT	
THU	PS LAB/MPMC LAB		NCES	SS		PSD	LIB	PSP
FRI	PSP	MP&MC	PSOC	PSD		PS LAB/SS LAB		NCES
SAT	MP&MC	NCES	PSD	SS		PSOC	SPORTS	

Subject Name	Faculty Name	Designation
Non-Conventional Energy Sources (NCES)	Dr.S. SRIKANTH REDDY	Assistant Professor
Power Semiconductor Drives (PSD)	M.SATISH KUMAR	Assistant Professor
Signals and Systems (S&S)	S. SAGAR	Assistant Professor
Microprocessors & Microcontrollers (MP&MC)	Dr. MORA SATYANARAYANA	Assistant Professor
Power System Protection (PSP)	Dr.T. KRANTHI KUMAR	Associate Professor
Power System Operation and Control (PSOC)	K. CHANDRA SHEKAR	Assistant Professor
Power System Lab (PS LAB)	K. MADHAVI/ U.GANESH/ P.SARASWATHI	Assistant Professor
Microprocessors & Microcontrollers Lab (MP&MC LAB)	Dr. MORA SATYANARAYANA/ J.RAJ KUMAR	Assistant Professor
Signals and Systems Lab (S&S LAB)	S. SAGAR/ E NAGESH	Assistant Professor

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A.Y 2022-23 TIME TABLE

IV B. Tech EEE II- SEM **W.E. F:03-02-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	NCSE	PQ& FACTS	CERTIFICATION COURSE		Lunch Break	PROJECT STAGE-II		
TUE	EDS	PQ& FACTS	CERTIFICATION COURSE			PROJECT STAGE-II		
WED	EDS	NCSE	CERTIFICATION COURSE			PROJECT STAGE-II		
THU	PQ& FACTS	EDS	CERTIFICATION COURSE			PROJECT STAGE-II		
FRI	NCSE	EDS	CERTIFICATION COURSE			PROJECT STAGE-II		
SAT	PQ& FACTS	NCSE	CERTIFICATION COURSE			PROJECT STAGE-II		

Subject Name	Faculty Name	Designation
Non-Conventional Sources of energy (NCSE)	P. SARASWATHI	Assistant Professor
Power Quality & FACTS (PQ&FACTS)	G. PAVAN KUMAR	Assistant Professor
Electrical Distribution Systems (EDS)	Dr MANDADI SURENDER REDDY	Associate Professor
Project Stage - II	D.NAGESHWAR RAO/ B.SRIKANTH/ Dr.T.KRANTHI KUMAR	Assistant/ Assoc Professor

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A.Y 2022-23 TIME TABLE

II B. Tech MECH II- SEM **W.E. F:01-05-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	KOM	BEE	TE-I	FM&HM	Lunch Break	BEEE-LAB / FM&HM-LAB		
TUE	FM&HM	BEE	KOM	TE-I		ICS	BEE	LIBRARY
WED	ICS	KOM	FM&HM	BEE		FM&HM-LAB/ ICS-LAB		
THU	FM&HM	ICS	TE-I	KOM		ICS-LAB / BEEE-LAB		
FRI	ICS	BEE	ICS	TE-I		KOM	FM&HM	LIBRARY
SAT	TE-I	FM&HM	KOM	BEE		ICS	GS-LAB	

Subject Name	Faculty Name	Designation
Basic Electrical and Electronics Engineering	M.RAGINI	ASSISTANT PROFESSOR
Kinematics of Machinery	A. SWATHI	ASSISTANT PROFESSOR
Thermal Engineering - I	A. SHANKAR	ASSISTANT PROFESSOR
Fluid Mechanics and Hydraulic Machines	R.V. PRAHLAD	ASSISTANT PROFESSOR
Instrumentation and Control Systems	Dr.Y. RAMESH BABU	ASSOCIATE PROFESSOR
Basic Electrical and Electronics Engineering Lab	G. PAVAN KUMAR/ P.SARASWATHI	ASSISTANT PROFESSOR
Fluid Mechanics and Hydraulic Machines Lab	R.V. PRAHLAD	ASSISTANT PROFESSOR
Instrumentation and Control Systems Lab	M.VENKATESWARLU	ASSISTANT PROFESSOR
Gender Sensitization Lab	D.SRILAXMI	ASSISTANT PROFESSOR

HOD

Head of the Department
Mechanical Engineering
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A.Y 2022-23 TIME TABLE

III B. Tech MECH II- SEM **W.E. F:13-02-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	DMM-II	FEM	HT	UCMP	Lunch Break	CAD/CAM	HT	FOM
TUE	HT	UCMP	DMM-II	FEM		CAD/CAM-LAB		
WED	FEM	CAD/CAM	HT	FOM		HT-LAB		
THU	HT	DMM-II	CAD/CAM	UCMP		DMM-II	FEM	FOM
FRI	UCMP	FEM	FOM	DMM-II		ACS-LAB		
SAT	DMM-II	UCMP	HT	FEM		UCMP	CAD/CAM	FOM

Subject Name	Faculty Name	Designation
Design of Machine Members-II	Dr A SIVA KUMAR	PROFESSOR
Heat Transfer	A. SHANKAR	ASSISTANT PROFESSOR
CAD & CAM	K.SUMANTH	ASSISTANT PROFESSOR
Finite Element Methods	M.VENKATESWARLU	ASSISTANT PROFESSOR
Unconventional Machining Processes	A.SWATHI	ASSISTANT PROFESSOR
FANDAMENTAL OF MANEGEMENT	ASHRAF HUSSAIN	ASSOCIATE PROFESSOR
Heat Transfer Lab	A. SHANKAR	ASSISTANT PROFESSOR
CAD & CAM Lab	K.SUMANTH	ASSISTANT PROFESSOR
Advanced Communication Skills lab	N.RAMESH / SWARUPA KUMARI	ASSISTANT PROFESSOR
Design of Machine Members-II	Dr A SIVA KUMAR	PROFESSOR

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Head of the Department
Mechanical Engineering
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A.Y 2022-23 TIME TABLE

IV B. Tech MECH II- SEM **W.E. F:03-03-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:50	12:50- 01:20	01:20- 02:10	02:10- 03:00	03:00- 03:50
MON	IM	IR	TQM	IR	Lunch Break	PROJECT STAGE- II		
TUE	IR	IM	SEMINAR			PROJECT STAGE- II		
WED	TQM	IR	IM	TQM		PROJECT STAGE- II		
THU	IR	IM	SEMINAR			PROJECT STAGE- II		
FRI	TQM	IM	SEMINAR			PROJECT STAGE- II		
SAT	TQM	IR	IM	IR		PROJECT STAGE- II		

Subject Name	Faculty Name	Designation
Industrial Management	R.V. PRAHLAD	ASSISTANT PROFESSOR
Industrial Robotics	Dr.Y.RAMESH BABU	ASSISTANT PROFESSOR
TOTAL QUALITY MANAGMENT	V. HARI NAYAK	ASSISTANT PROFESSOR
PROJECT STAGE -II	Dr GANDLURI RAMACHANDRA REDDY/ Dr A SIVA KUMAR	PROFESSOR

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II B. Tech ECE-A II- SEM **W.E. F:01-05-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:50	12:50- 01:20	01:20- 02:10	02:10- 03:00	03:00- 03:50
MON	EMFW	A&DC	ICA	ECA	Lunch Break	A&DC	LNCV	LNCV
TUE	ECA	ICA	A&DC	EMFW		ICA/ECA LAB		
WED	ICA	LMCV	EMFW	ECA		A&DC/ICA LAB		
THU	LNCV	EMFW	ECA	A&DC		ECA/A&DC LAB		
FRI	LNCV	ECA	A&DC	EMFW		ICA	LNCV	EMFW
SAT	ECA	GS LAB		A&DC		ICA	LIB	SPORTS

Subject Name	Faculty Name	Designation
Electromagnetic Field and Waves(EMFW)	Dr. SIDDHRATHA	Associate Professor
Analog & Digital Communications (A&DC)	P.V RAJU	Assistant Professor
Linear IC Applications (LICA)	Dr.V.NAGARAJU	Assistant Professor
Electronic Circuit Analysis(ECA)	G. SRINIVAS	Assistant Professor
Laplace Transforms, numerical methods & complex variables	NAGARAJU KURELLA	Assistant Professor
IC Applications(ICA) LAB	Dr.V.NAGARAJU/ D. SURYA PRAKASH	Assoc /Assistant Professor
Electronic Circuit Analysis(ECA) LAB	G. SRINIVAS/G.NAGU NAIK	Assistant Professor
Analog & Digital Communications (A&DC) LAB	P.V RAJU/K.SONY	Assistant Professor
GENDER SENSITIZATION LAB	Dr.K.SHYLAJA	Assistant Professor

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A.Y 2022-23 TIME TABLE

II B. Tech ECE-B II- SEM **W.E. F: 01-05-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:50	12:50- 01:20	01:20- 02:10	02:10- 03:00	03:00- 03:50
MON	EMFW	A&DC	ICA	ECA	Lunch Break	A&DC	LNCV	LNCV
TUE	ECA	ICA/ECA LAB				ICA	A&DC	EMFW
WED	ICA	A&DC/ICA LAB				LNCV	EMFW	ECA
THU	LNCV	ECA/A&DC LAB				EMFW	ECA	A&DC
FRI	LNCV	ECA	A&DC	EMFW		GSL		EMFW
SAT	ECA	LNCV	ICA	A&DC		ICA	LIB	SPORTS

Subject Name	Faculty Name	Designation
Electromagnetic Field and Waves(EMFW)	K.SHILPA	Assistant Professor
Analog & Digital Communications (A&DC)	M.YAMINI	Assistant Professor
Linear IC Applications(LICA)	M.SAI KRISHNA	Assistant Professor
Electronic Circuit Analysis(ECA)	V.NAGASWATHI	Assistant Professor
Laplace Transforms, numerical methods & complex variables	NAGARAJU KURELLA	Assistant Professor
IC Applications(ICA) LAB	K.SHILPA/ B.KALPANA	Assistant Professor
Electronic Circuit Analysis(ECA) LAB	V.NAGASWATHI/ M.SWATHI	Assistant Professor
Analog & Digital Communications (A&DC) LAB	M.YAMINI/ B.VENKATESHWARLU	Assistant Professor
GENDER SENSIGATION LAB	P.VENKATA SWAMY	Assistant Professor

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A.Y 2022-23 TIME TABLE

III B. Tech ECE-A II SEM **W.E. F:13-02-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	AWP	DSP	ESD	VLSI	Lunch Break	FOM	DSP	ESD
TUE	VLSI	VLSI	FOM	AWP		AI	CRT	
WED	ESD	DSP	AWP	VLSI		DSP/E-CAD&VLSI LAB		
THU	AWP	E-CAD&VLSI/SCRIPTING LAB				ESD	SOFT SKILLS	
FRI	DSP	ESD	AWP	VLSI		SCRIPTING LANGUAGE /DSP LAB		
SAT	FOM	AWP	DSP	AI		SEMINAR	LIB	SPORTS

Subject Name	Faculty Name	Designation
Antennas and Propagation(AWP)	B.DASHARATHA	Assistant Professor
Digital Signal Processing (DSP)	E.NAGESH	Assistant Professor
VLSI Design(VLSI)	B.VENKATESHWARLU	Assistant Professor
Embedded System Design (ESD)	V.GURAVAIAH	Assistant Professor
Fundamentals of Management for Engineers (FOM)	ASHRAF HUSSAIN	Assistant Professor
E-CAD &VLSI Lab	S.SAGAR/B.DASHARADHA	Assistant Professor
DSP Lab	E.NAGESH/P.GEETHA	Assistant Professor
Scripting Language lab	K.SONY/K.SHILPA	Assistant Professor

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A.Y 2022-23 TIME TABLE

III B. Tech ECE-B II- SEM **W.E. F:13-02-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:50	12:50- 01:20	01:20-02:10	02:10- 03:00	03:00- 03:50
MON	ESD	VLSI	FOM	DSP	Lunch Break	E-CAD &VLSI/ SCRPTING LAB		
TUE	DSP	FOM	CRT CLASSES			DSP LAB/ E-CAD&VLSI LAB		
WED	VLSI	AWP	DSP	ESD		AI	AI	FOM
THU	ESD	VLSI	VLSI	DSP		AWP	SOFT SKILLS	
FRI	FOM	FOM	VLSI	DSP		ESD	AWP	LIB
SAT	AWP	SCRIPTING LAB/DSP LAB				SEMINAR	INT	SPORTS

Subject Name	Faculty Name	Designation
Antennas and Propagation(AWP)	V. NAGA SWATHI	Assistant Professor
Digital Signal Processing (DSP)	B.KALPANA	Assistant Professor
VLSI Design(VLSI)	M.SWATHI	Assistant Professor
Embedded System Design (ESD)	B.VENKATESHWARLU	Assistant Professor
Fundamentals of Management for Engineers (FOM)	ASHRAF HUSSAIN	Assistant Professor
E-CAD &VLSI Lab	M.SWATHI/P.PADMAVATHI	Assistant Professor
DSP Lab	B.KALPANA/S.SAIDIREDDY	Assistant Professor
Scripting Language lab	G.DILEEP/Dr.G.CHANDRA SHEKAR	Assistant Professor

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A.Y 2022-23 TIME TABLE

IV B. Tech ECE-A II- SEM **W.E. F:03-02-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	SOC	SC	BPPE	INT	Lunch Break	PROJECT STAGE - II		
TUE	SOC	BPPE	BPPE	SPORTS		PROJECT STAGE - II		
WED	SOC	SOC	SC	SEMINAR		PROJECT STAGE - II		
THU	SC	SOC	BPPE	BPPE		PROJECT STAGE - II		
FRI	BPPE	SC	LIB	LIB		PROJECT STAGE - II		
SAT	SC	SEMINAR	SEMINAR	INT		PROJECT STAGE - II		

Subject Name	Faculty Name	Designation
Satellite Communications (SC)	K. SONY	Assistant Professor
System on Chip Architecture (SOC)	P.V. RAJU	Assistant Professor
BASICS OF POWER PLANT ENGINEERING (BPPE)	M.SHANKAR	Assistant Professor
PROJECT STAGE-2	Dr.J B SIDDHARTHA/ K. ARUNA/ O. MOUNIKA	Assoc/Assistant Professor
SEMINAR	G. NAGU NAIK/D.SURYA PRAKASH/ M.SAIKRISHNA	Assistant Professor

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A.Y 2022-23 TIME TABLE

IV B. Tech ECE-B II- SEM **W.E. F:03-02-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:50	12:50- 01:20	01:20- 02:10	02:10- 03:00	03:00- 03:50
MON	PROJECT STAGE-II			LIB	Lunch Break	SOC	SC	BPPE
TUE	PROJECT STAGE-II			SEMINAR		SOC	BPPE	BPPE
WED	PROJECT STAGE-II			INT		SOC	SOC	SC
THU	PROJECT STAGE-II			SPORTS		SC	SOC	BPPE
FRI	PROJECT STAGE-II			SEMINAR		BPPE	SC	SC
SAT	PROJECT STAGE-II			LIB		BPPE	SOC	INT

Subject Name	Faculty Name	Designation
Satellite Communications (SC)	P. GEETHA	Assistant Professor
System on Chip Architecture (SOC)	G.NAGU NAIK	Assistant Professor
BASICS OF POWER PLANT ENGINEERING (BPPE)	D.NAGESHWAR RAO	Assistant Professor
PROJECT STAGE-II	Dr.G. CHANDRASHEKAR/ Dr.G.SAI KUMAR/ D.NEELAKANTESHWAR RAO	Assistant /Assoc Professor
SEMINAR	Dr.G.SAI KUMAR/ R.LAXMIKANTH/P.GEETHA	Assoc/ Assistant Professor

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II B. Tech CSE-A II-SEM **W.E. F: 01-05-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50- 01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	DBMS	COI	OS	DM	Lunch Break	BEFA	JAVA	LIB
TUE	JAVA	OS	BEFA	DM		DBMS LAB/OS LAB		
WED	OS	DBMS	DM	BEFA		JAVA	SPORTS	
THU	BEFA	OS LAB/ JAVA LAB				DM	JAVA	DBMS
FRI	OS	DM	DBMS	COI		JAVA LAB/DBMS LAB		
SAT	DM	JAVA	OS	DBMS		COI	BEFA	OS

Subject Name	Faculty Name	Designation
Discrete Mathematics (DM)	SESHAGIRI RAO KALLURI	Assistant Professor
Business Economics & Financial Analysis (BEFA)	Dr. NARU RAMANA REDDY	Assistant Professor
Operating Systems (OS)	Dr. SHAKEERBASHA	Assistant Professor
Database Management Systems (DBMS)	YENAGANTI SATISH KUMAR	Assistant Professor
Java Programming	SILVERI RAJENDER	Assistant Professor
Operating Systems (OS) Lab	Dr. SHAKEERBASHA/ O.SRIDEVI	Assistant Professor
Database Management Systems (DBMS) Lab	YENAGANTI SATISH KUMAR/R.SATEESH KUMAR	Assistant Professor
Java Programming Lab	SILVERI RAJENDER/ A.PRAVEEN	Assistant Professor
Constitution of India (COI)	BOMARABOINA SHAILAJA	Assistant Professor

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II B. Tech CSE-B II-SEM **W.E. F: 01-05-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50- 01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	BEFA	JAVA	OS	COI	Lunch Break	DBMS	DM	SPORTS
TUE	DM	DBMS	COI	JAVA		BEFA	OS	JAVA
WED	OS	BEFA	DM	COI		OS LAB/JAVA LAB		
THU	DBMS	DM	BEFA	OS		JAVA LAB/DBMS LAB		
FRI	JAVA	DBMS LAB/OS LAB				DM	OS	DBMS
SAT	COI	DBMS	COI	DBMS		BEFA	OS	LIB

Subject Name	Faculty Name	Designation
Discrete Mathematics (DM)	SESHAGIRI RAO KALLURI	Assistant Professor
Business Economics & Financial Analysis (BEFA)	Dr. NARU RAMANA REDDY	Assistant Professor
Operating Systems (OS)	DOTI.NAGARAJU	Assistant Professor
Database Management Systems (DBMS)	YENAGANTI SATISH KUMAR	Assistant Professor
Java Programming	SILVERI RAJENDER	Assistant Professor
Operating Systems (OS) Lab	DOTI.NAGARAJU/P.TULASI	Assistant Professor
Database Management Systems (DBMS) Lab	YENAGANTI SATISH KUMAR/ M.UDAYABHANU	Assistant Professor
Java Programming Lab	SILVERI RAJENDER/ SUBHAN ALI SHAIK	Assistant Professor
Constitution of India (COI)	A NARESH	Assistant Professor

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A.Y 2022-23 TIME TABLE

II B. Tech CSE-C II-SEM **W.E. F: 01-05-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50- 01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	JAVA	DBMS LAB/JAVA LAB			Lunch Break	BEFA	OS	JAVA
TUE	BEFA	JAVA	OS	COI		JAVA LAB/OS LAB		
WED	DM	DBMS	COI	JAVA		DM	OS	DBMS
THU	OS	BEFA	DM	COI		BEFA	OS	LIB
FRI	COI	DBMS	JAVA	DM		DBMS	DM	SPORTS
SAT	DBMS	DM	BEFA	OS		OS LAB/DBMS LAB		

Subject Name	Faculty Name	Designation
Discrete Mathematics (DM)	SESHAGIRI RAO KALLURI	Assistant Professor
Business Economics & Financial Analysis (BEFA)	Dr. NARU RAMANA REDDY	Assistant Professor
Operating Systems (OS)	ALLA SRAVANI	Assistant Professor
Database Management Systems (DBMS)	NEELAKANTAM KALAGONI	Assistant Professor
Java Programming	DIGAJARLA PRASAD	Assistant Professor
Operating Systems (OS) Lab	ALLA SRAVANI/ G.NIKHILA REDDY	Assistant Professor
Database Management Systems (DBMS) Lab	NEELAKANTAM KALAGONI/ U.UMA	Assistant Professor
Java Programming Lab	DIGAJARLA PRASAD/ S.SRAVANVARDHAN	Assistant Professor
Constitution of India (COI)	G. LINGAIAH	Assistant Professor

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A.Y 2022-23 TIME TABLE

II B. Tech CSM II-SEM **W.E. F: 01-05-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50- 01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	OS	DBMS LAB/JAVA LAB			Lunch Break	JAVA	FLAT	SE
TUE	SE	FLAT	DBMS	JAVA		OS	FLAT	COI
WED	DBMS	JAVA LAB/OS LAB				FLAT	SE	OS
THU	COI	JAVA	DBMS	FLAT		SE	SPORTS	
FRI	FLAT	OS	JAVA	SE		DBMS	COI	LIB
SAT	JAVA	OS LAB/DBMS LAB				SE	DBMS	OS

Subject Name	Faculty Name	Designation
Formal Language and Automata Theory (FLAT)	Dr SHAIK SHAKEERBASHA	Assistant Professor
Software Engineering (SE)	SUBHAN ALI SHAIK	Assistant Professor
Operating Systems (OS)	Dr SHAHEBAZ AHMED KHAN	Assistant Professor
Database Management Systems (DBMS)	Dr ABDUL AHAD AFROZ	Assoc Professor
Object Oriented Programming using Java	LAVUDYA SHIVASHANKAR	Assistant Professor
Operating Systems (OS) Lab	Dr SHAHEBAZ AHMED KHAN/ S.VASANTHA	Assistant Professor
Database Management Systems (DBMS) Lab	Dr ABDUL AHAD AFROZ/ S.ROHINI	Assoc/ Assistant Professor
Java Programming Lab	LAVUDYA SHIVASHANKAR/ M.SHIREESHA	Assistant Professor
Constitution of India (COI)	BALAKRISHNA GOUD GARDULLA	Assistant Professor

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A.Y 2022-23 TIME TABLE

II B. Tech CSD II-SEM **W.E. F: 01-05-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	FLAT	OS	JAVA	SE	Lunch Break	DBMS LAB/JAVA LAB		
TUE	DBMS	JAVA LAB/OS LAB				SE	FLAT	OS
WED	SE	COI	DBMS	JAVA		JAVA	OS	DBMS
THU	COI	JAVA	DBMS	SE		OS	FLAT	SPORTS
FRI	FLAT	OS	JAVA	COI		DBMS	SE	LIB
SAT	JAVA	SE	COI	FLAT		OS LAB/DBMS LAB		

Subject Name	Faculty Name	Designation
Formal Language and Automata Theory (FLAT)	M.UDAYABHANU	Assistant Professor
Software Engineering (SE)	SUBHAN ALI SHAIK	Assistant Professor
Operating Systems (OS)	B.NAVEEN KUMAR	Assistant Professor
Database Management Systems (DBMS)	SHAIK SUBHAN ABDUL	Assistant Professor
Object Oriented Programming using Java	P.ASHWANTH KUMAR	Assistant Professor
Operating Systems (OS) Lab	B.NAVEEN KUMAR/ R.HIMABINDHU	Assistant Professor
Database Management Systems (DBMS) Lab	SHAIK SUBHAN ABDUL/ S.RAGHU	Assistant Professor
Java Programming Lab	P.ASHWANTH KUMAR/ P.HYMAVATHI	Assistant Professor
Constitution of India (COI)	BALAKRISHNA GOUD GARDULLA	Assistant Professor

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A.Y 2022-23 TIME TABLE

III B. Tech CSE-A II-SEM **W.E. F: 13-02-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	CD	STM	ML	DAA	Lunch Break	CD LAB/ML LAB		
TUE	STM	ML LAB/STM LAB				CD	DAA	QABD
WED	ES	ML	QABD	STM		DAA	CD	LIB
THU	DAA	STM LAB/ CD LAB				CD	QABD	ML
FRI	QABD	DAA	STM	CD		ML	SPORTS	
SAT	ML	QABD	DAA	ML		ES	STM	CD

Subject Name	Faculty Name	Designation
Machine Learning (ML)	JOOLU SPANDANA	Assistant Professor
Compiler Design (CD)	M.SHIRISHA	Assistant Professor
Design and Analysis of Algorithms (DAA)	UDDAGIRI UMA	Assistant Professor
Software Testing Methodologies (STM)	G.NIKHILA	Assistant Professor
Quantitative Analysis for Business Decision (QABD)	S.SRAVANVARDHAN	Assistant Professor
Machine Learning (ML) Lab	JOOLU SPANDANA/ A.SRAVANI	Assistant Professor
Compiler Design (CD) Lab	M.SHEERISHA/G.BALAKRISHNA	Assistant Professor
Software Testing Methodologies (STM) Lab	G.NIKHILA/ D.NAGARAJU	Assistant Professor

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III B. Tech CSE-B II-SEM **W.E. F: 13-02-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	ES	CD	DAA	QABD	Lunch Break	ML	STM	LIB
TUE	ML	ML LAB/CD LAB				QABD	DAA	CD
WED	CD	DAA	QABD	ML		ES	STM	SPORTS
THU	QABD	ML	DAA	ES		CD	STM	DAA
FRI	DAA	STM	ML	DAA		CD LAB/STM LAB		
SAT	STM	STM LAB/ML LAB				QABD	CD	SPORTS

Subject Name	Faculty Name	Designation
Machine Learning (ML)	A.PRAVEEN	Assistant Professor
Compiler Design (CD)	P.HYMAVATHI	Assistant Professor
Design and Analysis of Algorithms (DAA)	R.HIMABINDHU	Assistant Professor
Software Testing Methodologies (STM)	R. SATEESH KUMAR	Assistant Professor
Quantitative Analysis for Business Decision (QABD)	S.SRAVANVARDHAN RAO	Assistant Professor
Machine Learning (ML) Lab	A.PRAVEEN/ Dr.J SV SASATRY	Assistant Professor
Compiler Design (CD) Lab	P.HYMAVATHI/ L.SHIVA SHANKAR	Assistant Professor
Software Testing Methodologies (STM) Lab	R. SATEESH KUMAR/ MD. AZIZ UR REHMAN	Assistant Professor

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A.Y 2022-23 TIME TABLE

III B. Tech CSM II-SEM **W.E. F: 13-02-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	C&NS	QABD	DEVOPS	NLP	Lunch Break	AI	QABD	ES
TUE	QABD	AI	NLP	DEVOPS		C&NS Lab		
WED	C&NS	NLP	DEVOPS	AI		QABD	AI	LIB
THU	QABD	C&NS	NLP	DEVOPS		AI	C&NS	SPORT
FRI	C&NS	NLP/AI Lab				QABD	AI	NLP
SAT	AI	QABD	C&NS	DEVOPS		DEVOPS Lab		

Subject Name	Faculty Name	Designation
Artificial Intelligence (AI)	B.JAINABBI	Assistant Professor
DevOps	GOSALA SUBHASHINI	Assistant Professor
Natural Language Processing (NLP)	B.SHAILAJA	Assistant Professor
Cryptography and Network Security ((C&NS))	D.VIJAYAKRISHNA	Assistant Professor
Quantitative Analysis for Business Decision (QABD)	NALLABOLU PAVANI	Assistant Professor
Artificial Intelligence and Natural Language Processing (AI/NLP)Lab	B.JAINABBI/ B.SHAILAJA	Assistant Professor
DevOps Lab	GOSALA SUBHASHINI/ P.ASHWANTH KUMAR	Assistant Professor
Cryptography and Network Security (C&NS) LAB	D.VIJAYAKRISHNA/ B.NAVEEN KUMAR	Assistant Professor

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A.Y 2022-23 TIME TABLE

III B. Tech CSD II-SEM **W.E. F: 13-02-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	ES	CD	BDA	QABD	Lunch Break	ML	DVT	LIB
TUE	ML	ML LAB				QABD	BDA	CD
WED	CD	BDA	QABD	ML		ES	DVT	SPORT
THU	QABD	ML	BDA	ES		CD	DVT	BDA
FRI	BDA	DVT	ML	DAA		DVT LAB		
SAT	DVT	BDA LAB				QABD	CD	ES

Subject Name	Faculty Name	Designation
Compiler Design (CD)	G.LAVA KUMAR	Assistant Professor
Machine Learning (ML)	K.SWATHI	Assistant Professor
Big Data Analytics (BDA)	M.SRINATH	Assistant Professor
Data Visualization Techniques (DVT)	N.MANGAN	Assistant Professor
Quantitative Analysis for Business Decision (QABD)	D.NAGARAJU	Assistant Professor
Machine Learning (ML) Lab	K.SWATHI/ SHAIK SUBHAN ABDUL	Assistant Professor
Big Data Analytics Lab (BDA)	M.SRINATH/ K.NEELAKANTAM	Assistant Professor
Data Visualization Techniques (DVT) LAB	N.MANGAN/ B.JAINABBI	Assistant Professor

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A.Y 2022-23 TIME TABLE

IV B. Tech CSE-A II-SEM **W.E. F: 03-02-2023** **COLLEGE TIMINGS: 09:30AM – 03:50PM**

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	Project Stage - II			HCI	Lunch Break	OB	BPE	LIB
TUE	Project Stage - II			OB		BPE	HCI	SEMINAR
WED	Project Stage - II			BPE		HCI	OB	SPORTS
THU	Project Stage - II			BPE		OB	HCI	SPORTS
FRI	Project Stage - II			HCI		OB	BPE	SEMINAR
SAT	Project Stage - II			OB		HCI	BPE	SEMINAR

Subject Name	Faculty Name	Designation
Organizational Behaviour (OB)	Y.JAYAPRADA	Assistant Professor
Human Computer Interaction (HCI)	G.BALAKRISHNA	Assistant Professor
Basics of Power Plant Engineering (BPE)	B.SRIKANTH	Assistant Professor
Project Stage - II	Dr.ABDUL AHAD AFROZ/ D.S.S.RAVI TEJA/K.SWATHI	Assoc/ Assistant Professor
Seminar	U.UMA/S.VASANTHA/ G.SUBHASHINI	Assistant Professor

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A.Y 2022-23 TIME TABLE

IV B. Tech CSE-B II-SEM W.E. F: 03-02-2023 COLLEGE TIMINGS: 09:30AM – 03:50PM

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50- 01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	Project Stage - II			BPE	Lunch Break	HCI	OB	SEMINAR
TUE	Project Stage - II			HCI		OB	BPE	SEMINAR
WED	Project Stage - II			OB		BPE	HCI	SPORTS
THU	Project Stage - II			HCI		BPE	OB	SEMINAR
FRI	Project Stage - II			BPE		HCI	OB	LIB
SAT	Project Stage - II			BPE		OB	HCI	SPORTS

Subject Name	Faculty Name	Designation
Organizational Behaviour (OB)	Y. JAYAPRADA	Assistant Professor
Human Computer Interaction (HCI)	Dr.HAMEEDA SHAIK	Assistant Professor
Basics of Power Plant Engineering (BPE)	U.GANESH	Assistant Professor
Project Stage - II	Dr.SHAHEBAZ AHMED KHAN/ D.VIJAYAKRISHNA/ MOHD AZIZ UR RAHAMAN	Assistant Professor
Seminar	R.HIMABINDU/ M. UDAYABHANU/ J.SPANDANA	Assistant Professor

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A.Y 2022-23 TIME TABLE

IV B. Tech CSE-C II-SEM W.E. F: **03-02-2023** COLLEGE TIMINGS: 09:30AM – 03:50PM

DAY	9:30 - 10:20	10:20 - 11:10	11:10 - 12:00	12:00 - 12:50	12:50-01:20	01:20 - 02:10	02:10 - 03:00	03:00 - 03:50
MON	Project Stage - II			OB	Lunch Break	BPE	HCI	SEMINAR
TUE	Project Stage - II			BPE		HCI	OB	SEMINAR
WED	Project Stage - II			HCI		OB	BPE	SPORTS
THU	Project Stage - II			OB		HCI	BPE	SEMINAR
FRI	Project Stage - II			OB		BPE	HCI	SEMINAR
SAT	Project Stage - II			HCI		BPE	OB	LIB

Subject Name	Faculty Name	Designation
Organizational Behaviour (OB)	Y. JAYAPRADA	Assistant Professor
Human Computer Interaction (HCI)	D.S.S.RAVI TEJA	Assistant Professor
Basics of Power Plant Engineering (BPE)	Dr.T.KRANTHI KUMAR	Associate Professor
Project Stage - II	Dr.HAMEEDA SHAIK/ O.SRIDEVI/ P.TULASI	Assistant Professor
SEMINAR	S.ROHINI/ S.RAGHU/ M.SRINATH	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech CSE-A II- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	PYTHON LAB			Lunch Break	EDC	AP	SPORTS	
TUE	AP	ESE	EDC		ESE	ELCS(B-I)/EW(B-II)		
WED	ESE	AP	OD&VC		ES	ESE	EDC	ESE
THU	EW(B-I)/AP(B-II)				LIBRARY	AP	ESE	OD&VC
FRI	EDC	OD&VC	EDC		AP	AP(B-I)/ELCS(B-II)		
SAT	EDC	OD&VC	OD&VC		ES	IT WORKSHOP		

Subject Name	Faculty Name	Designation
Ordinary Differential Equationsand Vector Calculus (OD&VC)	A.Anjaneyulu	Assistant Professor
Applied Physics (AP)	E. Ravi	Assistant Professor
Engineering Workshop (EW)	Dr. Y. Ramesh Babu	Associate Professor
English For Skill Enhancement (ESE)	Ch. Sunanda	Assistant Professor
Electronic Devices And Circuits (EDC)	D.SURYAPRAKASH	Assistant Professor
Python Programming Laboratory (PYTHON LAB)	Dr. Hameeda Shaik/D.Nagaraju	Assistant Professor
Applied Physics Laboratory (AP LAB)	E. Ravi	Assistant Professor
English Language And Communication Skills Laboratory (ELCS LAB)	Ch. Sunanda/ A Gatteshwar Roy	Assistant Professor
It Workshop	S. Raghu/ S.Rohini	Assistant Professor
Environmental Science (ES)	D. Srilaxmi	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech CSE-B II- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:30	12:30-01:20	01:20- 02:10	02:10- 03:00	03:00- 03:50
MON	ESE	OD&VC	OD&VC	Lunch Break	AP	IT WORKSHOP		
TUE	EDC	AP	ESE		EDC	ESE	SPORTS	
WED	AP	ESE	AP		EDC	EW(B-I)/AP(B-II)		
THU	PYTHON LAB				ESE	EDC	AP	ESE
FRI	OD&VC	EDC	ES		LIBRARY	ELCS(B-I)/EW(B-II)		
SAT	AP(B-I)/ELCS(B-II)				EDC	ES	OD&VC	OD&VC

Subject Name	Faculty Name	Designation
Ordinary Differential Equationsand Vector Calculus (OD&VC)	A.Anjaneyulu	Assistant Professor
Applied Physics (AP)	G. Laxminarayana	Assistant Professor
Engineering Workshop (EW)	A.Shankar	Assistant Professor
English For Skill Enhancement (ESE)	A Gatteshwar Roy	Assistant Professor
Electronic Devices And Circuits (EDC)	G.Dileep	Assistant Professor
Python Programming Laboratorypython LAB	Dr. Hameeda Shaik/D.Nagaraju	Assistant Professor
Applied Physics Laboratory (AP LAB)	G. Laxminarayana	Assistant Professor
English Language And Communication Skills Laboratory (ELCS LAB)	Ch. Sunanda/ A Gatteshwar Roy	Assistant Professor
It Workshop	S. Raghu/ S.Rohini	Assistant Professor
Environmental Science (ES)	K. Rajamanohar Reddy	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech CSE-C II- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	AP(B-I)/ELCS(B-II)			Lunch Break	ESE	EDC	OD&VC	AP
TUE	PPS	AP	M-2		ESE	IT WORKSHOP		
WED	AP	ES	M-2		EDC	LIBRARY	ESE	OD&VC
THU	PPS	M-2	AP		AP	ELCS(B-I)/EW(B-II)		
FRI	AP LAB/ PPS LAB				ESE	EDC	OD&VC	ESE
SAT	M-2	ES	LIBRARY		EDC	AP	SPORTS	

Subject Name	Faculty Name	Designation
Ordinary Differential Equationsand Vector Calculus (OD&VC)	K. Sarawani	Assistant Professor
Applied Physics (AP)	Swamyrao Kulkarni	Assistant Professor
Engineering Workshop (EW)	A.Swathi	Assistant Professor
English For Skill Enhancement (ESE)	Dr. P.Sundeep	Assistant Professor
Electronic Devices And Circuits (EDC)	O.Mounika	Assistant Professor
Python Programming Laboratory (PYTHON LAB)	Dr. Hameeda Shaik/D.Nagaraju	Assistant Professor
Applied Physics Laboratory (AP LAB)	Swamyrao Kulkarni	Assistant Professor
English Language And Communication Skills Laboratory (ELCS LAB)	Dr. P.Sundeep / Swarupa Kumari	Assistant Professor
It Workshop	S. Raghu/ S.Rohini	Assistant Professor
Environmental Science (ES)	K. Rajamanohar Reddy	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech CSE-DS II- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	OD&VC	EDC	OD&VC	Lunch Break	AP	EW(B-I)/AP(B-II)		
TUE	PYTHON LAB				LIBRARY	ESE	EDC	ESE
WED	ESE	EDC	ES		OD&VC	ESE	SPORTS	
THU	AP	ESE	OD&VC		AP	AP(B-I)/ELCS(B-II)		
FRI	OD&VC	AP	EDC		EDC	IT WORKSHOP		
SAT	EDC	OD&VC	AP		ES	ELCS(B-I)/EW(B-II)		

Subject Name	Faculty Name	Designation
Ordinary Differential Equationsand Vector Calculus (OD&VC)	K. Sarwani	Assistant Professor
Applied Physics (AP)	Swamyrao Kulkarni	Assistant Professor
Engineering Workshop (EW)	K.Sumanth	Assistant Professor
English For Skill Enhancement (ESE)	Ramesh Narige	Assistant Professor
Electronic Devices And Circuits (EDC)	P. Padmavathi	Assistant Professor
Python Programming Laboratorypython LAB	G. Lava Kumar/ S.Vasantha	Assistant Professor
Applied Physics Laboratory (AP LAB)	E.Ravi	Assistant Professor
English Language And Communication Skills Laboratory (ELCS LAB)	Dr. P.Sundeep / Swarupa Kumari	Assistant Professor
It Workshop	P. Thulasi/ O.Sridevi	Assistant Professor
Environmental Science (ES)	P. Venkata Swamy	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech CSE-AI&ML II- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	EC	OD&VC	EDC	Lunch Break	OD&VC	CAEG		
TUE	BEE	EC	OD&VC		EDC	BEE/EC LAB		
WED	EDC	BEE	OD&VC		EC	IT WORKSHOP		
THU	BEE	EC	EDC		OD&VC	BEE	EDC	LIBRARY
FRI	PYTHON LAB				EC	CAEG		
SAT	BEE/EC LAB				OD&VC	BEE	SPORTS	

Subject Name	Faculty Name	Designation
Ordinary Differential Equations And Vector Calculus (OD&VC)	K. Sheshagiri Rao	Assistant Professor
Engineering Chemistry (EC)	Dr. K. Shailaja	Professor
Computer Aided Engineering Graphics (CAEG)	Dr.G.Ramachandra Reddy	Professor
Basic Electrical Engineering(BEE)	E.Prasanna	Associate Professor
Electronic Devices And Circuits (EDC)	S.SAIDI REDDY	Assistant Professor
Engineering Chemistry Laboratory (EC LAB)	Dr.K. Shailaja/ P.Venakataswamy	Professor/Assistant Professor
Basic Electrical Engineering Laboratory (BEE LAB)	E.Prasanna /M. Shankar	Assistant Professor
Python Programming Laboratory (Python Lab)	G. Lava Kumar/ S.Vasantha	Assistant Professor
It Workshop	P. Thulasi/ O.Sridevi	Assistant Professor

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I B. Tech ECE-A II- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	OD&VC	BEE	EDC	Lunch Break	EDC	EC(B-I)/BEE(B-II) LAB		
TUE	EDC (B-I) / EC (B-II) LAB				OD&VC	EC	SPORTS	
WED	EC	OD&VC	BEE		EC	BEE	OD&VC	EDC
THU	BEE	OD&VC	EDC		EC	CAEG		
FRI	EDC	EC	OD&VC		BEE	BEE (B-I) / EDC (B-II) LAB		
SAT	PYTHON LAB				LIBRARY	CAEG		

Subject Name	Faculty Name	Designation
Ordinary Differential Equations and Vector Calculus (OD&VC)	A Anjaneyulu	Assistant Professor
Engineering Chemistry (EC)	K. Rajamanohar Reddy	Assistant Professor
Computer Aided Engineering Graphics (CAEG)	A.Siva Kumar	Professor
Basic Electrical Engineering(BEE)	Dr S.Srikanth Reddy	Associate Professor
Electronic Devices and Circuits (EDC)	Mounika Chouhan	Assistant Professor
Engineering Chemistry Laboratory (EC LAB)	Dr. K.Shailaja/ D. Srilaxmi	Assistant Professor
Basic Electrical Engineering Laboratory (BEE LAB)	Dr S.Srikanth Reddy/ D.Nageshwar Rao	Assistant Professor
Python Programming Laboratory (PYTHON LAB)	N. Pavani / D. Prasad	Assistant Professor

HOD

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A.Y 2022-23 TIME TABLE

I B. Tech ECE-B II- SEM W.E. F:28-11-2022 COLLEGE TIMINGS: 09.30AM –03.50PM

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:30	12:30-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	BEE(B-I)/EDC(B-II) LAB			Lunch Break	EC	EC(B-I)/BEE(B-II) LAB		
TUE	OD&VC	EDC	BEE		BEE	CAEG		
WED	EDC	BEE	OD&VC		OD&VC	EC(B-I)/BEE(B-II) LAB		
THU	EC	BEE	EDC		EDC	PYTHON LAB		
FRI	CAEG				EDC	LIBRARY	OD&VC	EC
SAT	OD&VC	EC	BEE		BEE	OD&VC	SPORTS	

Subject Name	Faculty Name	Designation
Ordinary Differential Equations and Vector Calculus (OD&VC)	K. Nagaraju	Assistant Professor
Engineering Chemistry (EC)	P.Venkata Swamy	Assistant Professor
Computer Aided Engineering Graphics (CAEG)	V.HARINAYAK	Assistant Professor
Basic Electrical Engineering(BEE)	Dr.M.Surendar Reddy	Associate Professor
Electronic Devices and Circuits (EDC)	V.Sravanthi	Assistant Professor
Engineering Chemistry Laboratory (EC LAB)	P.Venkata Swamy/ B.Srilaxmi	Assistant Professor
Basic Electrical Engineering Laboratory (BEE LAB)	B.Srikanth/ K.ChandraShekar	Assistant Professor
Python Programming Laboratory (PYTHON LAB)	N. Pavani / D. Prasad	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech EEE II- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10-12:00	12:00- 12:30	12:30- 01:20	01:20- 02:10	02:10- 03:00	03:00- 03:50
MON	ELCS			Lunch Break	ESE	ECA-II	OD&VC	AP
TUE	PPS	AP	M-2		ESE	ECA LAB		
WED	AP	ECA-II	M-2		ECA-II	LIBRARY	ESE	OD&VC
THU	PPS	M-2	ES		AP	EW		
FRI	AP				ESE	ECA-II	OD&VC	ESE
SAT	M-2	ES	LIBRARY		ECA-II	AP	SPORTS	

Subject Name	Faculty Name	Designation
Ordinary Differential Equationsand Vector Calculus (OD&VC)	K. Nagaraju	Assistant Professor
Applied Physics (AP)	G Laxminarayana	Assistant Professor
Engineering Workshop (EW)	R V Prahalad	Assistant Professor
English for Skill Enhancement (ESE)	N. Ramesh	Assistant Professor
Electrical Circuit Analysis - II	K.Chandra Shekar	Assistant Professor
Applied Python Programming Laboratory	N. Pavani / D. Prasad	Assistant Professor
Applied Physics Laboratory (AP LAB	G Laxminarayana	Assistant Professor
English Language and Communication Skills Laboratory (ELCS LAB)	N. Ramesh	Assistant Professor
Electrical Circuit Analysis Laboratory (ECA)	M.Shankar/ G.Pavan Kumar	Assistant Professor
Environmental Science (ES)	D. Srilaxmi	Assistant Professor

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A.Y 2022-23 TIME TABLE

I B. Tech MECH II- SEM **W.E. F:28-11-2022** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:30	12:30- 01:20	01:20- 02:10	02:10- 03:00	03:00-03:50
MON	EC	OD&VC	EMT	Lunch Break	OD&VC	CAEG		
TUE	EM	EC	OD&VC		EMT	EC LAB		
WED	EMT	EM	OD&VC		EC	CAEG		
THU	EM	EC	EMT		OD&VC	EM	EMT	LIBRARY
FRI	PYTHON LAB				EC	CAEG		
SAT	F&L LAB				OD&VC	EM	SPORTS	

Subject Name	Faculty Name	Designation
Ordinary Differential Equations And Vector Calculus (OD&VC)	K Sarwani	Assistant Professor
Engineering Chemistry (EC)	K. Rajamanohar Reddy	Assistant Professor
Computer Aided Engineering Graphics (CAEG)	M.Venkateshwarlu	Assistant Professor
Engineering Mechanics (EM)	K. Sumanth	Associate Professor
Engineering Materials(EMT)	V. Harinayak	Assistant Professor
Engineering Chemistry Laboratory (EC LAB)	K. Rajamanohar Reddy	Assistant Professor
Fuels & Lubricants Laboratary	V.Harinayak	Assistant Professor
Python Programming Laboratory (Python Lab)	G. Lava Kumar/ S.Vasantha	Assistant Professor

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A.Y 2022-23 TIME TABLE

I MBA -A II- SEM **W.E. F:03-04-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20- 11:10	11:10- 12:00	12:00- 12:50	12:50- 01:20	01:20- 02:10	02:10- 03:00	03:00- 03:50
MON	ENTP	HRM	FM	QABD	Lunch Break	LSCM	MM RM	ENTP
TUE	RM	QABD	HRM	FM		ENTP	LSCM	RM
WED	QABD	MM	FM	HRM		RM	PPT	QABD
THU	RM	MM	QABD	FM		ENTP	LSCM	RM
FRI	MM	RM	FM	ENTP		QABD	LSCM	MM
SAT	ENTP	QABD	MM	FM		LSCM	HRM	ENTP

Subject Name	Faculty Name	Designation
Human Resource Management	M.Sudhakar	Assistant Professor
Marketing Management	A. Naresh	Assistant Professor
Financial Management	G.Lingaiah	Assistant Professor
Quantitative Analysis & Business Decisions	Dr. Ramana Reddy	Assistant Professor
Entrepreneurship and Design Thinking (EDT)	R.Srilatha	Assistant Professor
Logistics & Supply chain Management(LSCM)	M.Naresh	Assistant Professor
Rural Marketing	N V V Narayana Reddy	Assistant Professor

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A.Y 2022-23 TIME TABLE

I MBA -B II- SEM **W.E. F: 03-04-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	RM	QABD	HRM	FM	Lunch Break	ENTP	LSCM	RM
TUE	QABD	MM	FM	HRM		RM	PPT	QABD
WED	ENTP	HRM	FM	QABD		LSCM	MM RM	ENTP
THU	MM	RM	FM	ENTP		QABD	LSCM	MM
FRI	RM	MM	QABD	FM		ENTP	LSCM	RM
SAT	RM	MM	QABD	FM		ENTP	LSCM	RM

Subject Name	Faculty Name	Designation
Human Resource Management	Ashraf Husain	Assistant Professor
Marketing Management	Naresh Aelkaraju	Assistant Professor
Financial Management	K.Sharath	Assistant Professor
Quantitative Analysis & Business Decisions	Dr.Nayeema	Assistant Professor
Entrepreneurship and Design Thinking (EDT)	M.Sudhakar	Assistant Professor
Logistics & Supply chain Management (LSCM)	D.Manikanta	Assistant Professor
Rural Marketing	N.V.V.Narayana Reddy	Assistant Professor

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A.Y 2022-23 TIME TABLE

I MBA -C II- SEM **W.E. F:03-04-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	MM	RM	FM	ENTP	Lunch Break	QABD	LSCM	MM
TUE	ENTP	QABD	MM	FM		LSCM	HRM	ENTP
WED	QABD	MM	FM	HRM		RM	PPT	QABD
THU	RM	MM	QABD	FM		ENTP	LSCM	RM
FRI	ENTP	HRM	FM	QABD		LSCM	MMRM	ENTP
SAT	RM	QABD	HRM	FM		ENTP	LSCM	RM

Subject Name	Faculty Name	Designation
Human Resource Management	M.Sharadha	Assistant Professor
Marketing Management	O. Venkatesh	Assistant Professor
Financial Management	S. Rambabu	Assistant Professor
Quantitative Analysis & Business Decisions	K.Sharath	Assistant Professor
Entrepreneurship and Design Thinking (EDT)	G.Lingaiah	Assistant Professor
Logistics & Supply chain Management	M.Sudhakar	Assistant Professor
Rural Marketing	K. Sabitha	Assistant Professor

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A.Y 2022-23 TIME TABLE

II MBA -A II- SEM **W.E. F:13-04-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

DAY	9:30 - 10:20	10:20-11:10	11:10-12:00	12:00-12:50	12:50-01:20	01:20-02:10	02:10-03:00	03:00-03:50
MON	Library	Elective - 5	STM	Elective -6	Lunch Break	Elective -4	Elective -5	SPORTS
TUE	Library	Elective -4	Elective -5	STM		Elective -6	Main Project Viva-Voce	
WED	Library	STM	Elective -4	Elective -6		Elective -5	SEMINAR	
THU	Library	Elective -6	Elective -5	Elective -4		STM	SEMINAR	
FRI	Library	Elective -4	Elective -6	STM		English Soft Skills / Management Activity		
SAT	Main Project Viva-Voce					English Soft Skills / Management Activity		

Subject Name	Faculty Name	Designation
English Soft Skills / Management Activity	M.Sharadha	Assistant Professor
STM	O.Venkatesh	Assistant Professor
Fin.4 IFM	G.Lingaiah	Assistant Professor
HR4- [IHRM]	R.Srilatha	Assistant Professor
Mkt.4 (CRM)	D.Manikanta	Assistant Professor
Fin.5- [SIFD]	K.Sindhuri	Assistant Professor
HR.5- [LCM]	Dr.B,Nayeema	Assistant Professor
Mkt.5- (IM)	N.V.V.Narayana Reddy	Assistant Professor
Fin.6- [RMFD]	A Ramesh Goud	Assistant Professor
HR6- [TKM]	M Nageshwar Rao	Assistant Professor
SEMINAR	O.Venkatesh / A.Ramesh	Assistant Professor
MPVV	Dr.B.Nayeema	Associate Professor

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MON	Elective -4	STM	Library	Elective -6	Lunch Break	Elective -5	SEMINAR	
TUE	STM	Elective -6	Library	Elective -4		STM	SEMINAR	
WED	Elective -6	Elective -4	Library	Elective -5		English Soft Skills/ Management Activity		
THU	Main Project Viva-Voce					English Soft Skills / Management Actvity		
FRI	STM	Elective -5	Library	Elective -6		Elective -4	Elective -5	SPORTS
SAT	Elective -5	Elective -4	Library	STM		Elective -6	Main Project Viva-Voce	

Subject Name	Faculty Name	Designation
English Soft Skills / Management Activity	S.Rambabu	Assistant Professor
STM	O.Venkatesh	Assistant Professor
Fin.4 IFM	K.Sharath	Assistant Professor
HR4- [IHRM]	Anthati Ramesh Goud	Assistant Professor
Mkt.4 (CRM)	D.Manikanta	Assistant Professor
Fin.5- [SIFD]	K.Sindhuri	Assistant Professor
HR.5- [LCM]	Y.Jayaprada	Assistant Professor
Mkt.5- (IM)	K Sabitha	Assistant Professor
Fin.6- [RMFD]	M.Naresh	Assistant Professor
HR6- [TKM]	M Nageshwar Rao	Assistant Professor
SEMINAR	K.Sabitha/A.Ramesh	Assistant Professor
MPVV	R.Srilatha	Assistant Professor

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II MBA -C II- SEM **W.E. F:13-04-2023** **COLLEGE TIMINGS: 09.30AM –03.50PM**

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MON	Elective -4	Library	Elective -5	STM	Lunch Break	Elective -6	English Soft Skills / Management skills	
TUE	Main Project Viva-Voce					Elective -5	Elective -4	STM
WED	Elective -5	Library	STM	Elective -6		Elective -4	SEMINAR	
THU	STM	Library	Elective -4	Elective -6		Elective -5	English Soft Skills / Management skills	
FRI	Elective -6	Library	SEMINAR			STM	Main Project Viva-Voce	
SAT	Elective -4	Library	SEMINAR			Elective -6	Elective -5	SPORTS

Subject Name	Faculty Name	Designation
English Soft Skills / Management Activity	M.Naresh	Assistant Professor
STM	K.Sharath	Assistant Professor
Fin.4 IFM	K.Sindhuri	Assistant Professor
HR4- [IHRM]	Y.Jayaprada	Assistant Professor
Mkt.4 (CRM)	D.Manikanta	Assistant Professor
Fin.5- [SIFD]	N Venkata Veera Narayana	Assistant Professor
HR.5- [LCM]	K.Sabitha	Assistant Professor
Mkt.5- (IM)	M.Sharadha	Assistant Professor
Fin.6- [RMFD]	Mankala Naresh	Assistant Professor
HR6- [TKM]	Naresh Aelkaraju	Assistant Professor
SEMINAR	K.Sindhuri/ M.Nageshwar Rao	Assistant Professor
MPVV	M.Nageshwar Rao	Assistant Professor

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ESTD :1992

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B++ GRADE

COURSE FILE

Subject: APPLIED PHYSICS

Academic Year: 2022-2023

Name of the Faculty: G.Laxminarayana

Department :Humanities And Science

Branch & Year :CSE& I Year II Semester

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DEPARTMENT OF HUMANITIES AND SCIENCE

CONTENT OF COURSE FILE- CHECK LIST

1. VISION /MISSION/ POs
2. COURSE SYLLABUS
3. COURSE OUTCOMES
4. LESSON PLAN
5. ACADEMIC CALENDAR
6. TIME TABLE
7. TOPICS BEYOND SYLLABUS
8. LECTURE NOTES
9. UNIVERSITY QUESTION PAPER
10. INTERNAL QUESTION PAPER
11. INTERNAL QUESTION PAPER WITH ANSWER KEY
12. ASSIGNMENT QUESTION PAPER
13. STUDENT ASSIGNMENT.
14. RESULT
15. ATTAINMENT

COURSE FILE

COURSE DESCRIPTION / COURSE INFORMATION SHEET

Name of the Dept: Humanities and Science

<table>
<tr><td>Course Title</td><td colspan="4">APPLIED PHYSICS</td></tr>
<tr><td>Course Code</td><td>PH102BS</td><td>Programme</td><td colspan="2">CSE</td></tr>
<tr><td>Regulation</td><td>R22B. TECHCSE</td><td>Year/Semester</td><td colspan="2">I/II</td></tr>
<tr><td rowspan="2">Course Structure</td><td>Lectures</td><td>Tutorials</td><td>Practical</td><td>Credits</td></tr>
<tr><td>3</td><td>1</td><td>3</td><td>4</td></tr>
<tr><td>Course Teacher</td><td colspan="4">Mr. G.Laxminarayana</td></tr>
<tr><td>Email</td><td colspan="4">glnphysics999@gmail.com</td></tr>
<tr><td>Phone No</td><td colspan="4">8801888721</td></tr>
<tr><td rowspan="2">No of Hours Allotted per Week</td><td>Lectures</td><td>Tutorial</td><td colspan="2">Practical</td></tr>
<tr><td>3</td><td>1</td><td colspan="2">3</td></tr>
</table>

I. COURSE OVERVIEW:

An applied physics course typically explores the practical applications of fundamental physics principles in various real-world scenarios. Topics may include mechanics, thermodynamics, electromagnetism, optics, and quantum mechanics, with an emphasis on how these concepts are utilized in technology and engineering. Labs and projects may be included to provide hands-on experience, and the course aims to bridge theoretical knowledge with practical applications.

1. Vision & Mission of the Institution

Vision	**Imparting Knowledge and instilling skills to the aspiring students in the field of Engineering, Technology, Science and Management to face the emerging challenges of the society.**
Mission	➢ **Encouraging scholarly activities that transfer knowledge in the areas of Engineering, Technology, Science and Management.** ➢ **Ensuring students of all levels, well trained to meet the needs of education and their future endeavors.** ➢ **Inculcating human values and ethics into the education system for the all-round development of the students.**

2. Course Handout

a)Vision & Mission of the Department	
Vision	To be a centre of learning in the field of Electronics and Communication Engineering to develop competent professionals for industry and to fulfill the needs of the society.
Mission	➢ To impart quality education through effective teaching learning process. ➢ To provide essential inter-disciplinary technology to make the students readily employable. ➢ To inculcate entrepreneurial skillsto provide socially relevant and sustainable solutions.
b) Program Educational Objectives (PEOs)	After completion of the program the graduate is **PEO 1:** The graduates will be ableto adopt emerging technology for career development. **PEO 2:** The graduate will be able to develop professional skills and sense of social responsibility that paves them a way to secure key position. **PEO 3:** The graduate will have the capability to analyses real life problems of the society and produce innovative solutions.
c) Program Outcomes & Program Specific Outcomes (POs)& (PSOs)	**PO 1.Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. **PO 2. Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. **PO 3. Design/development of solutions:**Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. **PO 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and

	interpretation of data, and synthesis of the information to provide valid conclusions. **PO 5. Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. **PO 6. The engineer and society:**Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. **PO 7. Environment and sustainability:**Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development. **PO 8. Ethics:**Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. **PO 9. Individual and team work:**Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. **PO 10. Communication:**Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation make effective presentations and give and receive clear instructions. **PO 11. Project management and finance:**Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. **PO 12. Life-long learning:**Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. **PSO 1.** Demonstrate proficiency in use of software and hardware required to practice electronics and communication profession. **PSO 2.** To exhibit the ability to design and develop complex systems in the areas of IoT based Embedded Systems, Advanced Signal and Image Processing.
d)Prerequisites	➢ Basic knowledge of mathematics ➢ Knowledge on Signals and Systems ➢ Require basic knowledge in Filter designs
e) Course Outcomes (COs)	**At the end of the course the student will be able to:** **CO1. Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids..** **CO2. Identify the role of semiconductor devices in science and engineering Applications.** **CO3. Explore the fundamental properties of dielectric, magnetic materials and energy for their applications..**

	CO4. Appreciate the features and applications of Nanomaterials. **CO5. Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.**
f) Detailed Syllabus	**UNIT - I:** **QUANTUM PHYSICS AND SOLIDS** Quantum Mechanics: Introduction to quantum physics, blackbody radiation – Stefan-Boltzmann's law, Wein's and Rayleigh-Jean's law, Planck's radiation law - photoelectric effect - Davisson and Germer experiment –Heisenberg uncertainty principle - Born interpretation of the wave function – time independent Schrodinger wave equation - particle in one dimensional potential box. Solids: Symmetry in solids, free electron theory (Drude & Lorentz, Sommerfeld) - Fermi-Dirac distribution - Bloch's theorem -Kronig-Penney model – E-K diagram- effective mass of electron-origin of energy bands- classification of solids. **UNIT - II:** **SEMICONDUCTORS AND DEVICES** Intrinsic and extrinsic semiconductors – Hall effect - direct and indirect band gap semiconductors - construction, principle of operation and characteristics of P-N Junction diode, Zener diode and bipolar junction transistor (BJT)–LED, PIN diode, avalanche photo diode (APD) and solar cells, their structure, materials, working principle and characteristics. **UNIT - III** **DIELECTRIC, MAGNETIC AND ENERGY MATERIALS** Dielectric Materials: Basic definitions- types of polarizations (qualitative) - ferroelectric, piezoelectric, and pyroelectric materials – applications – liquid crystal displays (LCD) and crystal oscillators. Magnetic Materials: Hysteresis - soft and hard magnetic materials - magnetostriction, magnetoresistance - applications - bubble memory devices, magnetic field sensors and multiferroics. Energy Materials: Conductivity of liquid and solid electrolytes- superionic conductors - materials and electrolytes for super capacitors - rechargeable ion batteries, solid fuel cells. **UNIT - IV** **NANOTECHNOLOGY** Nanoscale, quantum confinement, surface to volume ratio, bottom-up fabrication: sol-gel, precipitation, combustion methods – top-down fabrication: ball milling - physical vapor deposition (PVD) - chemical vapor deposition (CVD) - characterization techniques - XRD, SEM &TEM - applications of nanomaterials. **UNIT - V** **LASER AND FIBER OPTICS** Lasers: Laser beam characteristics-three quantum processes-Einstein coefficients and their relations- lasing action - pumping methods- ruby laser, He-Ne laser , CO_2 laser, Argon ion Laser, Nd:YAG laser- semiconductor laser-applications of laser.

	Fiber Optics: Introduction to optical fiber- advantages of optical Fibers - total internal reflectionconstruction of optical fiber - acceptance angle - numerical aperture- classification of optical fiberslosses in optical fiber - optical fiber for communication system - applications.
Topics Covered Beyond Syllabus	➢ Basics of Statistical mechanics ➢ Study of De-Broglie hypothesis ➢ Study of Compton effect
Text Books	1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" A Text book of Engineering Physics"- S. Chand Publications, 11th Edition 2019. 2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019 3. Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill, 4thEdition,2021. 4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2ndEdition,2022. 5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.
Reference Books	1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" A Text book of Engineering Physics"- S. Chand Publications, 11th Edition 2019. 2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019 3. Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill, 4thEdition,2021. 4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2ndEdition,2022. 5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.

g) Course Plan (Theory)

S. No.	Topic(s)	No. of Lecture Hours
	UNIT-I : QUANTUM PHYSICS AND SOLIDS	
1.	Introduction to quantum physics, blackbody radiation	1
2.	Stefan-Boltzmann's law, Wein's and Rayleigh-Jean's law, Planck's radiation law	2
3.	photoelectric effect	1
4.	Davisson and Germer experiment –Heisenberg uncertainty principle	1
5.	Born interpretation of the wave function – time independent Schrodinger wave equation	2
6.	particle in one dimensional potential box.	1
7.	Solids: Symmetry in solids, free electron theory (Drude & Lorentz, Sommerfeld)	3
8.	Fermi-Dirac distribution - Bloch's theorem	2
9.	Kronig-Penney model – E-K diagram- effective mass of electron	3

10.	origin of energy bands- classification of solids.	1
	UNIT-II:SEMICONDUCTORS AND DEVICES	
11.	Intrinsic and extrinsic semiconductors	2
12.	Hall effect - direct and indirect band gap semiconductors construction	1
13.	principle of operation and characteristics of P-N Junction diode	2
14.	Zener diode and bipolar junction transistor (BJT)	2
15.	LED, PIN diode	2
16.	avalanche photo diode (APD)	2
17.	solar cells their structure materials,	2
18.	Solar cell working principle and characteristics.	2
	UNIT-III :DIELECTRIC, MAGNETIC AND ENERGY MATERIALS	
19.	Dielectric Materials: Basic definitions- types of polarizations	3
20.	ferroelectric, piezoelectric, and pyroelectric materials – applications	3
21.	liquid crystal displays (LCD) and crystal oscillators. Magnetic Materials: Hysteresis	3
22.	soft and hard magnetic materials - magnetostriction, magnetoresistance - applications	3
23.	bubble memory devices, magnetic field sensors and multiferroics.	2
24.	Energy Materials: Conductivity of liquid and solid electrolytes	2
25.	superionic conductors - materials and electrolytes for super capacitors - rechargeable ion batteries, solid fuel cells.	3
	UNIT-IV: NANOTECHNOLOGY	
26.	Nanoscale, quantum confinement, surface to volume ratio,:) - -	3
27.	bottom-up fabrication sol-gel, precipitation, combustion methods – top-down fabrication:	3
28.	ball milling - physical vapor deposition (PVD)	1
29.	chemical vapor deposition (CVD) - characterization techniques	
30.	XRD, SEM &TEM - applications of nanomaterials.	1
	UNIT-V:LASER AND FIBER OPTICS	2
31.	Lasers: Laser beam characteristics-three quantum processes	2
32.	Einstein coefficients and their relations- lasing action	2
33.	pumping methods- ruby laser	2
34.	He-Ne laser , CO2 laser	2
35.	Argon ion Laser, Nd:YAG laser	
36.	semiconductor laser-applications of laser	1
37.	Fiber Optics: Introduction to optical fiber	2

38.	advantages of optical Fibers - total internal reflectionconstruction of optical fiber	1
39.	acceptance angle - numerical aperture- classification of optical fiberslosses in optical fiber	1
40.	optical fiber for communication system - applications	2

h) Evaluation Scheme

Theory

Evaluation Criteria		Marks
Midterm-1	Assignment I	10
	Objective paper	10
	Descriptive Paper	20
	Total	40
Midterm-2	Assignment II	10
	Objective paper	10
	Descriptive Paper	20
	Total	40
	Average of Midterm-1 and Midterm-2	**40**
End-Examination		**60**
Total		**100**

3. Mapping of CO-PO&PSO

COURSEOBJECTIVES:

- The course objectives of an applied physics course typically include:
-
- Exploring the principles and fundamentals of lasers and optical fiber.
- Understanding the characteristics and properties of lasers and optical fiber.
- Studying the applications of lasers and optical fiber in diverse fields such as telecommunications, medicine, manufacturing, and research.
- Gaining hands-on experience with laser and fiber optic experiments and technologies.
- Analyzing real-world case studies to understand the practical applications and challenges in using lasers and optical fiber.
- Developing problem-solving skills and critical thinking abilities in the context of lasers and optical fiber.
- Understanding the theoretical and mathematical foundations of laser physics and fiber optics.
- Exploring emerging trends and advancements in laser and fiber optic technologies.
- Understanding the safety considerations and regulations associated with laser and fiber optic usage.
- Enhancing communication skills to effectively convey scientific concepts related to lasers and optical fiber.
- These objectives aim to provide students with a comprehensive understanding of lasers and optical fiber, enabling them to apply their knowledge in various interdisciplinary fields and industries..

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Mapping between Course Delivery Methodology and Program Outcomes

Course Delivery Methods					
	1	**2**	**3**	**4**	**5**
Class room lecture	3	3	3	3	3
Presentations	2	2	1	2	2
Laboratory sessions	0	0	0	0	0
Demo or simulations	0	0	0	0	0
Assignments	3	2	3	3	2
Case studies	0	0	0	0	0
Projects	0	0	0	0	0
Seminars	2	2	2	2	2
E-Learning resources	1	1	1	1	1
Weightage	73.33 %	66.67 %	66.67 %	73.33 %	66.67 %

*To be rated with 1- slightly, 2 – moderately, 3- substantial

Assessment Methodology

Outcome	Assessment Tool	Activity aligned to the Outcome
CO1,CO2, CO3,CO4	Test	Conducted mid exams and Unit tests
CO1,CO2, CO3,CO4,CO5	Assignment	Given problems questions &to solve and told to write multiple choice questions
CO1,CO2, CO3,CO4,CO5	Rubric	Evaluated mid exam question paper.
CO3,CO4,CO5	Quiz	Conducted multiple choice questions &fill in the blanks for mid exams & minor-2 exam.
CO1,CO2, CO3,CO4,CO5	E-Learning Resources	Followed NPTEL videos
CO1,CO2, CO3,CO4,CO5	End Semester Test	We delivered the contents according to the syllabus and given important questions according to the unit wise

Note - Mention other Assessment tools (if any)

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APPLIED PHYSICS

UNIT - I: QUANTUM PHYSICS AND SOLIDS

Quantum Mechanics: Introduction to quantum physics, blackbody radiation – Stefan-Boltzmann's law, Wein's and Rayleigh-Jean's law, Planck's radiation law - photoelectric effect - Davisson and Germer experiment –Heisenberg uncertainty principle - Born interpretation of the wave function – time independent Schrodinger wave equation - particle in one dimensional potential box.
Solids: Symmetry in solids, free electron theory (Drude & Lorentz, Sommerfeld) - Fermi-Dirac distribution - Bloch's theorem -Kronig-Penney model – E-K diagram- effective mass of electron-origin of energy bands- classification of solids.

UNIT - II: SEMICONDUCTORS AND DEVICES

Intrinsic and extrinsic semiconductors – Hall effect - direct and indirect band gap semiconductors - construction, principle of operation and characteristics of P-N Junction diode, Zener diode and bipolar junction transistor (BJT)–LED, PIN diode, avalanche photo diode (APD) and solar cells, their structure, materials, working principle and characteristics.

UNIT - III: DIELECTRIC, MAGNETIC AND ENERGY MATERIALS

Dielectric Materials: Basic definitions- types of polarizations (qualitative) - ferroelectric, piezoelectric,and pyroelectric materials – applications – liquid crystal displays (LCD) and crystal oscillators.

Magnetic Materials: Hysteresis - soft and hard magnetic materials - magnetostriction,magnetoresistance - applications - bubble memory devices, magnetic field sensors and multiferroics. Energy Materials: Conductivity of liquid and solid electrolytes- superionic conductors - materials andelectrolytes for super capacitors - rechargeable ion batteries, solid fuel cells.

UNIT - IV: NANOTECHNOLOGY

Nanoscale, quantum confinement, surface to volume ratio, bottom-up fabrication: sol-gel, precipitation, combustion methods – top-down fabrication: ball milling - physical vapor deposition (PVD) - chemical vapor deposition (CVD) - characterization techniques - XRD, SEM &TEM - applications of nanomaterials.

UNIT - V: LASER AND FIBER OPTICS

Lasers: Laser beam characteristics-three quantum processes-Einstein coefficients and their relations- lasing action - pumping methods- ruby laser, He-Ne laser , CO_2 laser, Argon ion Laser, Nd:YAG laser- semiconductor laser-applications of laser.
Fiber Optics: Introduction to optical fiber- advantages of optical Fibers - total internal reflection-construction of optical fiber - acceptance angle - numerical aperture- classification of optical fibers-losses in optical fiber - optical fiber for communication system - applications.

TEXT BOOKS:

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" A Text book of Engineering Physics"- S. Chand Publications, 11^{th} Edition 2019.
2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019
3. Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill,4^{th}Edition,2021.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2^{nd}Edition,2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical CreativesNANO DIGEST, 1^{st} Edition, 2021.

REFERENCE BOOKS:

1. Quantum Physics, H.C. Verma, TBS Publication, 2^{nd} Edition 2012.
2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons,11^{th} Edition,2018.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.
4. Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.
5. A.K. Bhandhopadhya - Nano Materials, New Age International, 1^{st}Edition, 2007.
6. Energy Materials a Short Introduction to Functional Materials for Energy Conversion andStorage Aliaksandr S. Bandarenka, CRC Press Taylor & Francis Group
7. Energy Materials, Taylor & Francis Group, 1^{st} Edition, 2022.

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	APPLIED PHYSICS-LESSON PLAN	
	NAME OF THE TOPIC	**NO. OF CLASSES**
I.	**UNIT-I QUANTUM PHYSICS AND SOLIDS**	
1	introduction to quantum mechanics	1
2	black body radiation-Stefan-Boltzmann's law and	2
3	Planck's radiation law-Wein 's, Rayleigh-jean 's law	1
4	photo-electric effect	1
5	Davisson and Germer experiment	2
6	Heisenberg uncertainty principle AND Born interpretation of the wave function	2
7	time independent Schrodinger wave equation	1
8	particle in one dimensional potential box	2
9	INRTODUCTION TO SOLIDS AND Symmetry in solids	2
10	free electron theory (Drude & Lorentz, Sommerfeld) & Fermi-Dirac distribution	2
11	Bloch's theorem	1
12	Kronig-Penney model AND E-K diagram	3
13	effective mass of electron	1
14	origin of energy bands AND classification of solids	2
	TOTAL CLASSES	**23**
II.	**UNIT - II: SEMICONDUCTORS AND DEVICES**	
1	Intrinsic and extrinsic semiconductors	1
2	Hall effect	2
3	direct and indirect band gap semiconductors	1
4	construction, principle of operation and characteristics of P-N Junction diode	1
5	construction, principle of operation and characteristics of Zener diode	1
6	construction, principle of operation and characteristics of bipolar junction transistor (BJT)	2
7	construction, principle of operation and characteristics of PIN diode, avalanche photo diode (APD)	2
8	construction, principle of operation and characteristics of LED AND SOLAR CELL	2
	TOTAL CLASSES	**12**

III.	**UNIT - III: DIELECTRIC, MAGNETIC AND ENERGY MATERIALS**	
1	Dielectric Materials:INTRODUCTION-types of polarizations	2
2	ferroelectric, piezoelectric, and pyroelectric materials – applications	2
3	liquid crystal displays (LCD) and crystal oscillators.	2
4	Magnetic Materials:soft and hard magnetic materials	1
5	magnetostriction, magnetoresistance - applications	1
6	bubble memory devices	1
7	magnetic field sensors and multiferroics	2
8	Energy Materials: Conductivity of liquid and solid electrolytes	1
9	superionic conductors - materials and electrolytes for super capacitors	2
10	- rechargeable ion batteries, solid fuel cells.	2
	TOTAL CLASSES	**16**
IV.	**UNIT - IV: NANOTECHNOLOGY**	
1	INTRODUCTION-Nanoscale	1
2	quantum confinement, surface to volume ratio	1
3	bottom-up fabrication: precipitation,combustion METHOD	2
4	bottom-up fabrication: sol-gel METHOD	1
5	top-down fabrication: ball milling	2
6	top-down fabrication: physical vapor deposition (PVD)	1
7	top-down fabrication: chemical vapor deposition (CVD)	2
8	characterization techniques - XRD,SEM AND TEM	4
9	applications of nanomaterials.	1
	TOTAL CLASSES	**14**
V.	**UNIT - V: LASER AND FIBER OPTICS**	
1	Lasers: Laser beam characteristics	1
2	three quantum processes-Einstein coefficients and their relations	2
3	lasing action - pumping methods	1
4	TYPES OF LASER:- ruby laser	1
5	TYPES OF LASER:He-Ne laser	1
6	TYPES OF LASER:CO2 laseR	2

7	TYPES OF LASER: Argon ion Laser,	2
	TYPES OF LASER:Nd:YAG laser	2
8	semiconductor laser-applications of laser	1
9	Fiber Optics: Introduction to optical fiber	1
10	construction ANDadvantages of optical Fibers	2
11	total internal reflection,acceptance angle	1
12	numerical aperture	1
13	classification of optical fibers	1
14	losses in optical fiber	2
15	optical fiber for communication system - applications	1
	TOTAL CLASSES	**22**
	TOTAL NO OF CLASSES =87	

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S.NO	MONTH	WORKING DAYS	TEACHING PERIODS	PERIODS ALLOTED	UNIT NAME	NAME OF THE TOPIC	NO.OF CLASSI	RESOURCES REQUIRED	Remarks
I.						introduction to quantum mechanics			
1						black body radiation-Stefan-Boltzmann's law	1	basic principles of	
2						Planck's radiation law-Wein 's, Rayleigh-jean 's law	2	quantum physics and	
3						photo-electric effect	1	band theory of solids	
4						Davisson and Germer experiment	1		
5						Heisenberg uncertainty principle AND Born interpretation of the wave function	2		
6					UNIT-I	time independent Schrodinger wave equation	2	library reference	
7					QUANTUM PHYSICS	particle in one dimensional potential box	1	Applied physics	
8	APRIL	17	24	24	AND SOLIDS	INRTODUCTION TO SOLIDS AND Symmetry in solids	2	text books	
9						free electron theory (Drude & Lorentz, Sommerfeld) & Fermi-Dirac distribution	2		
10						Bloch's theorem	2		
11						Kronig-Penney modeL AND E-K diagram	3		
12						effective mass of electron	3		
13						origin of energy bands AND classification of solids	1		
14				5		SLIP TEST	5		
15						Intrinsic and extrinsic semiconductors	2		
16						Hall effect	2		
17						direct and indirect band gap semiconductors	1		
18	MAY	12	16		UNIT - II	construction, principle of operation and characteristics of P-N Junction diode	1	basic principles of	
19					SEMICONDUCTORS	construction, principle of operation and characteristics of Zener diode	1	semiconductors	
20					AND DEVICES	construction, principle of operation and characteristics of bipolar junction transistor (BJT)	2		
21				11		construction, principle of operation and characteristics of PIN diode	2	library reference	
22						construction, principle of operation and characteristics of avalanche photo diode	2	Applied physics	
23				7		SLIP TEST	5	text books	
24									
25						Dielectric Materials:INTRODUCTION-types of polarizations	2		
26					UNIT - III	ferroelectric, piezoelectric, and pyroelectric materials – applications	2	fundamental	
27	JUNE	25	26		DIELECTRIC, MAGNETIC	liquid crystal displays (LCD) and crystal oscillators.	2	properties of	
28					& ENERGY MATERIALS	Magnetic Materials:soft and hard magnetic materials	2	dielectric, magnetic	
29				19		magnetostriction, magnetoresistance - applications	2	and energy material	
30						bubble mem. evices	1		

31						magnetic field sensors and multiferroics	2		
32						Energy Materials: Conductivity of liquid and solid electrolytes	1	library reference	
33						superionic conductors - materials and electrolytes for super capacitors	2	Applied physics	
34						- rechargeable ion batteries, solid fuel cells.	2	text books	
35				5		SLIP TEST	**5**		
36									
37						INTRODUCTION-Nanoscale	1		
38						quantum confinement, surface to volume ratio	2		
39					UNIT - IV	bottom-up fabrication: precipitation,combustion METHOD	2	library reference	
40	**JULY**	24	24	19	NANOTECHNOLOGY	bottom-up fabrication: sol-gel METHOD	2	Applied physics	
41						top-down fabrication: ball milling	2	text books	
42						top-down fabrication: physical vapor deposition (PVD)	2	internet	
43						top-down fabrication: chemical vapor deposition (CVD)	2		
44						characterization techniques - XRD,SEM AND TEM	4		
45						applications of nanomaterials.	1		
46				2		SLIP TEST	**2**		
47						Lasers: Laser beam characteristics			
48						three quantum processes-Einstein coefficients and their relations	1		
49						lasing action - pumping methods	2		
50						TYPES OF LASER:- ruby laser	1		
51						TYPES OF LASER:He-Ne laser	1	basic principles of	
52						TYPES OF LASER:CO2 laseR	1	LASERS	
53						TYPES OF LASER: Argon ion Laser,	2		
54	**AUG**	22	24	22	UNIT - V	TYPES OF LASER:Nd:YAG laser	2		
55					LASER AND FIBER OPTICS	semiconductor laser-applications of laser	2		
56						Fiber Optics: Introduction to optical fiber	1		
57						construction ANDadvantages of optical Fibers	1		
58						total internal reflection,acceptance angle	2		
59						numerical aperture	1		
60						classification of optical fibers	1	library reference	
61						losses in optical fiber	1	Applied physics	
62						optical fiber for communication system - applications	2	text books	
63						SLIP TEST	1		

signature of faculty **signature of HOD** **signature of Principal**

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4. ACADEMIC CALENDAR FOR I B.TECH.IISEM. 2022-23

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

B.Tech. I YEAR I & II SEMESTERS

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork (including Induction programme)	03.11.2022	
2	1st Spell of Instructions	03.11.2022	28.12.2022 (8 Weeks)
3	First Mid Term Examinations	29.12.2022	04.01.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	10.01.2023	
5	2nd Spell of Instructions	05.01.2023	02.03.2023 (8 Weeks)
6	Second Mid Term Examinations	03.03.2023	09.03.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	10.03.2023	16.03.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	16.03.2023	
9	End Semester Examinations	17.03.2023	01.04.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 91

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	03.04.2023	
2	1st Spell of Instructions (including Summer Vacation)	03.04.2023	10.06.2023 (10 Weeks)
	Summer Vacation	15.05.2023	27.05.2023 (2 Weeks)
3	First Mid Term Examinations	12.06.2023	17.06.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	23.06.2023	
5	2nd Spell of Instructions	19.06.2023	12.08.2023 (8 Weeks)
6	Second Mid Term Examinations	14.08.2023	19.08.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	21.08.2023	26.08.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	26.08.2023	
9	End Semester Examinations	28.08.2023	09.09.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 90

22/10/22

REGISTRAR

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AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
(Approved by A I C T E, Recognised by Govt. of Telangana & Affiliated to J N T U, Hyderabad)
Gunthapally (V), Abdullapurmet (M), R.R. Dist., Near Ramoji Filmcity, Hyderabad - 501 512.
ESTD : 1992
✆ 97047 55516
99637 77979
NAAC
NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL
B++ GRADE

DEPARTMENT OF HUMANITIES & SCIENCE

TIME-TABLE FOR THE A.Y 2022-2023 I-II SEM

I B.Tech. CSE-B (AVIH) COLLEGE TIMINGS:9:30 AM-4:00 PM

DAY	9.30-10.20	10.20-11.10	11.10-12.00	12.00-12.40	12.40-1.30	1.30-2.20	2.20-3.10	3.10-4.00
MON	ESE	OD&VC	OD&VC	L	AP	IT WORKSHOP		
TUE	EDC	AP	ESE	U	EDC	ESE	SPORTS	
WED	AP	ESE	AP	N	EDC	EW(B-I)/AP(B-II)		
THU	PYTHONLAB			C	ESE	EDC	AP	ESE
FRI	OD&VC	EDC	OD&VC	H	LIBRARY	ELCS(B-I)/EW(B-II)		
SAT	AP(B-I)/ELCS(B-II)				EDC	AP	OD&VC	OD&VC

OD&VC:	P.ASHOK
APLAB:	G.LAXMI NARAYANA
ESE:	CH.SUNANDA
ELCSLAB:	CH.SUNANDA
AP:	G.LAXMINARAYANA
EWLAB:	B.VENKATESHWARLU
EDC:	DR.J.SIDDHARTHA
ITWORKSHOP:	S.RAJENDER/DIVYA
PYTHONLAB:	DR.HAMEEDA/DIVYA
CLASS INCHARGE	G.LAXMI NARAYANA

HOD

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5. SUBJECT TIME TABLE

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(Approved by A I C T E, Recognised by Govt. of Telangana & Affiliated to J N T U, Hyderabad)

Gunthapally (V), Abdullapurmet (M), R.R. Dist., Near Ramoji Filmcity, Hyderabad - 501 512.

ESTD : 1992

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TIME-TABLE FOR THE A.Y 2022-2023 I-II SEM

I B.Tech. CSE-A (AVIH)   COLLEGE TIMINGS:9:30 AM-4:00 PM

DAY	9.30-10.20	10.20-11.10	11.10-12.00	12.00-12.40	12.40-1.30	1.30-2.20	2.20-3.10	3.10-4.00
MON	PYTHONLAB			L	EDC	AP	SPORTS	
TUE	AP	ESE	EDC	U	ESE	ELCS(B-I)/EW(B-II)		
WED	ESE	AP	OD&VC	N	OD&VC	ESE	EDC	ESE
THU	EW(B-I)/AP(B-II)			C	LIBRARY	AP	ESE	OD&VC
FRI	EDC	OD&VC	EDC	H	AP	AP(B-I)/ELCS(B-II)		
SAT	EDC	OD&VC	OD&VC		AP	IT WORKSHOP		

OD&VC:	P.ASHOK
APLAB:	G. LAXMINARAYANA
ESE:	CH.SUNANDA
ELCSLAB:	CH.SUNANDA
AP:	G.LAXMINARAYANA
EWLAB:	DR.RAMESH BABU
EDC:	DR.J.SIDDHARTHA
ITWORKSHOP:	DR.N.RAMANAREDDY/DIVYA
PYTHON LAB:	DR.HAMEEDA / DIVYA
CLASSINCHARGE:	CH.SUNANDA

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TOPICS COVERED BEYOND SYLLABUS

- **Basics of Statistical mechanics**
- **Study of de-broglie hypothesis**
- **Study of Compton effect**

1.1 INTRODUCTION

In our everyday life, we often come across objects in motion.Human beingswere inquisitive to understand the motion in detail since ages. Nowadays, we categorize the branch of physics dealing with these moving bodies as *mechanics*. The motion of objects, we see around us, astronomical objects, etc., which are macroscopic in nature can be defined by the principles of classical mechanics. One of the earliest contributions in the classical mechanics were by Isaac Newton and Gottfried Wilhelm Leibniz, who described the motion of a body under the action of forces. Applicability of classical mechanics is superseded by relativistic mechanics introduced by Albert Einstein for the bodies moving near the speed of light. Similarly, another branch of mechanics developed in the beginning of the last century for the microscopic systems, such as subatomic particles.Therefore, all these developments widened our horizon in understanding of the nature and motion of an object.

In the meantime, our understanding of thermodynamic propertiesdealing with the systems inequilibrium was developed and summarized by the laws of thermodynamics. You may already be familiar with thermodynamics and related basic key terminologies, like the concept of system and surroundings, different types of thermal processes, laws of thermodynamics, state function, state variables and various macroscopic properties (macroscopic properties are the properties of matter as a whole in terms of macroscopic variables,likedensity, volume, temperature, pressure) related through an equation of state. Sofar these thermodynamic properties for the macroscopic system were not described in terms of its microscopic constituents.Thus, statistical mechanics is that branch of modern physics which deals with physical systems with many degrees of freedom and describes their macroscopic properties in terms of the microscopic properties of the constituent particles.

We understood so far that our treatment of the constituent particles depends upon whether they can individually be described by classical mechanics or quantummechanics. Dependingupon that statistical mechanics is broadly studied under two categories namely classical and quantum statistics.The classical statistics is discussed with Maxwell-Boltzmann statistics, whereas quantum statistics can further be categorized as Bose-Einstein and Fermi-Dirac statistics depending upon yet another quantum feature called the spin of the particle.Specifically, all the microscopic particles with integral (half-integral) spin governed by quantum mechanics are studied under Bose-Einstein (Fermi-Dirac) statistics. Therefore, in this book, we will discuss the physical properties of various systems containing a large number of particles (atoms or molecules), comparable to Avogadro number, i.e., 6.022×10^{23}, on the basis of the properties and behavior of the microscopic constituents ofthose systems. To accomplish this we will be using statistical tools and probability theory aswell asthe dynamics of microscopic particles governed by either classical or quantum mechanics.

In this unit, we will discuss various concepts in classical statistical mechanics, like phase space, microscopic and macroscopic variables, the concepts of ensemble, and one of the important principles, i.e., postulate of equal a priori probability. These basic concepts are building blocks of statistical mechanics which are helpful in understanding the forthcoming

units and in discussing quantum statistics. In particular, we want to make a statistical analysis of a large number of collections of identical systems and determine their most probable behavior. In this process, we are not interested in the individual dynamics of a single particle.In statistical mechanics, we average the properties of all the particles to studythe macroscopicbodies they form. For instance, the temperature of a gas is found to be related to the randommotion of the gas molecules. The faster they move on average, the higher is the temperature.

BASIC CONCEPTS OF STATISTICAL MECHANICS

- **Probability**

Probability is a mathematical concept that deals with calculating the likelihood of a given event's occurrence. Thus, the probability of an event is defined as the ratio of the number ofthe cases in favor to the total number of possible cases also called sample size.

$$\text{Probability of an event} = \frac{\text{Number of favorable cases}}{\text{Total number of possible cases}}$$

- Basic rules of probability

There are three basic rules of probability distribution, like summation rule, multiplication rule, and conditional probability.

- Summation rule is applicable to mutually exclusive events, i.e., happening of oneevent excludes the possibility of the happening of the other.

- The multiplication rule is applicable when the probability of occurrence of one eventdoes not affect the probability of occurrence of the other. This rule is also known as joint probability, and the probability of joint occurrence of two independent events is equal to the product of the probabilities of each of the independent events.

- The probability for an event say A to occur conditioned to the fact that another eventsay B has also occurred is called the conditional probability. This is denoted as $\left(\frac{A}{B}\right)$

All the three rules discussed above can be better understood by the following examples.

➢ PHASE SPACE

You all know, in a static system the complete position of an object or a point particle in classical mechanics is specified bythree Cartesian coordinates. This three dimensional spaceis known as position space ( ) and a small volume element in position space is

defined as $dV_r = dx\ dy\ dz$. If the system is dynamic then in addition to the position coordinates, we require three components of momenta for the specification of particles in the

system. These three mutually perpendicular momentum coordinates $(p = p_x, p_y, p_z)$ constitute momentum space. A small volume element in this space is expressed asdV_p $dp_y\ dp_z$.

In a similar way, phase space is a scheme for the specification of a system in statistical mechanics. In this, the position of a particle is represented in terms of Cartesian coordinates (x, y, z) and the corresponding momentum ( ) components. Thus, the phase space is

a combined position and momentum space. A small volume element in phase space is definedas

$dV = (dx\ dy\ dz)(dp_x\ dp_y\ dp_z)$....(1.2)

Such a six dimensional space for a single particle or molecule is called phase space or mu- space (μ-space). The phase space is a pure mathematical concept used to describe a single particle. Let us divide the phase space in two dimensional energy sheet as shown in Figure1.1. Further, if we subdivide the range of variables and into arbitrary small

discrete intervals, then the single interval is known as phase cell. The minimum size of the phase cell in classical statistics is equal to the area of thesingle cell, i.e., $dx\ dp_x = h_0$ (say). This h_0 may be viewed as our experimental limitation in measurement.In the classical scenario, h_0 can be chosen arbitrarily as small as possible.Further, phase cell is the volume occupied by each phase point in the phase space. Hence the value of this elementary volume is equal to ${h_0}^3$. However, in quantum statistics,according to the Heisenberg's uncertainty principle the minimum size(volume) of phase cell in phase spaceis given by h^3,where h is Planck's constant.

- WHAT IS AN ENSEMBLE?

If we are considering a collection of particles with macroscopic properties, like energy, volume, chemical potential,then the collection of such particles is considered as an assembly.Further, this collection of a large number of non-interacting, independent assemblies is known as an ensemble or statistical ensemble. The members of an ensemble are referred to as elements or assemblies.These elements are identical in macroscopic properties, like , , , and differ in their microscopic properties, i.e., elements have different position and momentum coordinates.

In other words, we can say that an ensemble is defined as a collection of a large number of assemblies which are identical in macroscopic properties but differ in microscopic properties.Thus, it can be viewed as numerous copies of a system or a probability distribution definingthe state of the system.

- DENSITY OF STATES

We have already discussed that the microscopic properties of a system are represented by phase points. The condition of an ensemble at any time can be specified by the density, whichdescribes the distribution of phase points in phase space. The density distribution is often denoted by$\rho = \rho(q,p)$ and is a function of the continuous variables and . Consequently, the normalization condition for a closed system is$\int d^{3N}q\,d^{3N}p\,\rho(q,p)$, where the volume elements are$d^{3N}q = dq_1 \ldots dq_m \ldots dq_{3N}$and $d^{3N}p = dp_1 \ldots dp_m \ldots dp_{3N}$. Specifically, thedensity of distribution in phase space gives the number of states per unit volume in a given interval of energy of the phase space. This distribution function is a function of position coordinates and momentum coordinates. The time dependence of may be implicitly governed by the time dependence of $q$and p. However, may also have an explicit time dependence.

Hence, we can write

$$\rho = \rho(q,p,t). \qquad \ldots (1.5)$$

Therefore, the number of phase points in a small volume element say $d\Gamma = d^{3N}q\, d^{3N}p$

isgiven by

$\delta N = \rho(q,p,t)d\Gamma$.

We will further calculate an expression of density of state for a single particle of mass m withmomentum in the range p to $p+dp$and energy in the range E to $E+dE$, respectively, placed ina phase cell of volume h_0^3 in phase space. The total volume of the phase space is given by $\int d^3q\, d^3p = \iiint dq_x dq_y dq_z \iiint dp_x dp_y dp_z$ Total volume of phase space

$= V \times 4\pi p^2 dp,$ ...(1.6)

where we have used the volume of position space $\iiint dq_x dq_y dq_z = V$,the volume of themomentum space $\iiint dp_x dp_y dp_z = 4\pi p^2 dp$.

Thus, we can write the total number of phase cells in the given momentum range as

$n(p)dp = \frac{V \times 4\pi p^2 dp}{h_0^3}$. ...(1.7)

Using the relation between energy$E$and momentum p, i.e.,

$E = \frac{p^2}{2m}$ or $p = \sqrt{2mE}$,

and therefore,

$dp = \sqrt{\frac{m}{2E}}\, dE$.

Using this relation in equation (1.7), the total number of phase cells in the energy range E to
$E+dE$ is

$$n(E)dE = \frac{8\pi mE}{h_0^3} V \sqrt{\frac{m}{2E}}\, dE$$

$$= \frac{4\pi V}{h_0^3} \sqrt{2E}\, m^{3/2} dE. \qquad ...(1.8)$$

Hence, the density of state or the total number of phase cells per unit energy range can beobtained as

The total number ofphase cells per unit energy range $= \frac{4\pi V \sqrt{2E}\, m^{3/2}}{h_0^3}$.

1.2 SUMMARY

In this unit, you have studied the basics of the statistical physics. In particular, this unit focuses on classical statistics. You learned the concepts of phase space and phase points. Thisconcept also helps you to understand the density of states. In this unit, the concept of distinguishability and indistinguishability is also discussed. We understood that the notion of distinguishability (indistinguishability) has a profound impact on the underlying statistics. This is because the statistics involves computation of probabilities and the rules of probability are sensitive to distinguishability (indistinguishability) of the particles. Various other important concepts, like probability, probability distribution, equal a priori principle, are also discussedwith the help of numerical examples. We have briefly introduced the concept of ensemble which will be discussed in detail in Unit 4. All the basics of statistical thermodynamics we have discussed in this unit are very helpful in discussing and understanding many interesting concepts of thermodynamics and statistical physics in the forthcoming units. Many solved examples are given in the unit to make the fundamental concepts clear. Additionally, to check your progress and understanding some self-assessment questions are given at the end of different sections.

We will return to some of the concepts introduced in this unit, like ensembles, equal a prioriprinciple in Units 2-4. The rest of the units of this block (Units 2-3) are dedicated completelyto classical statistics, but many of the topics introduced here, which can be easily extended to quantum statistics, are discussed in detail.Dedicated study of ensemble theory and differenttypes of ensembles will be discussed in Block 2, which contains Units 4-6. Further, Block 3(Units 7-10) is entirely focused on quantum statistics. In the last block, which contains Units 11-12, we will discuss the application part of both classical and quantum statistics by applying the methods of statistical mechanics to some physical situations.

➢ GLOSSARY

Microscopic properties	*These are defined in terms of microscopic variables, like positionand momentum coordinates.*
Macroscopic properties	*These are defined in terms of macroscopic variables, like numberof particles N, volume V, temperature T, energy E.*
Phase space	*A scheme for the specification of a system in terms of the positioncoordinates* (x,y,z) *and corresponding* p_x, p_y, p_z *momentum ( )* *components.*
Phase points	*It represents an individual particle in the phase space.*
Density of states	*It tells us about the distribution ofphase points in phase space*
Ensemble	*It is a collection of a large number of independent collections ofparticles.*
Ensemble average	*The value of a variable when averaged over all the states exploredwithin an ensemble.*
Time average	*The value of a variable when averaged over a time period.*
Ergodic hypothesis	*An average over time is equal to an average over all the possiblemicrostates.*
Probability	*A mathematical concept that deals with calculating the likelihoodof a given event's occurrence.*
Probability distribution	*A statistical distribution function that describes all the possible values and likelihoods that a random variable can take within agiven range.*

De Broglie's hypothesis: wave-particle duality

Light behaves as wave when it undergoes interference, diffraction etc. and is com- pletely described by Maxwell's equations. But then, the wave nature of electromag- netic radiation is called into question when it is involved in blackbody radiation, photoelectric effect and such. Einstein forwarded his idea of photon, bundle of quan- tized radiant energy localized in a small volume, as a way to describe particle-like nature of light. The energy and momentum of such a photon was proposed to be,

$$E = h\nu \quad \text{and} \quad p = \frac{E}{c} = \frac{h}{\lambda}.$$

de Broglie (1924) made a great unifying, speculative hypothesis that just as radiation has particle-like properties, electrons and other material particles possess wave-like properties. For free material particles, de Broglie assumed that the associated wave also has a frequency ν and wavelength λ related to its energy E and momentum p,

$$\nu = \frac{E}{h} \quad \text{and} \quad \lambda = \frac{h}{p}. \tag{60}$$

For non-relativistic particles having mass m and moving with a velocity v and kinetic energy $E_k = mv^2/2$, the de Broglie wavelength is

$$\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2mE_k}} \tag{61}$$

For high energy particles, $E^2 = p^2c^2 + m^2c^4$, having kinetic energy $E_k = E - m_0c^2$, the momentum is $pc = \sqrt{E_k(E_k + 2m_0c^2)}$ and hence the de Broglie wavelength is,

$$\lambda = \frac{h}{p} = \frac{hc}{\sqrt{E_k(E_k + 2m_0c^2)}}. \tag{62}$$

For instance, the de Broglie wavelength of an object of mass $m = 1.0$kg and moving with a velocity $v = 10$m/s is ($h = 6.6 \times 10^{-34}$J-s)

$$\lambda = \frac{h}{mv} = \frac{6.6 \times 10^{-34}\,\text{J}-\text{s}}{1.0 \times 10\,\text{kg}-\text{m/s}} = 6.6 \times 10^{-35}\,\text{m} = 6.6 \times 10^{-25}\,\overset{\circ}{A}.$$

The de Broglie wavelengths of an electron ($m = 9.1 \times 10^{-31}$kg) at kinetic energy 100eV and 0.1MeV are ($1eV = 1.6 \times 10^{-19}J$),

$$\lambda = \frac{h}{\sqrt{2mE}} = \frac{6.6 \times 10^{-34}}{(2 \times 9.1 \times 10^{-31} \times 100 \times 1.6 \times 10^{-19})^{1/2}} = 1.2\overset{\circ}{A}$$

$$\frac{ch}{\sqrt{\quad}}$$

$$\lambda_{rel} = \frac{J}{E(E + 2m\ c^2)} = 0.037A$$

$$\lambda_{nr} = \frac{h}{\sqrt{2mE}} = 0.038\mathring{A}$$

Sure enough, de Broglie's hypothesis of wave-particle duality was confirmed by Davis- son and Germer (1927) and G.P. Thomson (1927) [refer Eisberg & Resnick, pg 64 – 67].

The de Broglie hypothesis gives an interesting physical insight into Bohr's quan- tization rule (34),

$$mvr = pr = \frac{nh}{2\pi},$$

where p is the linear momentum of an electron in an allowed orbit of radius r. If we use equation (60), the expression for p in terms of de Broglie's wavelength $p = h/\lambda$, Bohr's quantization rule can be written as,

$$\frac{hr}{\lambda} = \frac{nh}{2\pi} \quad \Rightarrow \quad 2\pi r = n\lambda \quad n = 1, 2, 3, \ldots \tag{63}$$

implying the allowed orbits are those in which the circumference of the orbit can contain exactly an integral number of de Broglie wavelengths.

Let us express the de Broglie wave of a free micro particle by a plane wave of constant amplitude A, which will represent a particle of energy $E = h\nu = \hbar\omega$ and momentum $p = h/\lambda = \hbar k$,

$$\psi(r, t) = Ae^{i(\vec{k}\cdot\vec{r}-\omega t)} \qquad \text{in 1-dim} \Rightarrow \qquad \psi(x, t) = Ae^{i(kx-\omega t)} \tag{64}$$

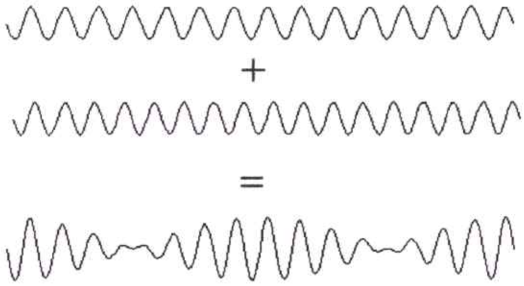
Assuming $|\psi(x, t)|^2$ gives the probability of finding the particle at space-time point (x, t) (according to Max Born's idea that came much later), it is constant A^2 every- where. This implies that probability of finding our particle is same everywhere or, in other words, we do not know where it is. But our idea of particle is one having definite momentum and at the same time a specific position *i.e.* it is localized. If we know the position of the particle fairly accurately, then probability of finding it in different place must be confined to that space (say, Δx) outside which the probability is zero. Therefore, the matter wave must somehow be retricted in that space with the particle $\Rightarrow$ we have a wave train of length Δx and wavelength of the wave train corresponds to particle momentum.

In order to manufacture a wave train we revoke the idea of group of moving waves of classical wave motion. Suppose we have two waves of (ω, k) and $(\omega + d\omega, k + dk)$ and for simplicity let them be represented as

$$\psi_1 = A\cos[kx - \omega t] \qquad \text{and} \qquad \psi_2 = A\cos[(k + dk)x - (\omega + d\omega)t]$$

We superpose these two waves, considering $d\omega \ll \omega$ and $dk \ll k$, to obtain,

$$\begin{aligned} \psi &= \psi_1 + \psi_2 \\ &= 2A\cos\left(\frac{dk}{2}x - \frac{d\omega}{2}t\right)\cos\left(\frac{2k + dk}{2}x - \frac{2\omega + d\omega}{2}t\right) \\ &\approx 2A\cos\left(\frac{dk}{2}x - \frac{d\omega}{2}t\right)\cos[kx - \omega t]. \end{aligned} \tag{65}$$



From the plot of above function ψ we see that two waves of slightly different frequency and wavelength, interfere and reinforce in such a way as to produce a series of groups. These groups, and the individual waves they contain, are both moving in the same direction. The velocity of the group, called *group velocity* v_g and velocity of the individual waves, called *phase velocity* v_p, are given by,

$$v_g = \frac{d\omega}{dk} \qquad v_p = \frac{\omega}{k} \tag{66}$$

If the particle of mass m is moving with a velocity v so the kinetic energy $E = mv^2/2$ and momentum $p = mv$, then

$$\omega = \frac{E}{n} \Rightarrow d\omega = \frac{dE}{n} \quad \text{and} \quad k = \frac{p}{n} \Rightarrow dk = \frac{dp}{n}$$

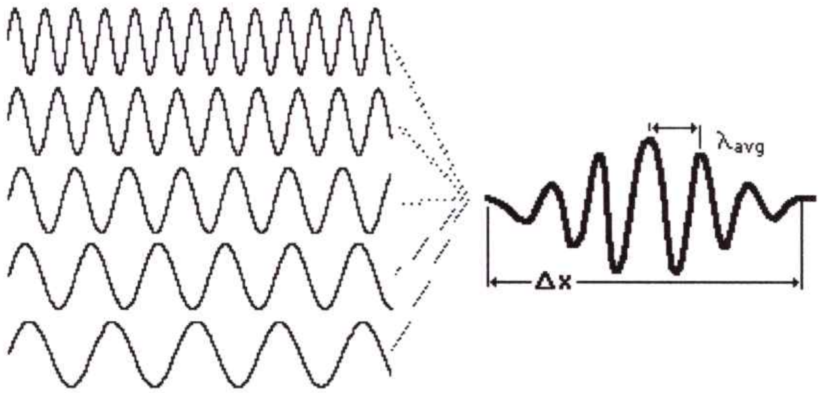
which leads to,

$$v_g = \frac{d\omega}{dk} = \frac{dE}{dp} = \frac{mv\,dv}{m\,dv} = v$$

i.e. the velocity of the particle is equal to velocity of the group of matter wave describing the particle. The same is true for relativistic particle.

The superposition of two matter waves of slightly varying frequency and wavenum- ber k manage to create succession of groups but not one group which is the wave train. To obtain a wave train or a *wave packet* of finite extent in space, we need superposition of large number waves with different but slightly varying frequency and wavenumber,

$$\psi(x, t) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} dk\, A(k) e^{i(kx-\omega(k)t)}.$$



λ_{avg}
Δx

Assuming $A(k)$ is nonzero and constant only in an interval, $k_0 - \Delta k/2 \leq k \leq k_0 + \Delta k/2$, if Δk is not too large, we can expand $\omega(k)$ about k_0,

$$\omega(k) = \omega(k_0) + (k - k_0)\left.\frac{d\omega}{dk}\right|_{k=k_0} + \ldots$$

and write the above wave function as,

$$\begin{aligned}
\psi(x,t) &= \frac{1}{\sqrt{2\pi}}\int_{k_0-\Delta k/2}^{k_0+\Delta k/2} dk\, A\, e^{i(kx-\omega(k)t)} \\
&= \frac{A}{\sqrt{2\pi}} e^{i(k_0x-\omega(k_0)t)}\int_{k_0-\Delta k/2}^{k_0+\Delta k/2} dk\, e^{i(k-k_0)[x-(d\omega/dk)_0 t]} \\
&= \sqrt{\frac{2}{\pi}}\, A\, \frac{\sin[\Delta k(x-(d\omega/dk)_0 t)/2]}{x-(d\omega/dk)_0 t}\, e^{i(k_0x-\omega(k_0)t)} \qquad (67)
\end{aligned}$$

The equation (67) defines a wave packet of finite extent, $\Delta x \approx 2 \times 2\pi/\Delta k$, whose group velocity is $v_g = (d\omega/dk)_{k=k_0}$ and phase velocity is $v_p = \omega(k_0)/k_0$ as before.

A very interesting illustration of wave-nature of microscopic particle is Feynman's thought experiment – *double-slit experiment* with classical and quantum particles – for details of which see Feynman's Lecture vol 3.

<u>**Study of Compton Scattering**</u>

1) Aim of the experiment:

- Determine the change in wavelength of the scattered gamma radiation as a function of the scattering angle.
- Determine the differential cross-section using Klein-Nishina formula and calculation of the calibration factor.

2) Theory:

Compton scattering is an example of inelastic scattering of light by a charged particle, where the wavelength of the scattered light is different from that of the incident radiation. In 1920, Arthur Holly Compton observed scattering of x-rays from electrons in a carbon target. He found that the scattered x-rays have a longer wavelength than the incident x-rays. The shift of the wavelength increased with scattering angle according to the Compton formula:

$$\lambda_\theta - \lambda_0 = \Delta\lambda = \frac{h}{m_e c}(1 - cos\theta) \qquad (1)$$

Where,

λ_0 is the incident wavelength of photon, λ_θ is the scattered wavelength of photon, h is Planck's constant, m_e is the rest mass of electron, c is the velocity of light and θ is the scattering angle of the photon.

The Compton scattering process is illustrated in Figure 1. In the figure, Φ is the scattering angle of the recoiled electron.

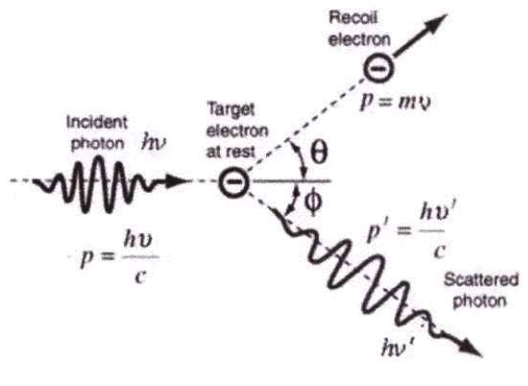


Figure 1. Compton scattering

The value $\frac{h}{m_e c}$ = 0.02426 Å is called Compton wavelength of electron. In terms of energy Equation (1) can be rewritten as

$$E_{\theta} = E_{0}\frac{1}{1+(\gamma.(1-cos\theta))} \qquad (2)$$

where E_0 and E_θ are energy of incident and scattered photon, respectively, and $\gamma = \frac{E_0}{m_e c^2}$. For high energy photons with (λ << 0.02 Å or E >> 511 keV), the wavelength of the scattered radiation is always of the order of the Compton wavelength whereas for low energy photons (E << 511 keV), the Compton shift is very small. In other words, in a non-relativistic energy regime, Compton scattering results approach the results predicted by classical Thompson scattering.

Compton's experiment had a lot of significance that time since it gave clear and independent evidence of particle-like behaviour of light. Compton was awarded the Nobel Prize in 1927 for the "discovery of the effect named after him".

The differential Compton scattering cross section was correctly formulated by Klein-Nishina in 1928 using quantum mechanical calculations. This formula is famously known as Klein-Nishina formula which is expressed as follows:

$$\frac{d\sigma}{d\Omega} = r_0^2 \frac{1+cos^2\theta}{2} \frac{1}{[1+\gamma(1-cos\theta)]^2}\left[1 + \frac{\gamma^2(1-cos\theta)^2}{(1+cos^2\theta)(1+\gamma(1-cos\theta))}\right] \qquad (3)$$

Here, $r_0 = \frac{e^2}{4\pi\varepsilon_0 m_e c^2}$ is the classical electron radius and has the value $r_0 = 2.8179 \times 10^{-15}$ m. This result is for the cross section averaged over all incoming photon polarizations. By integrating Equation (3) over all angles, the total cross section can be obtained.

In this experiment gamma rays from a Cs^{137} source are used as the source of photons that are scattered. Difference in the incident and scattered energy and wavelength of the photons is determined by a calibrated scintillation detector placed at different scattering angles. The relative intensities I_θ of the scattered radiation peaks can be compared with the predictions of the Klein-Nishina formula for the differential effective cross section $\frac{d\sigma}{d\Omega}$ by calculating the calibration factor C using the formula below:

$$C = \frac{1}{n}\sum_{\theta=0}^{n} \frac{I_\theta}{(\frac{d\sigma}{d\Omega})}$$

UNIT-I
Quantum physics and Solids

Introduction to Quantum mechanics :-

→ Classical mechanics explains the motion of the macroscopic particles based on the Newton's laws of mechanics.

→ Classical mechanics cannot explain when we consider the motion of the microscopic particles of the atomic system such as electrons, protons etc.

→ Quantum theory was able to explain the nature of the light waves interms of discrete packets known as "quanta".

→ Classical mechanics successfully explained the phenomenon such as interference, difraction and polarization · based on the wave nature of light

→ In the early 20th century a new theory was developed by "Max Planck" known as quantum theory based on the particle nature of light

→ Einstein was successfully explained the "photo-electric effect" based on the planck's hypothesis, that a quantum of radiation carries an energy 'hν'.

→ The phenomenon such as compton effect and black body radiation are also explained based on the particle nature of light.

Black body radiation :-

" A body that completely absorbs radiations of all wavelengths incident on it. is called a perfect black body".

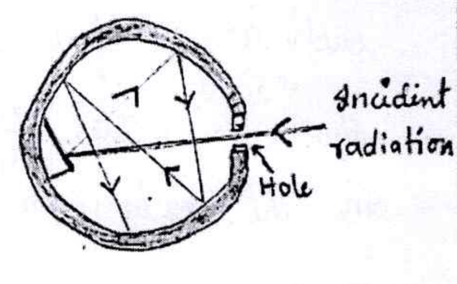
→ When a black body is heated, it emits radiations of all wavelengths which is known as "black body radiations".

→ Ex :- Ferry's black body, Wein's black body are artificial black bodies.

→ A perfect black body is a good absorber as well as good emitter of heat.

→ A black body is a hollow container with a narrow opening (hole), it is made up of copper or iron material.

→ Its inner surface is coated with lampblack.



Black body

→ When any radiation enters into the hollow container through hole and gets multiple reflections at the walls and gets absorbed.

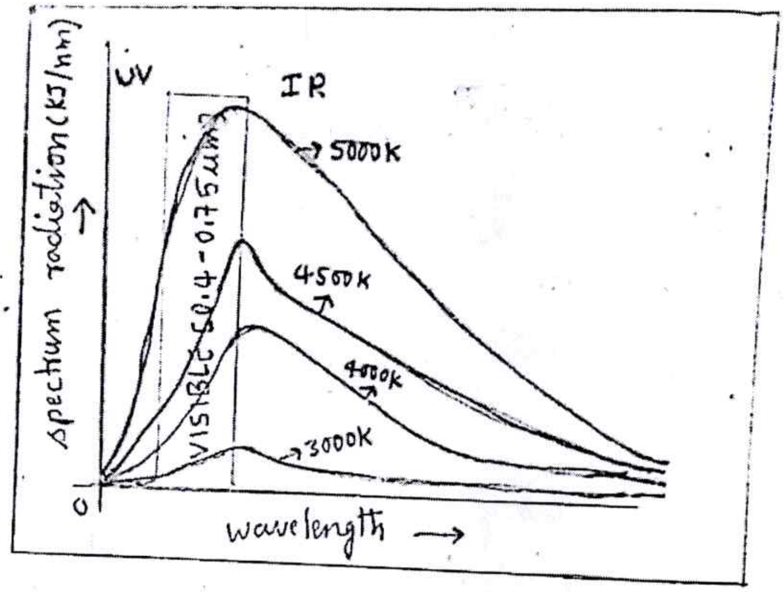
→ When the hollow container is heated at various temperatures it will emits radiations of all wavelength.

→ This different wavelength spectrum can be analyzed by an IR spectrometer.

→ This spectrum is depends only on the temperature of hollow container but not on the material of the hollow container.

→ Distribution of energy as a function of wavelength at different temperature as shown below graph.

→ The graph shows that at a given temperature radiation energy density initially increases with increasing wavelength, then peaks at a particular wavelength (λ_m) and after that decreases and finally to min (zero) at very high wavelength.



→ Stefan-Boltzmann law :- "The total radiation emitted from a black body at temperature (T) is proportional to the ~~forth~~ fourth power of the absolute temperature of the body T^4

$$E \propto T^4$$
$$E = \sigma T^4$$

where 'σ' - stefan constant

$$\sigma = 5.678 \times 10^{-8} \ J/m^2 s\text{-}K^4$$

Planck's radiation law:-

Max Planck in 1900 introduced the quantum theory of radiation to explain the distribution of energy in the spectrum of black body radiation.

→ He assumed that the atoms of the walls of a black body behave as oscillators.

→ The oscillator can emit or absorb energy only in the form of packets of energy ($h\nu$) but not continuously. i.e emission or absorption of energy occurs only when oscillator jumps from one energy state to another

→ The energy of the oscillation is quantised.

$\boxed{E = nh\nu}$; $n = 0, 1, 2 \ldots\ldots$

ν = frequency of oscillation

h = Planck's constant ($= 6.62 \times 10^{-34}$ JS)

(or)

$\Delta E = \Delta n h\nu$

$E_2 - E_1 = (n_2 - n_1) h\nu$

If N be the total no. of oscillators and E as the energy of these oscillators, then average energy is given by.

$$\bar{E} = \frac{E}{N} \rightarrow (1)$$

let $N_0, N_1, N_2 \ldots\ldots N_n$ as the no. of oscillators having energy values $0, E, 2E \ldots\ldots nE$ respectively.

$$N = N_0 + N_1 + N_2 + \ldots\ldots N_n \longrightarrow (2)$$

Total energy $E = 0 \cdot N_0 + E N_1 + 2E N_2 + \ldots\ldots nE N_n \longrightarrow (3)$

By Maxwell's distribution law $N_n = N_0 e^{-nh\nu/KT}$ $(n\epsilon = nh\nu) \rightarrow$ ④

sub eq ④ in eq ②

$$N = N_0 + N_0 e^{-h\nu/KT} + N_0 e^{-2h\nu/KT} + N_0 e^{-3h\nu/KT} + \dots$$

$$N = N_0 [1 + e^{-h\nu/KT} + e^{-2h\nu/KT} + e^{-3h\nu/KT} + \dots]$$

$$N = \frac{N_0}{(1 - e^{-h\nu/KT})} \rightarrow ⑤ \quad \left[\because \frac{1}{1-x} = 1 + x + x^2 + x^3 + \dots\right]$$

sub eq ④ in eq ③

$$E = N_0 \cdot 0 + N_0 e^{-\epsilon/KT} \cdot \epsilon + N_0 e^{-2\epsilon/KT} \cdot 2\epsilon + \dots$$

$$E = N_0 e^{-\epsilon/KT} [\epsilon + 2\epsilon e^{-\epsilon/KT} + 3\epsilon e^{-2\epsilon/KT} + \dots]$$

$$E = N_0 e^{-\epsilon/KT} \cdot \epsilon [1 + 2e^{-\epsilon/KT} + 3e^{-2\epsilon/KT} + \dots]$$

$$E = \frac{N_0 e^{-\epsilon/KT} \cdot \epsilon}{[1 - e^{-\epsilon/KT}]^2} \rightarrow ⑥ \quad \left[\frac{1}{(1-x)^2} = 1 + 2x + 3x^2 + \dots\right]$$

sub eq ⑤ & eq ⑥ in eq ①

$$\bar{E} = \frac{E}{N} = \frac{\cancel{N_0} e^{-\epsilon/KT} \cdot \epsilon}{[1 - e^{-\epsilon/KT}]^{\cancel{2}}} \times \frac{\cancel{[1 - e^{-h\nu/KT}]}}{\cancel{N_0}}$$

$$\bar{E} = \frac{\epsilon \cdot e^{-\epsilon/KT}}{[1 - e^{-\epsilon/KT}]}$$

$$\bar{E} = \frac{\epsilon}{\frac{[1 - e^{-\epsilon/KT}]}{e^{-\epsilon/KT}}} \Rightarrow \frac{\epsilon}{\left[\frac{1}{e^{-\epsilon/KT}} - \frac{e^{-\epsilon/KT}}{e^{-\epsilon/KT}}\right]}$$

$$\bar{E} = \frac{\epsilon}{\left(\frac{1}{e^{-\epsilon/KT}} - 1\right)} \Rightarrow \boxed{\bar{E} = \frac{\epsilon}{(e^{\epsilon/KT} - 1)}}$$

→ The energy density of radiation (u_ν) in the frequency range ν & $\nu + d\nu$ is given by.

$$u_\nu d\nu = \frac{8\pi\nu^2}{c^3} d\nu \cdot \bar{E}$$

$$u_\nu d\nu = \frac{8\pi\nu^2}{c^3} d\nu \times \frac{h\nu}{e^{h\nu/kT} - 1} \quad [\because E = h\nu]$$

$$\boxed{u_\nu d\nu = \frac{8\pi h\nu^3}{c^3(e^{h\nu/kT}-1)} d\nu}$$

Above relation is known as Planck's radiation interms of frequency.

→ Plank's law in terms of wavelength is given by.

$$\boxed{u_\lambda d\lambda = \frac{8\pi hc}{\lambda^5}\left[\frac{1}{e^{hc/kT\lambda}}\right]}$$

$\because \nu = \frac{c}{\lambda}$

$d\nu = \frac{-c}{\lambda^2} d\lambda$

$u_\lambda d\lambda = -u_\nu d\nu$

Derivation of different laws from planck's law:-

1) ~~Wein~~ Wien's law :- When the wavelength and temperature (T) are very small $e^{h\nu/kT} >> 1$. Therefore, 1 can be neglected in denominator

$$\boxed{u_\lambda d\lambda = \frac{8\pi hc}{\lambda^5}\left[\frac{d\lambda}{e^{hc/kT\lambda}}\right]}$$

② Rayleigh - Jeans law :-

For high temperature (T) and large wave length λ, then

$$e^{hc/\lambda kT} \cong 1 + \frac{hc}{\lambda kT} \quad ; \quad u_\lambda d\lambda = \frac{8\pi hc}{\lambda^5}\left[\frac{d\lambda}{1 + \left(\frac{hc}{\lambda kT}\right) - 1}\right]$$

$$\boxed{u_\lambda d\lambda = \frac{8\pi kT}{\lambda^4} d\lambda}$$

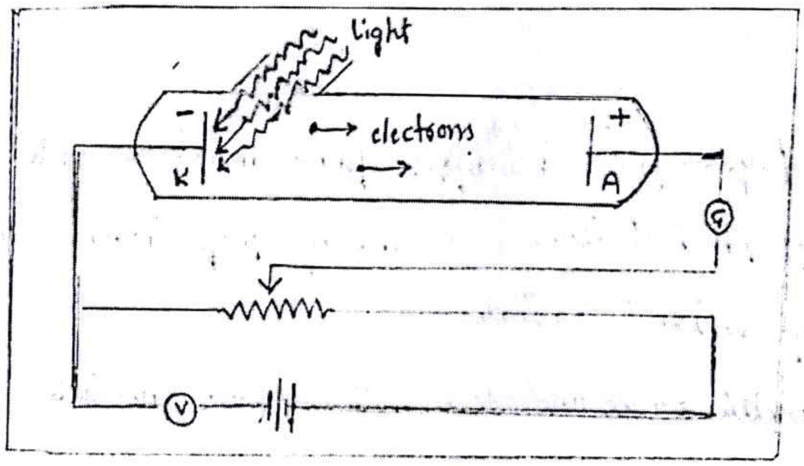
Photo-electric effect :-

Photo-electric effect is the phenomenon in which "the electrons are released from a metal surface, when light of suitable frequency incident on it."

→ The metal is said to be a photosensitive metal.

→ The emitted electrons are known as photo-electrons.

→ Flow of photo-electrons is called 'photo-electric current'.



→ In 1905 Einstein successfully explained the photo-electric effect

→ According to Einstein when a light beam of photons of energy ($E = h\upsilon$) incident on metal surface, the energy of photons is transferred to the electrons to the surface of metal

→ one photon (of energy $(E) = h\upsilon$) is completely absorbed by one electron and gains one quantum of energy.

→ Energy of photon is used in two parts.

(1) One part of photon energy is used to remove the electron from metal surface, this energy is known as "photo-electric work function (ω_0)".

③ The other part of photon energy is used to increase in kinetic energy of the photo-electron

$$\boxed{\therefore h\nu = \omega_0 + \frac{1}{2}mv^2}$$

Above equation is known as Einstein photo-electric equation.

→ The threshold frequency(ν_0) is defined as the minimum frequency of light is required to emit electron from the metal surface.

Features of the photo-electric effect :-

→ Threshold frequency (ν_0) is differs from metal to metal.

→ The rate of photo electrons is directly proportional to the intensity of incident radiation

→ The photo electric emission does not depend on the temp. of metal.

→ The energy of photo electrons is directly proportional to the frequency of incident radiation

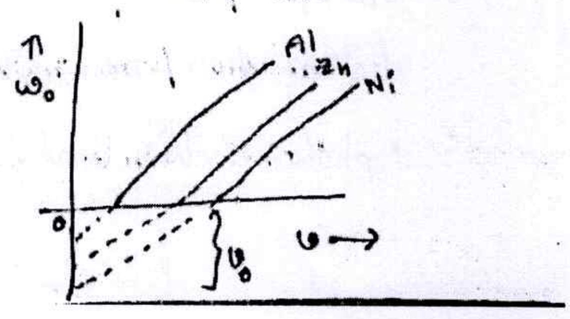
→ photo-electrons are ~~on~~ emitted from the metal only if the frequency of photon is above threshold frequency.

$$h\nu > \omega_0$$

→ If the energy of photon can only remove the electron from the metal, then K.E of the photo-electron is zero.

$\therefore h\nu \simeq \omega_0 \quad (\because \frac{1}{2}mv^2 = 0)$

→ The plot b/w ~~K.E~~ ω_0 & ν is →.

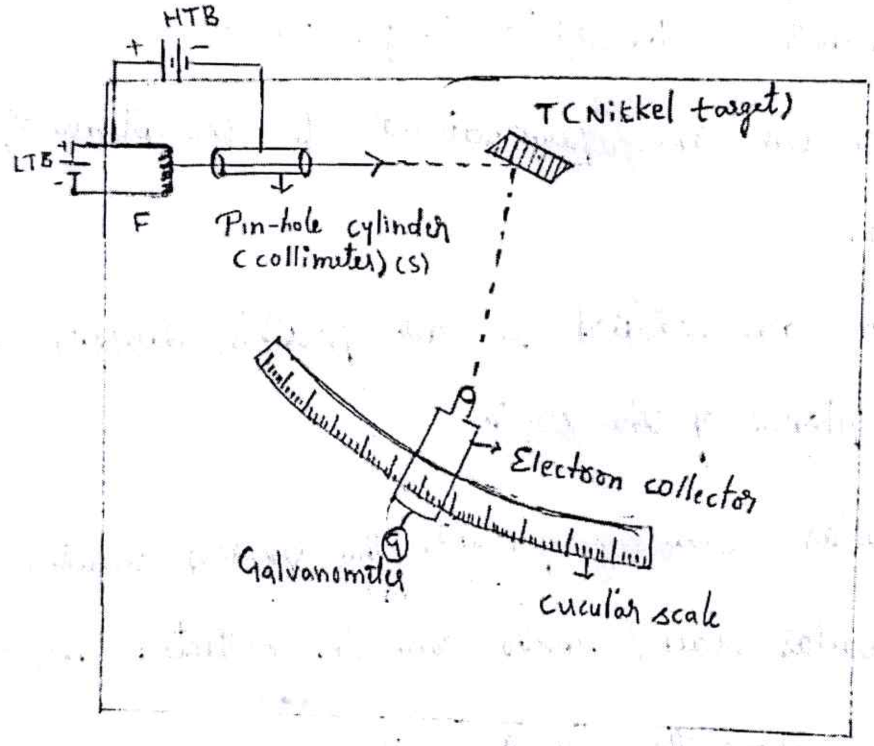


Devisson & Germer Experiment :-

First practical evidence for the matter waves was given by C.J. Devisson & L.H. Germer in 1927. This was the first experimental support to de-Broglie hypothesis

Devisson & Germer were studying scattering of electron from crystal & demonstrated the wave nature of the particle

Experimental setup :-



→ It consist of 3 parts ; ① Electron gun
② Target
③ Circular scale arrangement.

→ The whole set up is kept in vaccume.

→ The job of electron gun is to provide a fine beam of electrons of a required velocity, it consist of a filament (F), Low tension battery (LTB), High tension battery (HTB) and pin-hole cylinder(s)

→ When target filament is heated by LTB. then electrons are produced. these electrons are accelarated to a required velocity by applying sufficient potential on HTB.

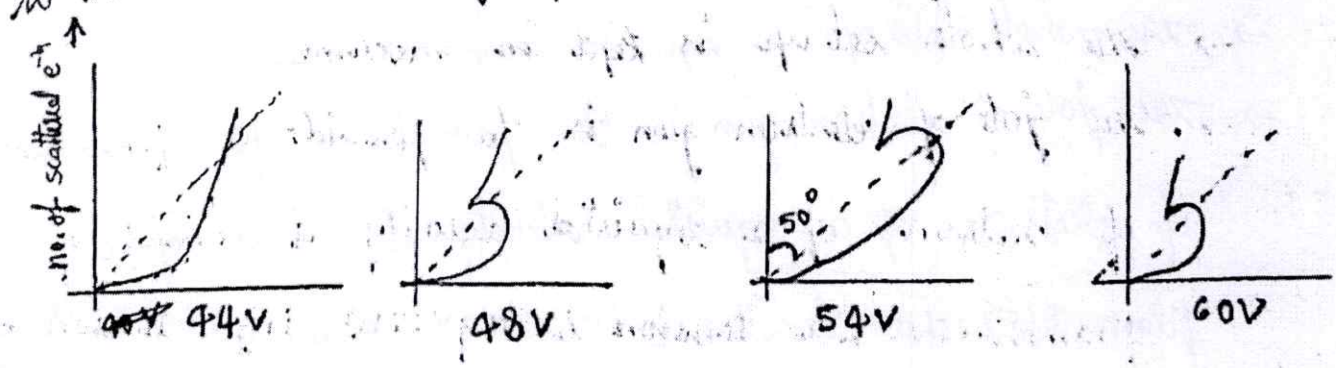
→ The accelarated electrons are collimated into a beam of pencil ray passing through pin-hole collimator(s)

→ The fast moving beam of electrons from electron gun made to incident on the Nickel target, which can be rotated about an axis perpendicular to the plane of electron beam.

→ The electrons are scattered in all possible direction by the atomic planes of the crystal

→ In the circular scale arrengement, the electron collector is fixed to circular scale, which can be collected the e^- and can move along the circular scale

→ The ~~col~~ electron collector is conected to sensitive galvanometer to mature the intensity of electron entering into the collector.



→ It is absoved that the no. of scattered electrons intensity along with potential (V) by the graph.

→ A potential of 54V applied, the maximum no. of electrons are scattered, maximum deflection shown in the galvanometer, and angle on circular scale is 50°, and later it was decreased slowly.

∴ According to de-Broglie wavelength $\lambda = \frac{h}{p}$

$$\lambda = \frac{h}{\sqrt{2meV}} = \frac{12.26}{\sqrt{V}} A^\circ.$$

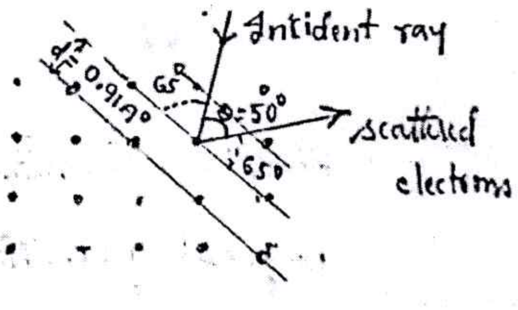
where $V = 54V \Rightarrow \lambda = \frac{12.26}{\sqrt{54}} = \boxed{1.668A^\circ = \lambda}$

∴ According to Bragg's condition

$$n\lambda = 2d\sin\theta.$$

→ Where θ is angle b/w atomic planes & incident rays

→ In our experiment $\theta = 65^\circ \left(\frac{180^\circ - 50^\circ}{2}\right)$ and distance b/w atomic planes $d = 0.91A^\circ$.



$$1 \times \lambda = 2 \times 0.91 \times \sin 65^\circ$$

$$\boxed{\lambda = 1.656A^\circ}$$

→ A wavelengths of the electron collected from Bragg's law and de-Broglie eq's are in good arrengement.

→ Hence the wave nature of particle is proved experimentally.

Heisenberg's Uncertainty principle :-

Uncertainty principle of quantum mechanics was discovered by Heisenberg in 1927. The uncertainty principle is a direct consequence of the dual nature of the wave matter.

When we regard a moving particle as a wave group, then it may be located anywhere ~~whe~~ within the wave group. at any given time, we can't estimate the exact position of the particle inside the wave group. it arises some uncertainty

Hence; According to The Heisenberg uncertainty principle

" It ~~it~~ is imposible to Know or to measure ~~the~~ both the exact position and momentum of a particle at the same time".

$$\boxed{\Delta x \cdot \Delta P_x \geq \frac{h}{4\pi}}$$

Here $\Delta x \rightarrow$ uncertainty in position

$\Delta P_x \rightarrow$ uncertainty in momentum

& $h \rightarrow$ Planck's constant.

→ Therefore simultaneous determation of a pair of physical quantities (position & momentum) of a particle is not posible with required accuracy.

→ Another form of uncertainty concerns energy & time.

$$\boxed{\Delta E \cdot \Delta t \geq \frac{h}{4\pi}}$$

$\Delta E \rightarrow$ Energy.

$\Delta t \rightarrow$ Time

→ Another two variables

$\boxed{\Delta J \cdot \Delta\theta \geq \frac{h}{4\pi}}$ $\Delta J \rightarrow$ Angular momentum uncertainty
$\Delta\theta \rightarrow$ Angular displacement uncertainty.

thus, the generalized statement of Heisenberg uncertainty principle is.

" It is impossible to specify precisely and simultaneously the values of both no. of particlar pair of physical variable that discribe the behaviour of an atomic system."

Born's interpretation of of the wavefunction :-

→ Max Born in 1926 was given a satisfactory interpretation of the wavefunction (ψ) is associated with the moving particle

→ Wave function (ψ) is a variable quantity that mathematically discrebes the variation of matterwave.,

→ It is a complex amplitude of ~~wavematter~~ matterwave.

→ It is a complex function $(x+iy)$. It does not have a direct physical meaning

→ It's complex conjugate is $\psi^* = (x-iy)$

→ The product of the wavefunction (ψ) and its complex conjugate is a real quantity

$$\psi^*\psi = (x+iy)(x-iy) = (x^2+y^2) \text{ is a real.}$$

→ This can represent the probability density of locating the particle at a place in a given instant time.

→ For the total probabilities of finding a particle in the space

$$\int_0^\infty |\psi|^2 \, dx\,dy\,dz = 1 \quad (\text{Normalized}).$$

Here $dx \cdot dy \cdot dz$ is the volume of space.

→ The wavefunction (ψ) satisfying this condition is said to be normalized.

Limitation of wavefunction:-

There are certain limitations to take 'ψ' as a function for the solution of the Schrodinger wave equation.

They are

→ ψ must be finite for the values of x, y & z

→ ψ must be a single valued.

→ ψ must be continuous in all the region except where the potential energy is infinite.

→ ψ vanishes at the boundaries.

→ ψ possessed continuous 1^{st} order derivative.

Schrodinger's time indipendent wave equation :-

According to the de-Broglie's hypothesis, the particle in the motion is always associated with a wave. To discribe the motion of a particle interms of its associated wave. Schrodinger derived a wave equation in 1928, is known is schrodinger wave equation.

If a particle of ~~molen~~ mass(m), moving with a velocity (v) is associated with a group of waves. Let 'ψ' is the wavefunction of the particle.

A one-dimensional wave equation for a steady wave associated with a particle is

$$\psi(x) = A\sin(\omega t - kx) \longrightarrow (1)$$

Here A — Amplitude

K — wave no. $(2\pi/\lambda)$

differentiating $\psi(x)$ partially with respect to "x" twice

$$\frac{\partial \psi}{\partial x} = -kA\cos(\omega t - kx)$$

$$\frac{\partial^2 \psi}{\partial x^2} = -k^2 A\sin(\omega t - kx)$$

from eq (1) $[\psi(x) = A\sin(\omega t - kx)]$

$$\frac{\partial^2 \psi}{\partial x^2} = -k^2\psi(x)$$

$$\frac{\partial^2 \psi}{\partial x^2} + k^2\psi(x) = 0 \longrightarrow (2)$$

$$\frac{\partial^2\psi}{\partial x^2} + \frac{4\pi^2}{\lambda^2}(\psi(x)) = 0 \quad (\because k = \frac{2\pi}{\lambda})$$

According to the de-Broglie's $\lambda = \frac{h}{mv}$.

$$\therefore \frac{\partial^2\psi}{\partial x^2} + \frac{4\pi^2 m^2 v^2}{h^2}\psi(x) = 0 \longrightarrow (3)$$

The total energy (E) of the particle is the sum of its Kinetic energy (K.E) and potential energy (P.E).

i.e $E = \frac{1}{2}mv^2 + V(x)$

$$m^2v^2 = 2m(E-V) \longrightarrow (4)$$

Substitude eq (4) in eq (3) then we get

$$\frac{\partial^2\psi}{\partial x^2} + \frac{4\pi^2}{h^2}[2m(E-V)]\psi(x) = 0$$

$$\frac{\partial^2\psi}{\partial x^2} + \frac{8\pi^2 m}{h^2}(E-V)\psi(x) = 0 \longrightarrow (5)$$

Now extending above eq for a 3-D wave.

$$\frac{\partial^2\psi}{\partial x^2} + \frac{\partial^2\psi}{\partial y^2} + \frac{\partial^2\psi}{\partial z^2} + \frac{8\pi^2 m}{h^2}(E-V)\psi(x,y,z) = 0,$$

$$\Delta^2\psi + \frac{8\pi^2 m}{h^2}(E-V)\psi = 0.$$

$\because \hbar = \frac{h}{2\pi}$.

$$\Delta^2\psi + \frac{8\pi^2 m}{\hbar^2 4\pi^2}[E-V]\psi = 0 \qquad \because h^2 = \hbar^2 4\pi^2$$

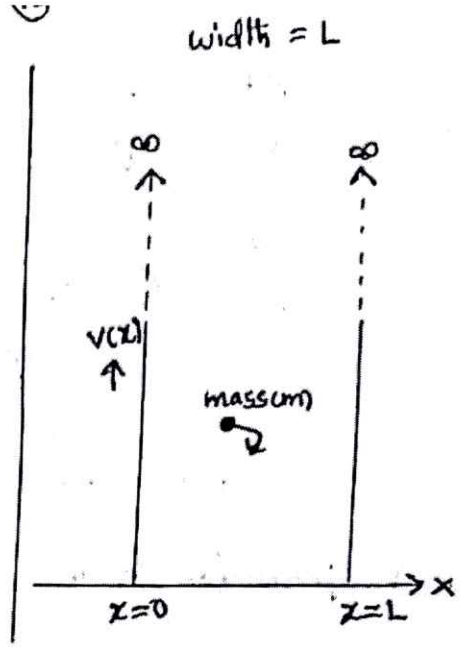
$$\boxed{\Delta^2\psi + \frac{2m}{\hbar^2}(E-V)\psi = 0}$$

this eq. is known as schrodinger time independent wave equation.

Here $\Delta^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$ is called Laplace operator.

→ Application of schrodingers wave eq :-

Particle in one dimensional box :-



→ consider a particle moving inside a box along the x-direction.

→ The particle is bouncing back and forth b/w the walls of the box having infinite height at x=0 & x=L i.e. walls of infinite potential well.

→ The potential energy "V" of the particle can be assumed to be zero b/w x=0 to x=L. but rises infinite on both sides of the box, the particle can not be ~~exco~~ escape from the box i.e $V(x)=0$ for $0<x<L$

and $V(x)=\infty$ $x<0$ and $x>L$

→ Since the particle can not exist outside the box. so its wavefunction (ψ) is zero.

→ i.e the probability of finding the particle out side must be zero). Inside the box wavefunction (ψ) is finite

→ The motion of the particle in 1-D box can be described by the schrodinger's wave equation

$$\frac{\partial^2 \psi(x)}{\partial x^2} + \frac{2m}{\hbar^2}[E-V]\psi(x) = 0 \longrightarrow ①$$

within the box V=0 [potential energy V=0]

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$$\frac{\partial^2 \psi(x)}{\partial x^2} + \frac{2mE}{\hbar^2}\psi(x) = 0.$$

$$\frac{\partial^2 \psi(x)}{\partial x^2} + K^2\psi(x) = 0 \longrightarrow (2)$$

Where $K^2 = \frac{2mE}{\hbar^2} \longrightarrow (A)$

This is the wave equation for a free particle inside a potential well.

The general solution for this eq. is

$$\psi(x) = A\sin kx + B\cos kx \longrightarrow (3)$$

where A & B are the constants

Now applying the boundary conditions.

$\rightarrow$ $\psi(x) = 0$ at $x = 0$. [1st]

$$A\sin K(0) + B\cos K(0) = 0$$

$$B = 0$$

~~but~~

sub $B=0$ in eq (3)

$$\psi(x) = A\sin kx. \longrightarrow (4)$$

$\rightarrow$ 2nd Boundary condition.

$\psi(x) = 0$ at $x = L$ & $B = 0$.

from (3).

$$0 = A\sin KL.$$

the particle cannot come outside of the box

so $A \neq 0$ therefore KL must be an integer multiple of π

$\therefore KL = n\pi$

$$\boxed{K = \frac{n\pi}{L}} \longrightarrow (B)$$

Thus $\psi_n(x) = A\sin\left(\frac{n\pi}{L}\right)x \longrightarrow (5)$

eq (5) is Known as wavefunction eq.

from eq (A) & (B)

$$\frac{n^2\pi^2}{L^2} = \frac{2mE}{\hbar^2}$$

$$\boxed{\therefore E_n = \frac{n^2h^2}{8mL^2}} \quad \because \hbar = \frac{h}{2\pi} \longrightarrow (6)$$

Where $n = 1, 2, 3 \ldots\ldots$

→ By this equation we can ~~calculate~~ concluded that the energy of the particle is quantised.

→ It can not vary continuously but can take only certain discrete energy levels

→ Each value of $E_n (n=1,2\ldots)$ is called Eigen value and corresponding ψ_n is called Eigen function

→ The value of A can be obtained by normatization condition. i.e

$$\int_0^L |\psi(x)|^2 dx = 1$$

sub $\psi(x)$ in above eq.

$$\int_0^L A^2 \sin^2\left(\frac{n\pi x}{L}\right) dx = 1$$

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$$\therefore \frac{A^2}{2}\int_0^L \left[1-\cos\left[\frac{2\pi n x}{L}\right]\right] dx = 1 \qquad \therefore \sin^2\theta = \frac{1-\cos 2\theta}{2}$$

$$\frac{A^2}{2}\left[x - \frac{1}{2\pi n}\sin\frac{2\pi n x}{L}\right]_0^L = 1$$

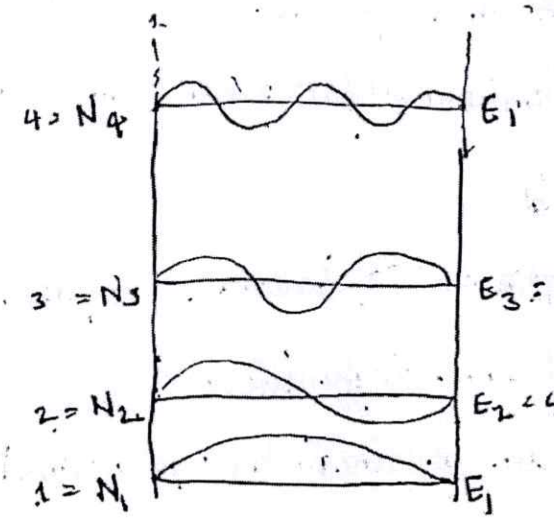
$$\frac{A^2 L}{2} = 1 \Rightarrow A = \sqrt{\frac{2}{L}}$$

$\therefore$ The normalization is $\psi_n(x) = \sqrt{\frac{2}{L}} \sin\frac{n\pi x}{L}$.

This is the solution for one dimensional potential box.

If a particle in 3-D potential box.

$$\psi_n(x) = \left(\frac{8}{L^3}\right)^{1/2} \sin\frac{n\pi}{L}x \cdot \sin\frac{n\pi}{L}y \cdot \sin\frac{n\pi}{L}z.$$



Energy diagram of particle in 1-D Box.

Solids :-

A solid consist of a large no of closely packed atoms (or) molecules. The physical structure of a solid and its properties are related to the arrangement of atoms or molecules in the solid.

→ Solids are classified into two types based on the arrangement of atoms or molecules.

They are i) crystalline solids,

and ii) Amorphous Slids

→ In amorphous solids, the atoms or molecules are arranged randomly which have no regular structure.

Example - rubber, Glass etc

Symmetry in solids (or) crystalline solids :-

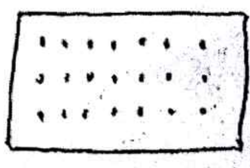
Symmetry in solids means, the atoms or molecules are arranged in a regular manner. i.e the atomic array is periodic.

→ Each atom is at regular intervels along arrays in all directions of the crystal.

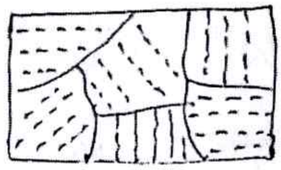
Examples — Al, Cu, Ag, Tungston, diamond, NaCl etc.

→ Crystalline solids may be single crystalline solids (or) polycrystalline solid.

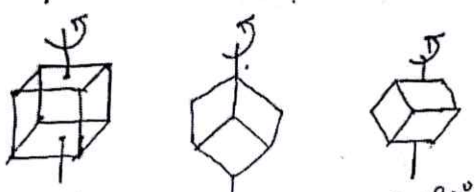
→ In single crystalline solids, the periodicity of atoms or molecules is extended to the entire crystal.



→ In polycrystalline solids it is extended to small regions Known as grains

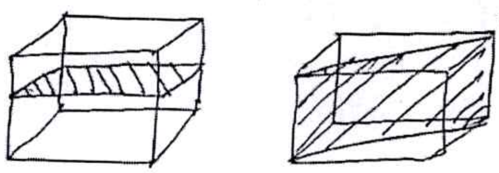


i) Axis of symmetry :- During the rotation of the crystal around an axis, if it occupies two or more identical position in a complete rotation (360°)

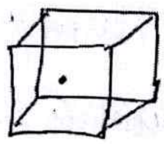


$\theta = 90^\circ$ $\theta = 120^\circ$ $\theta = 180^\circ$

ii) Plane of symmetry :- In plane of symmetry a crystal cut into two halves in such a way that one half becomes the mirror image of the other half.



iii) Centre of symmetry :- In centre of symmetry, a point in a crystal such that a line drawn from any point on the crystal through this point, equal distance is produced on the other side of this central point



electron theory of solids :-

→ The electron theory of solids explains

Structural, electrical, Magnetic and Thermal properties of Material

→ The electron theory is applicable to all solids (Metal & non metals)

→ This theory has been developed in three main steges

1) The classical free electron theory :-

→ According to this theory, the metal containing free electrons which are responsible for electrical conductivity obeys the laws of classical mechanics. here potential of electron is uniform entire the metal

→ This theory devoloped by Drude & Lorentz in 1900.

2) The Quantum free electron theory :-

→ According to this theory, the free electrons move with a constant potential obeys quantum laws

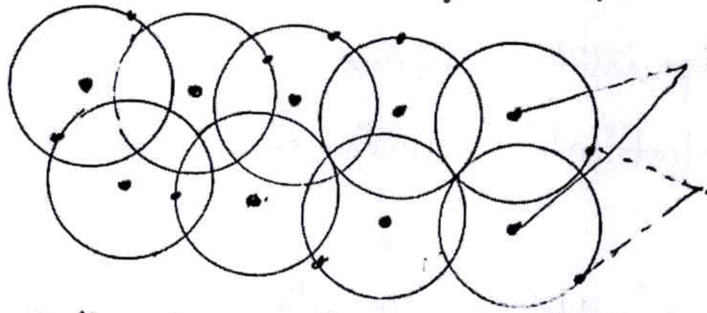
→ This theory developed by sommerfeld in 1928.

Above theories are failed to explain why some substances behaves as excellent insulators even they have certain free electrons. A solution to this problem was given by Zone theory or Band theory of solids

3) Zone theory or Band theory :-

According to this theory the free electron move in a periodic field provided by the lattice 'a'

1) Classical free electron theory (or) Drude - Lorentz free electron theory:



According to Drude - Lorentz theory (Assumptions)

→ When a large no. of atoms arranged in 3D lattice point to form a metal, the boundaries of neighbouring atoms slightly overlaped with each other.

→ Due to this overlapping valance electrons of all atoms are free to move within the metal lattice, these electrons are called free electrons

→ These free electrons move randomly within the metal so that net current is zero in the absence of electric field

→ These free electrons treated as gas molecules confined in a vessel.

→ free electrons obey Pauli's exclusion principle.

→ When electric field is applied, current is produced due to the drift velocity of the electron, so these free electrons are also known as conduction electrons.

→ The electrostatic field due to the positive ion core is constant and uniform hence negligible.

→ The forces of attraction between the electrons and positive ion core, the forces of repulsion between the electrons is negligible

2) Quantum free electron theory (or) Sommerfield theory (assumption)

Sommerfield proposed Quantum free electron theory.

→ He treated as electron as a quantum particle

→ The free electrons in a metal can have only discrete energy values.

→ Thus the energies of electrons are quantized.

→ The electron obey Pauli's exclusion principle.

i.e there can not be more than two electrons in any energy level

→ The distribution of electron in various energy levels obey the Fermi-Dirac quantum statistics.

→ Free electrons have the same potential energy within the metal. because of the potential due to ionic cores is uniform throughout the metal.

→ forces of attraction between electron & lattice ions, the of force of repulsion between electrons can be neglected.

→ the electrons are treated as wave-like particle

Fermi - Dirac distribution :-

According to fermi-Dirac distribution

→ The system is consist of identical. independent and indestinguishable particles of having half integral spin.

→ The particles which obey fermi-Dirac statistic are called fermions example - electrons, protons, Neutrons etc.

→ The fermions must obey Pauli's exclusion principle i.e there can be only one particle in each state.

→ Interchanging of two particle of the system leaves the resultant system in an antisymmetric state

$$n_i(E) = \frac{g_i(E)}{(e^{(E-E_F)/KT}+1)}$$

$$\boxed{\frac{n_i(E)}{g_i(E)} = \frac{1}{(e^{(E-E_F)/KT}+1)}}$$

where n_i - no. of particle in energy state E

g_i - statistical weight factor

E_F - fermi energy level

→ fermi energy is indipendent of Temperature.

case i) At $T=0°c$; $E<E_F$

$$\frac{n_i(E)}{g_i(E)} = 1$$

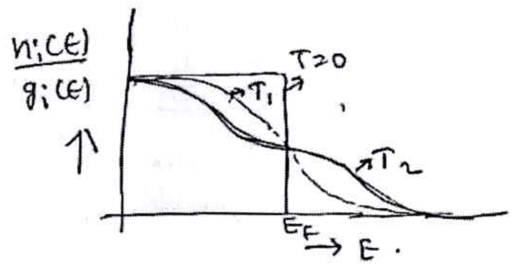
case ii) At $T=0$; $E > E_F$.

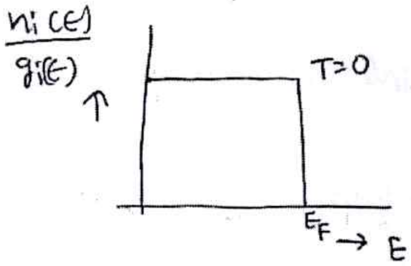
$$\frac{n_i(E)}{g_i(E)} = 0$$

→ At $n_i = 0$; means

All such energy states which have energies greater than fermi energy are vacent

→ so that all states with energies upto E_F are filled.



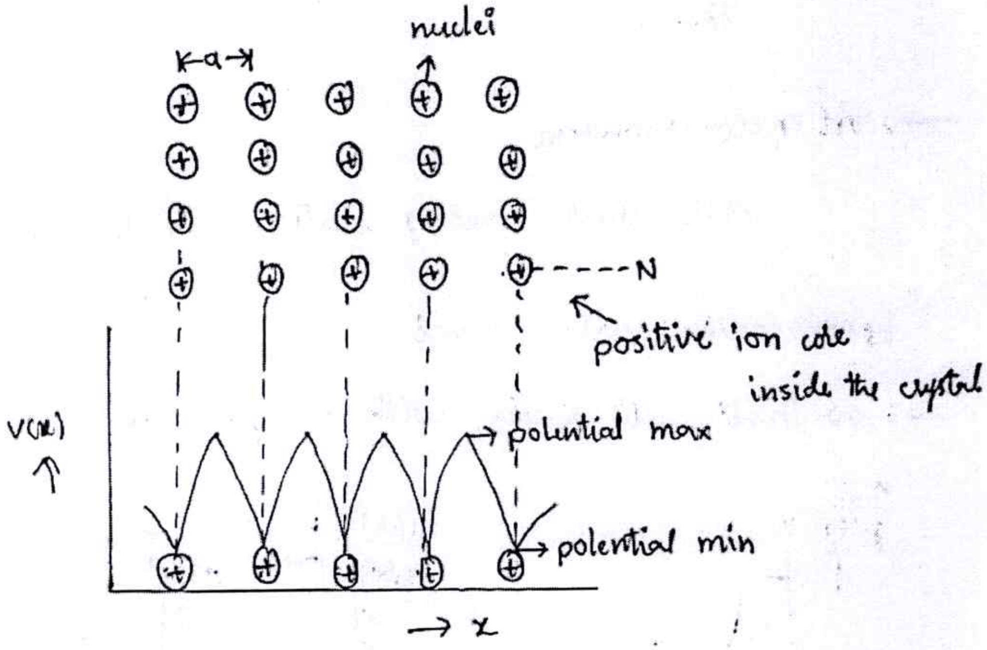


Electron in a periodic potential (Bloch theorem) :-

A crystalline solid consist of a lattice which is composed by a large no. of ionsore at regular intervels and the conduction electrons that can move freely throughout the lattice

Let a conduction election has a potential energy (V) due to its position in the lattice, the variation of Potential energy inside the metallic crystal is periodic as shown in the diagram

→ The potential is minimum at the positive ion core site. and Maximum between the two ions.



1D periodic potential

the electron is represented by a wave function '$\psi(x)$' corresponding with one dimensional schrodinger wave equation

$$\frac{\partial^2 \psi(x)}{\partial x^2} + \frac{2m}{\hbar^2}[E - V(x)]\psi(x) = 0 \longrightarrow ①$$

Here $V(x)$ is the periodic potential.

periodic potential ($V(x)$) may be defined by means of Lattice constant 'a' as $V(x) = V(x+a) \longrightarrow ②$

where x-distance of the electron from any ion core and 'a' is lattice constant (or) periodicity.

According to Bloch; wave equation has the solution

$$\psi_k(x) = U_k(x)\exp(ikx) \longrightarrow ③$$

the above equation is known as 'Bloch function' where

$U_k(x)$ - periodic function

Exp (ikx) is plane wave solution.

let us consider a linear chain of atoms of length 'L' in one-dimensional with 'N' no. of atoms in the chain,

$$U_k(x) = U_k(x+N.a) \rightarrow ④ \Rightarrow x = (x+Na)$$

from eq ③ & ④

$$\psi_k(x+Na) = U_k(x+Na)\exp(ik(x+Na))$$

$$\Rightarrow \exp(ikNa)\ \underline{U_k(x)\exp ikx}.$$

$$\therefore \psi_k(x+Na) = \psi(x)\exp(ikNa) \rightarrow ⑤$$

eq ⑤ is called Bloch condition.

Taking the complex conjugate of the above eq.

$$\psi_k^*(x+Na) = \psi_k^*(x)\exp(-ikNa) \rightarrow ⑥$$

Multiplying eq ⑤ & ⑥

$$\boxed{\psi_k(x+Na).\psi_k^*(x+Na) = \psi_k(x).\psi_k^*(x)} \longrightarrow ⑦$$

i.e the probability density of finding the electron is also periodic in nature, when the potential is periodic.

Hence from eq ⑤

$$\exp(ikNa) = 1$$

i.e $kNa = 2\pi n$

$$\boxed{k = \frac{2\pi n}{Na} \Rightarrow \frac{2\pi n}{L}} \longrightarrow ⑧ \quad \because Na = L \text{ (length of the chain of atom)}.$$

If we consider $N = 2n$

then $k = \frac{\pi}{a}$ → represent boundary and is called 1st Brillouin Zone.

Kronig - Penny modal :-

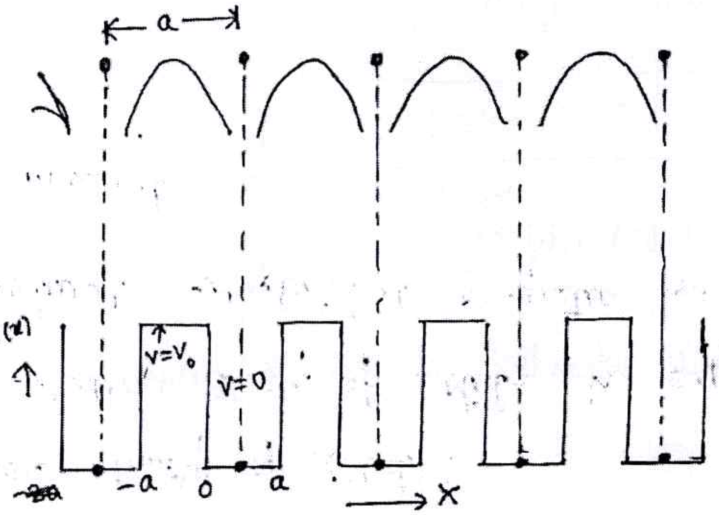
According to Kronig - Penny modal

The elections move in a periodic potential produced by the positive ion core. The potential of the election varies periodically with the periodicity of the core

→ potential energy of the election is zero near the nucleus and maximum between the two adjacent nuclei

→ nuclei are separated by the interatomic spacing "a"

→ The variation of the potential of the election. which it is moving through ion core is represented by in the form of rectangular walls as shown in the diagram.



one dimensional periodic potential

$V(x) = V_0$ for the region $0 < x < a$

$V(x) = 0$ for the region $-a < x < 0$

The Schrodinger wave equation for the two regions can be written as

$$\frac{\partial^2 \psi(x)}{\partial x^2} + \frac{2mE}{\hbar^2} \psi(x) = 0 \longrightarrow ① \quad (\because V=0)$$

$$\frac{\partial^2 \psi(x)}{\partial x^2} + \frac{2m}{\hbar^2} [E - V_0] \psi(x) = 0 \longrightarrow ② \quad [\because V = V_0]$$

assume $E < V_0$

$$\frac{\partial^2 \psi(x)}{\partial x^2} + \frac{2m}{\hbar^2} [V_0 - E] \psi(x) = 0 \longrightarrow ③$$

let us put $\alpha^2 = \frac{2mE}{\hbar^2}$ and $\beta^2 = \frac{2m(V_0 - E)}{\hbar^2}$

eq ① & eq ② can be written as.

$$\frac{\partial^2 \psi(x)}{\partial x^2} + \alpha^2 \psi(x) = 0 \longrightarrow ④$$

$$\frac{\partial^2 \psi(x)}{\partial x^2} + \beta^2 \psi(x) = 0 \longrightarrow ⑤$$

the solution for the eq ④ & ⑤ can be written in the Bloch form as. $\psi(x) = U_k(x) e^{-ikx} \rightarrow ⑥$

where $U_k(x)$ is periodicity of the ion core through lattice constant 'a'

i.e $U_k(x) = U_k(x + na)$; $k = \frac{2\pi}{\lambda}$

The form of $U_K(x)$ depends on the exact nature of the potential field

→ As V_0 increases the width of the potential box is decreases such that $V_0 a$ = constant $[\because V_0 \propto \frac{1}{a}]$

it turns out that solution are posible only for energies given by the relation

$$\boxed{\cos ka = \frac{P}{\alpha a}\sin\alpha a + \cos\alpha a} \longrightarrow (7)$$

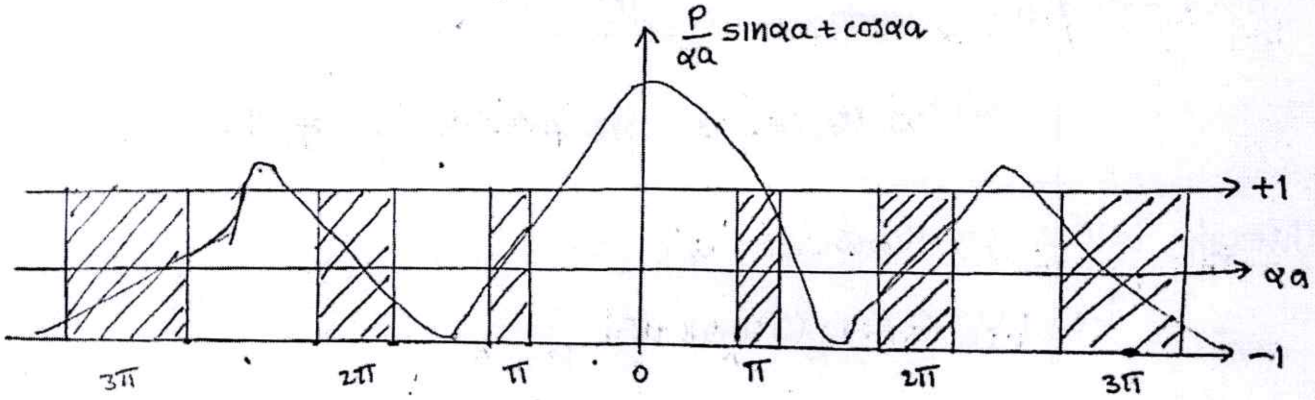
where $P = \frac{mV_0 a^2}{\hbar}$ and it is the measure of potential barrier strength

$\alpha^2 = \frac{2mE}{\hbar^2} = k^2$ $\quad [\because \alpha = \frac{2\pi}{h}\sqrt{2mE}]$; $\hbar = \frac{h}{2\pi}$; $\lambda = \frac{h}{\sqrt{2mE}}$

$$\boxed{\therefore E = \frac{k^2\hbar^2}{2m}}$$

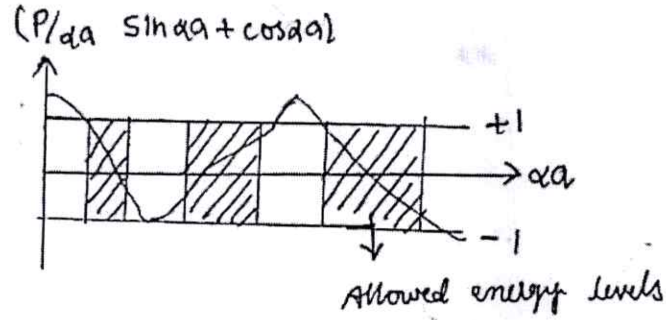
→ The left hand side of the eq (7) is ploted as a function of αa for the different value of 'P' which is shown in diagram

→ The right hand side only takes the values b/w −1 to +1 as indicated by horizontal lines in fig

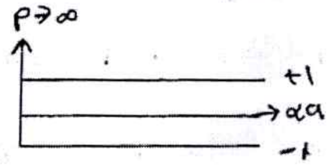


→ The energy spectrum of electron consist of a no. of allowed and forbidden band

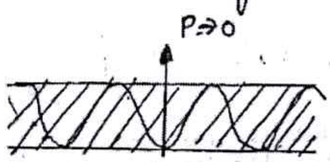
ii) → The width of the allowed energy band increases with increase of energy values (increasing the value of αa)



iii) → With increasing P (potential barrier ~~energy~~) width of the allowed region decreases. As $P \to \infty$, the allowed band decreases infinitively narrow and the energy spectrum is a line spectrum as shown in diagram

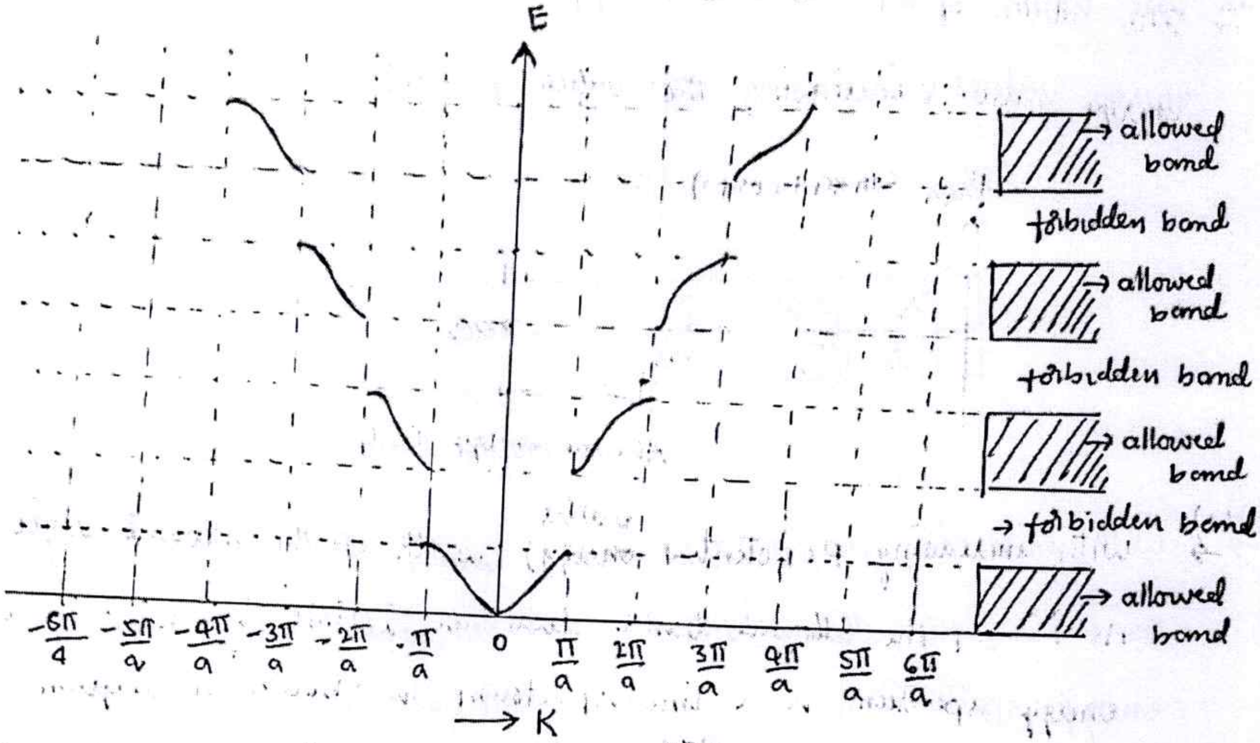


iv) → when $P \to 0$ then the all electrons are completely free to move in the crystal. Hence no energy level exists, this case supports the classical free electron theory.



E-K Diagram :-

Using the equation $\frac{P}{\alpha a} \sin\alpha + \cos\alpha = \cos ka$, it is possible to plot a curve showing the energy 'E' as a function of 'K' wave n which is shown in diagram. It is clear from the ~~the~~ diagram that the energy of the electron is continuously increasing from $K=0$ to $\frac{\pi}{a}$, the right hand side of the eq. becomes $+1$ to -1 for the values of $K = \pm \frac{n\pi}{a}$ and hence discontinuously appears in the E-K graph at $K = \pm \frac{n\pi}{a}$



→ From the graph it can be seen that the energy spectrum of electron is consisting allowed region and forbidden region

→ The allowed region or zone extended from $-\pi/a$ to π/a is known as 1^{st} Brillouin zone.

→ After a discontinuity in energy, called "forbidden gap", the another allowed region or zone extended from $-\frac{2\pi}{a}$ to $-\frac{\pi}{a}$ and $\frac{\pi}{a}$ to $\frac{2\pi}{a}$, this is known as 2^{nd} Brillouin zone

→ In the same way further Brillouin zone will be continued

Classification of solids.

Based on forbidden energy bandgap, solids are classified into three Types

They are :- i) conductors (metals)

ii) Insulators

and iii) semiconductors

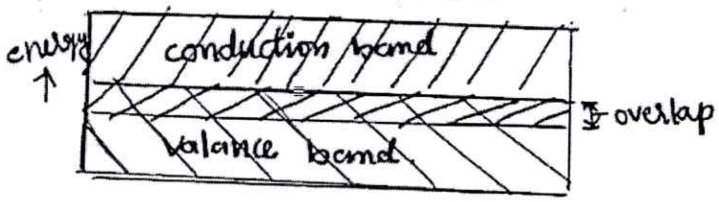
i) conductors (metals) :-

→ In conductors, valance band overlaps conduction band

→ There are sufficient no. of free electrons are available.

→ free electrons freely move within the valance and conduction band. so that electrical conduction produced.

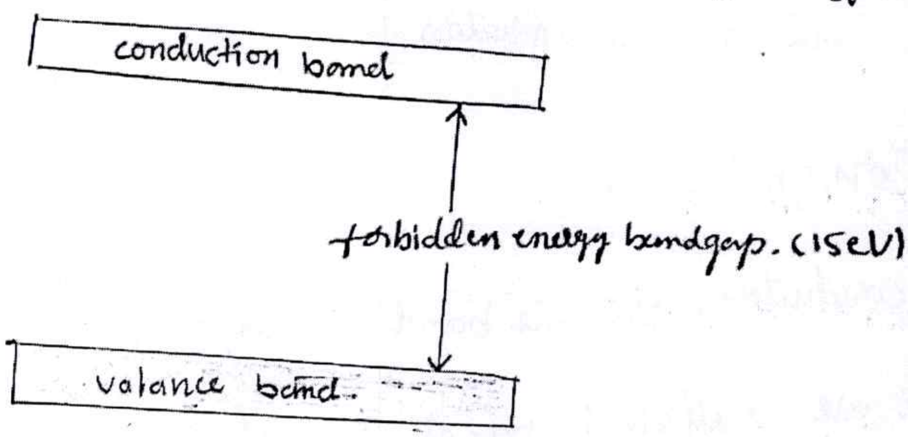
→ In conductors no forbidden energy bandgap is between conduction band and valance band.



ii) Insulators :-

→ In insulators, a large forbidden energy band gap (15 eV) between conduction band and valance band.

→ Valance band is filled with ~~valance~~ electron and conduction band is empty so that electric conductivity is zero.



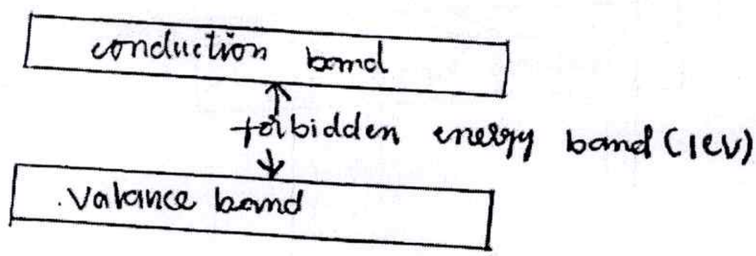
iii) semiconductors :-

→ The conductivity is lies in between conductors and ~~semiconduct~~ Insulators

→ there is small energy band gap (1 eV) is present b/w conduction band and ~~insulators~~ valence band.

→ semiconductors behaves as conductors at very high temp.

→ and also behaves as insulators at low temp.



Effective mass of electron (m^*) :-

→ When an electron in a periodic potential of lattice is accelarated by an electric field, then the mass of the electron is called effective mass (m^*) and which is different from the mass (m) of the ~~free~~ electron in free space

→ The effective mass (m^*) depends on the nature of the crystallattice and varies with the direction of motion of the free electron in the lattice

Let us consider an electron of charge 'e' and mass (m^*) moving inside a crystal lattice of electric field (E)

The electric force on the electron $F = eE$

$$\text{but } F = m^* a \rightarrow (1)$$

$$m^* a = eE$$

$$\text{accelaration } a = \frac{eE}{m^*} \rightarrow (2)$$

considering the free electron as a wave packet, the group velocity (V_g) corresponding to the particle velocity can be written as

$$V_g = \frac{d\omega}{dk} \Rightarrow \frac{2\pi d\upsilon}{dk} \quad (\because \omega = 2\pi\upsilon)$$

$$\Rightarrow \frac{2\pi}{h}\frac{dE}{dk} \Rightarrow \frac{1}{\hbar}\frac{dE}{dk} \quad [\because E = h\upsilon \ \& \ \frac{h}{2\pi} = \hbar]$$

But accelaration $a = \frac{d}{dt} V_g$

$$\Rightarrow \frac{1}{\hbar}\frac{d^2E}{dt\,dk}$$

Deviding & Multiplying with 'dk' to right side eq., $\Rightarrow \frac{1}{\hbar}\frac{d^2E}{dk^2} \times \frac{dk}{dt}$

since $P = \hbar K$ and $\frac{dp}{dt} = F$

$$\therefore \frac{dk}{dt} = \frac{F}{\hbar}$$

$$a = \frac{1}{\hbar^2} \frac{d^2E}{dk^2} \cdot F$$

$$F = \frac{\hbar^2}{\frac{d^2E}{dk^2}} \times a \longrightarrow (3)$$

from eq (1) & (3)

$$\boxed{m^* = \frac{\hbar^2}{\frac{d^2E}{dk^2}}}$$

$P = \hbar K$

$= \frac{h}{2\pi} \times \frac{2\pi}{\lambda} = \frac{h}{\lambda} \Rightarrow P$

$\frac{dp}{dt} = m\frac{dv}{dt} \Rightarrow ma = F$

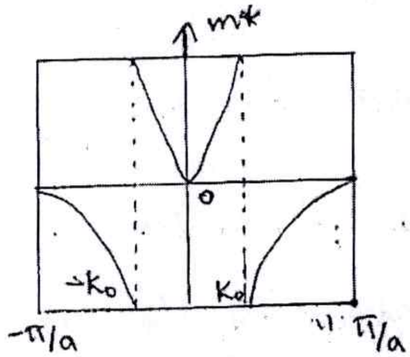
$\hbar k = P$

$\hbar \frac{dk}{dt} = \frac{dp}{dt}$

$\frac{F}{\hbar} = \frac{dk}{dt}$

Thus, the mass of a moving electron in a periodic lattice is not constant. it is a function of K, and depends on $\frac{d^2E}{dk^2}$.

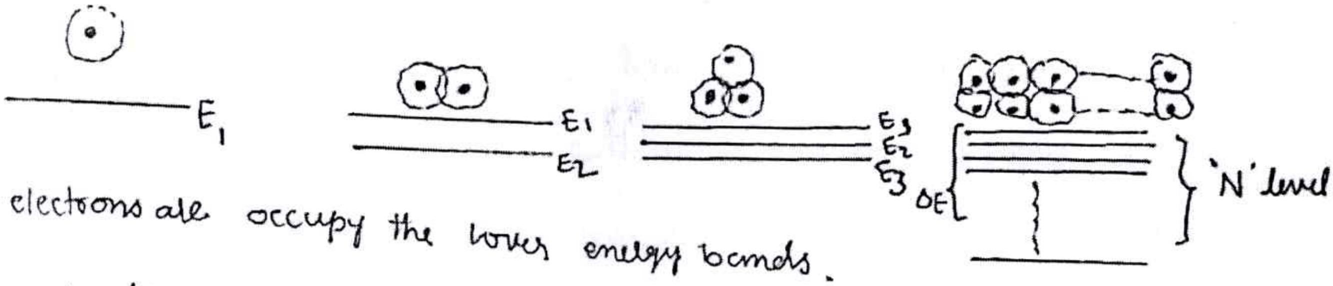
The graph b/w m^* & K as shown in diagram



Origin of Energy bands :-

In an atom, the electrons are tightly bound and have discrete sharp energy levels. when two identical atoms are brought closer, the outermost orbits of these atoms overlaped and interact. the energy levels corresponding to those atoms split and form a set of bands of very closely spaced levels.

If more atoms are brought together, more levels are formed and for a solid of 'N' atoms, each of the energy levels of an atoms splits into 'N' levels of energy



→ electrons are occupy the lower energy bands.

Classification of ~~Solids~~ :- Bands :-

i) Valence band :-

The electrons in the outermost shell (orbit) are called valence electrons. the band formed by a series of energy levels containing the valence electrons is known as valence band.

→ Valence band may also be defined as a band which is occupied by the valence electron

→ The band may be partially or completely filledup depending on the nature of the material.

→ valence electrons are responsible for electrical, thermal and optical properties of solids.

ii) conduction band :-

The next higher permitted band is the conduction band. this band may be empty or partially filled

→ In conduction band the electrons are can move freely.

→ At 'OK' conduction band is empty.

→ valence band & conduction band both are called as 'Allowed energy bands'.

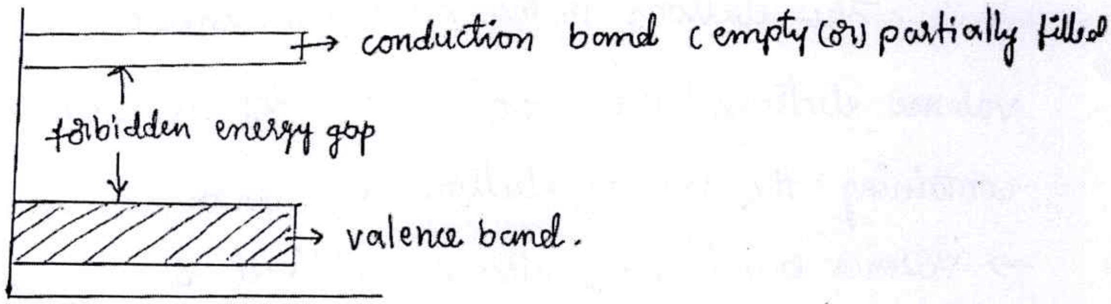
iii) Forbidden energy band gap :-

Both the band conduction and valence band are separated by a gap known as forbidden gap (or) forbidden band

→ This band collectively formed by series of energy leves above top of the valence band and below conduction band.

→ no election can exist in this band.

→ when an election in the valence band obsebs enough energy it crosses the foribidden energy gap and enters the conduction band



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Semiconductor Physics & Devices UNIT-II

Based on conduction mechanism, solids are classified into three catogories, they are ① conductors
② Semiconductors
and ③ Insulators.

→ In conductors, large no. of free electrons are available for electric conduction mechanism. These materials have very low resistivity and very high conductivity.

→ In insulators, no free electrons are available. These materials have very high resistivity and almost zero conductivity.

→ From the point of band theory of solids, semiconductors differs from conductors and insulators because they have a narrow forbidden energy gap.

→ The semiconductors have intermediate properties of conductors and insulators. These materials have two types of charge carriers ① electrons and ② Holes.

→ Semiconductors behaves as insulators at low temperatures and as conductors at high temperatures.

→ These materials play vital role in all most all advanced electronic devices.

→ In the periodic table, there are eleven elements are semiconductors

→ Ex. Germanium & Silicon ... etc.

Electron-hole generation in a semiconductor :-

When a suitable form of energy is supplied to a semiconductor. Then electron take transition from valence band to conduction band. Hence a free electrons in conduction band and a free hole in valance band is formed. This phenomenon is known as electron-hole pair generation.

Types of semiconductors :-

There are two types of semiconductors. They are

① Intrinsic semiconductors.
② Extrinsic semiconductors.

Intrinsic semiconductor :-

A semiconductor in an extremely pure form is called as intrinsic semiconductor

Ex :- Germanium and Silicon.

→ In intrinsic semiconductor the charge carriers are hole in valance band and electrons in conduction band.

(2)

→ These charged carriers are generated due to the breaking of covalent bonds

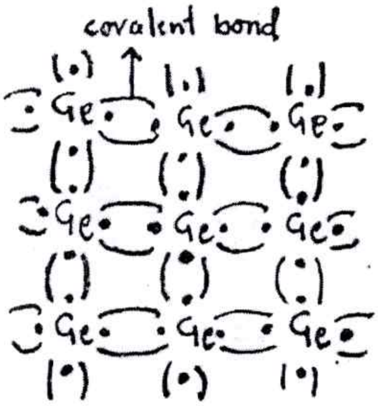
→ In this semiconductor no. of conduction electrons are equal to no. of holes in valance band at 0 K temperature. Hence fermi energy level (E_f) is exactly at the centre of the forbidden energy gap.

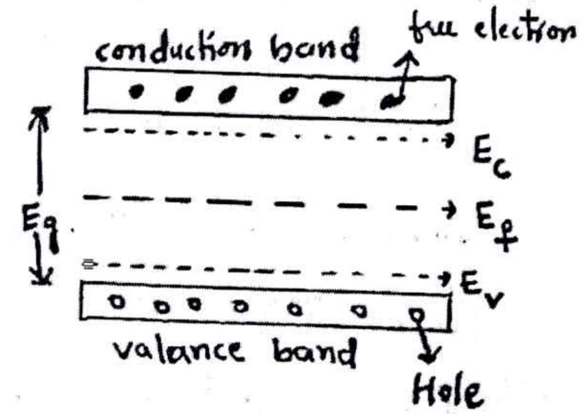
$$\boxed{E_f = \frac{E_c + E_v}{2}}$$

Explanation :-

Germanium → 32 (atomic no) → $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^2$

→ In the both cases of silicon and germanium have 4 valency electrons in its outermost orbit.





from the above diagram, Neighbouring atoms of Germanium (Ge) share '4' valence electrons with another '4' germanium (Ge) atoms, 4 electrons by co-valent bond process represented by curved lines.

Doping :- The process of adding impurity to a pure semiconductor

→ Generally one impurity atom is added to 10^8 atoms of pure semiconductor.

Extrinsic semiconductor :-

A semiconducting material in which the charge carriers originate by impurity atoms added to the pure semiconductor is called extrinsic semiconductor.

→ They are obtained by doping.

→ Based on the type of impurity added they are devided into two types.

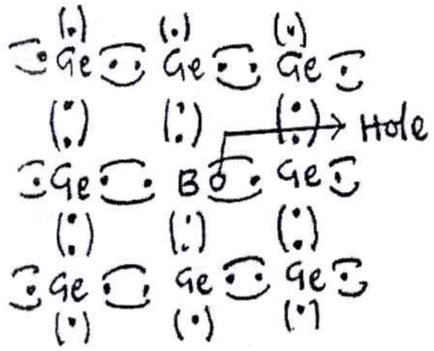
① N- type semi conductor

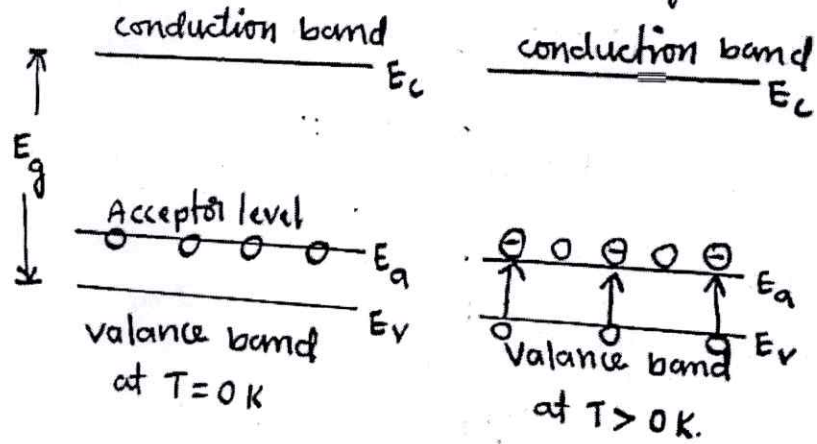
② P-type semiconductor.

P-type of semiconductor :-

P- type of semiconductor is obtained by doping of trivalent impurity (or) III group of elements like Boron, Gallium, Alluminium, Indium into an intrensic semiconductor.

The three valance electrons of an impurity atoms (Boron) pairs with 3-valance electrons of semiconductor (Ge), by covalent bond process, and one position at the impurity atom remains vacant is called hole, as shown in diagram.





→ In P-type of semiconductor majority charge carriers are holes and minority charge carriers are electrons.

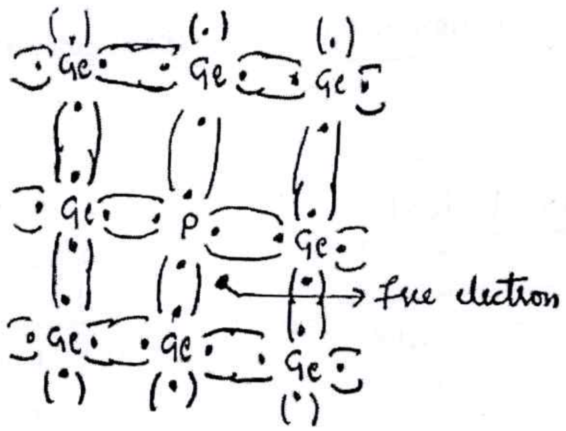
→ From the diagram (energy), the energy level just above the valance band is 'acceptor energy level'

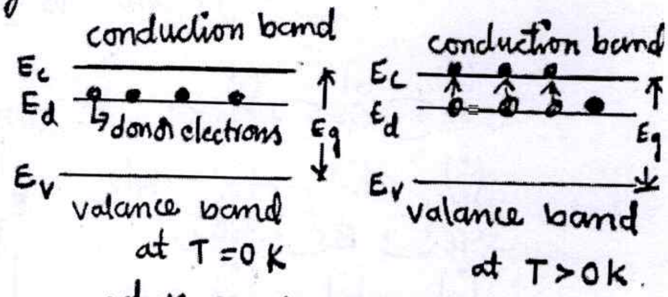
→ At low temperatures, these acceptor atoms get ionized, taking electrons from valance band and thus giving rise to holes in valance band for conduction.

N-Type semiconductor :-

N-type of semiconductor is obtained by doping an intrinsic semiconductor with the pentavalent impurity (or) V group of elements like Phasphorous, Arsenic, Antimony.

The 4 valance elections of the impurity atoms (phasphorous), bond with 4 valance elections of the semiconductor (germanium) and the remaining one election of the Phasphorous atom left free as shown in the diagram.





where E_d - donar level

→ In the energy level diagram, the energy level of the fifth elections is called donor level.

→ The donor level is so close to the bottom of the conduction band.

→ most of the donar level elections are excited into the conduction band at the room temperatures and become the majority charge carriers.

→ Hence in N-type semiconductors elections are majority charge carriers.

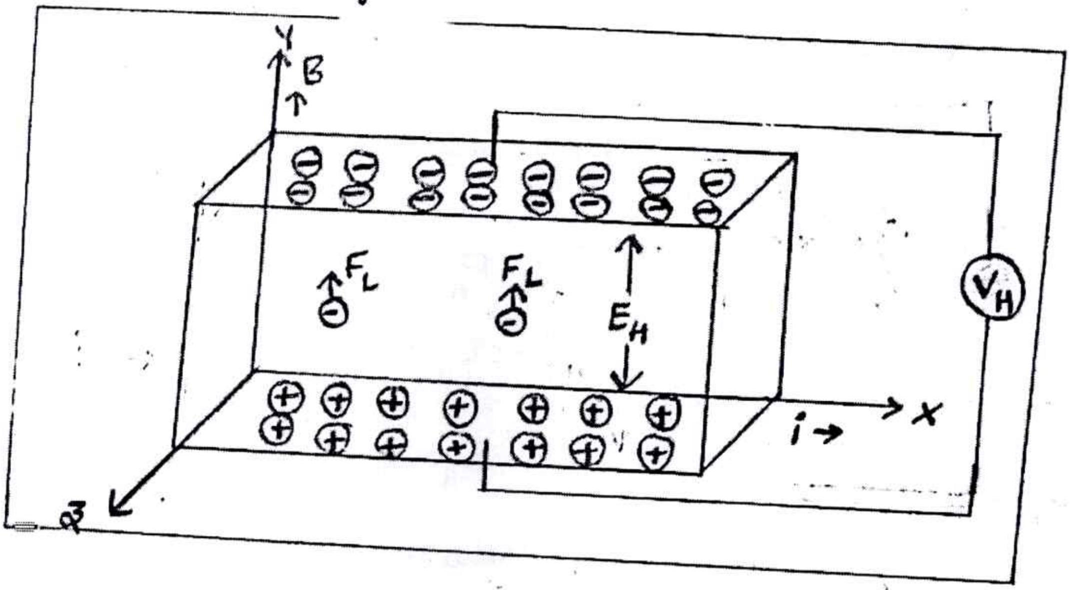
Hall effect :-

" When a current carring semi conductor is placed in a transverse magnetic field, an electric field is produced inside the semiconductor in a direction normal to both the current and magnetic field. This phenomenon is known as Hall effect'.

→ Generated voltage is called " Hall voltage"

Hall effect was introduced by E.H. Hall in 1879.

Theory :-



consider a rectangular slab of semiconductor, carrying current in positive 'x' direction. The magnetic field is acting along y-axis. Due to this applied magnetic field (B), charge carriers experiences a force (known as Lorentz force F_L) along the z-axis. The Lorentz force $F_L = e V_d B$ causes electron accumalated on upper surface and positive charges accumalated on the lower surface of the semiconductor as shown in the diagram.

This separation of positive and negative charge carriers creates electric field which is known as Hall electric field (E_H).
The accumalation of charge on the surfaces of semiconductor, continues until Hall electric field is equal to applied magnetic field (B). Ultimately a steady state is reached in which the net force on the moving charges vanishes and the election can again move freely along the semiconductor

The Lorentz force $(F_L) = eV_dB$
The Hall force $(F_H) = eE_H$

under equilibrium condition, $F_H = F_L$

$$eE_H = eV_dB$$

$$E_H = V_dB \longrightarrow ①$$

The relation between conductivity and drift velocity is

$$V_d = \frac{J}{ne} \longrightarrow ②$$

Substituting eq ② in ①

$$E_H = \frac{JB}{ne} \longrightarrow ③$$

The Hall co-efficient is defined as the ratio of Hall field to the product of current density and magnetic field

$$R_H = \frac{E_H}{JB}$$

from eq ③ $R_H = \frac{\cancel{JB}}{ne} \times \frac{1}{\cancel{JB}}$

$$\boxed{R_H = \frac{1}{ne}} \longrightarrow (4) \quad (or) \quad R_H = \frac{1}{p.e}$$

where p - density of hole

This is called Hall co-efficient

→ This Hall co-efficient is negative if the charge carries are electrons.

→ It is positive if the charge carriers are holes.

Applications of Hall effect :-

① Hall co-efficient is used to determine the type of the semiconductor.

→ For N-type, Hall co-efficient is negative

→ For P-type, Hall co-efficient is positive

② Hall co-efficient is used to measure drift velocity of charge carriers

$$\boxed{V_d = \frac{J}{nE}}$$

③ Strong magnetic fields can be measured by the application of Hall coefficient

$$\boxed{B = \frac{neLdE_H}{i}}$$

Determination of the Hall coefficient :-

→ If "b" is the width of the sample across the Hall voltage V_H is measured.

$$E_H = \frac{V_H}{b} \qquad J = \frac{I}{bt}$$

$$R_H = \frac{E_H}{JB} \Rightarrow \frac{V_H}{JBb} \qquad V_H = \frac{R_H IB}{t}$$

$$V_H = R_H \times JBb \qquad \boxed{\therefore R_H = \frac{V_H \times t}{IB}}$$

Indirected Band gap · of semiconductor :-

→ In a semiconductor if the minimum energy ~~&~~ in the conduction band is shifted by K-vector relative to the valance band

→ In Indirect bandgap of semiconductor electron in the conduction band minimum recombine with hole in valance band maximum indirectly, called non-radiative recombination.

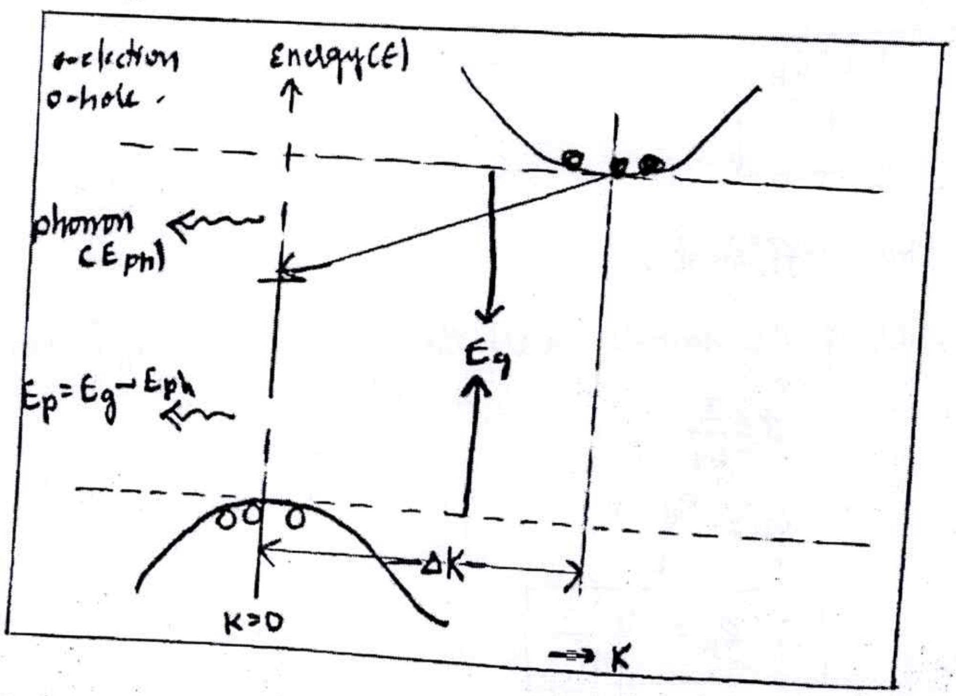
→ Initially the electron release phonon of energy then recombine with hole

→ Electron is emitted energy in the form of heat in the crystal lattice

→ some defects (surface & bulk defects) are present in in-directed bandgap of semiconductor.

→ The probability of non-radiative recombination is comparatively low.

Ex:- Silicon & Germanium



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Direct bandgap of semiconductor :-

In a semiconductor if the minimum of the conduction band is directly above the maximum of valance band in the energy-wave vector (E-K) space is called direct bandgap semiconductor.

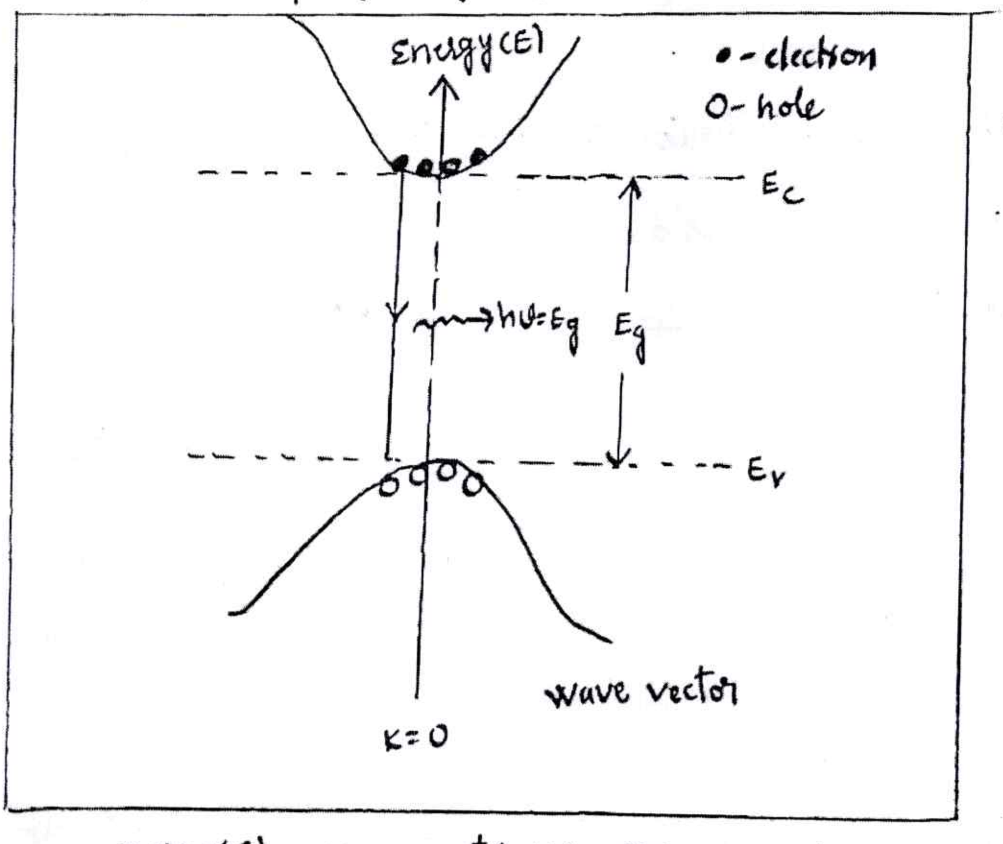
→ electron at the conduction band minimum can recombine directly with hole at valance band maximum i.e Radiative Recombination

→ Energy of electron is emitted in the form of photon. known as spontaneous emission.

→ The probability of radiative recombination is very high

Ex:- Gallium Arsenide (GaAs)

and Indium ~~phasphate~~ phasphide (InP)

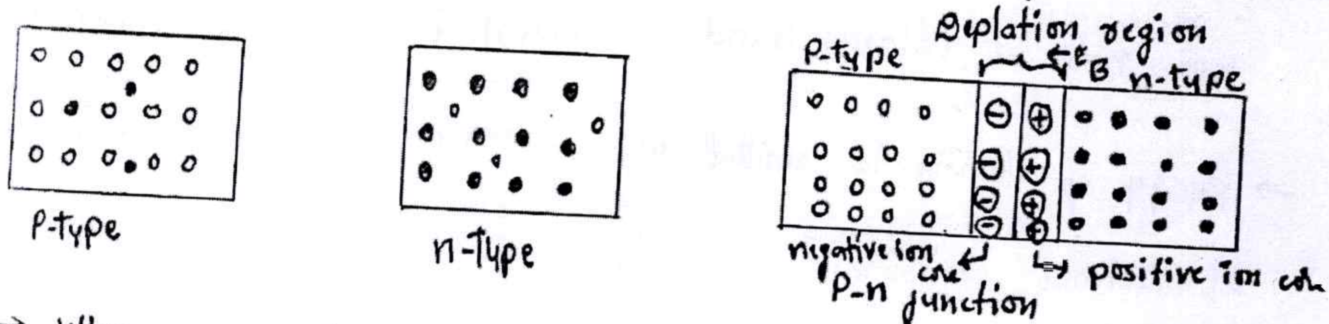


Energy(E) – wave vector (K) (or) momentum curve.

P-n junction diode :-

Formation :-

The p-n junction diode is formed by placing of p-type crystal in contact with n-type crystal. The surface of contact of p and n-type crystals is called p-n junction



→ When a p-n junction is formed, the excess elections in the n-type crystal diffuses the holes in p-type crystal. Similallly the excess holes in the p-type crystal diffuses the electoon in n-type crystal.

→ This diffision process continues until the concentration of elections and holes on both sides are same (equal)

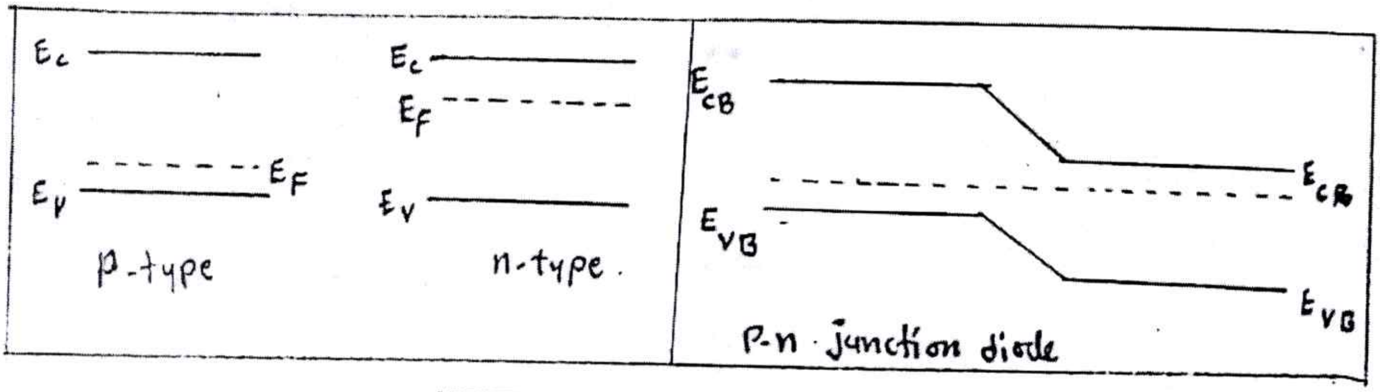
→ The migration of elections to the p-side leaves positive ion cores on n-side, while the migration of holes to the n-side leaves negative ion core on p-side.

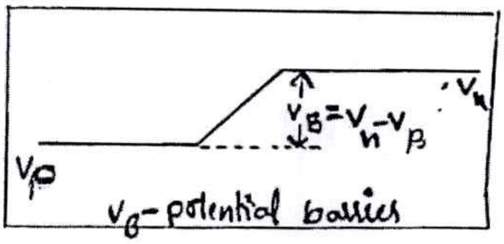
→ Thus, the layer is formed at the junction which is known as 'Deplation region'. (or) 'Deplations layer'.

→ The width of the Deplation region depands on the amount of impurity added to the semiconductor.

→ The potential differences across the deplation region is called potatial barriers.

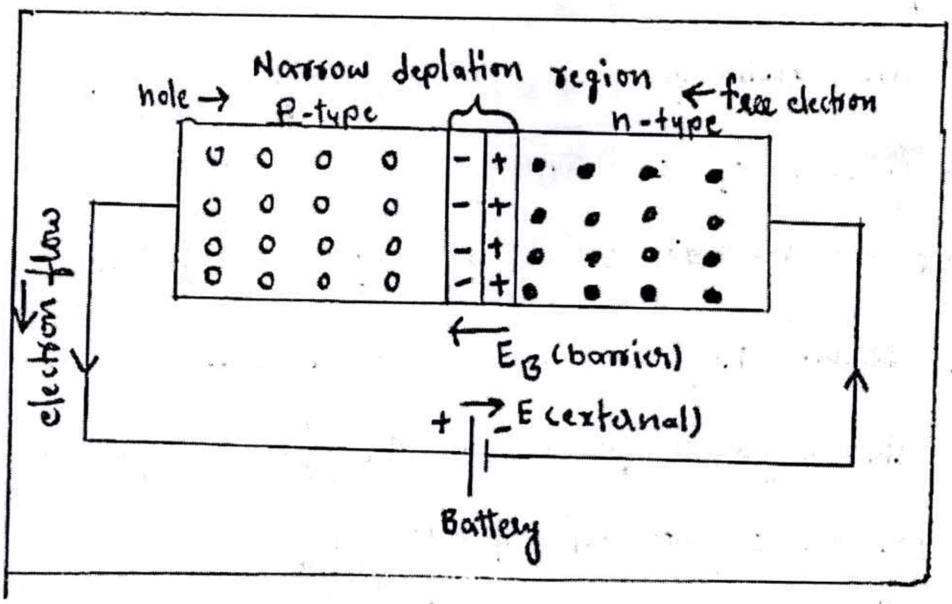
Energy diagram of p-n junction diode :-





Biasing :- " The process of applying external voltage to a p-n junction semiconductor diode called 'Biasing'.

① Forwad Bias :-



* ~~The process of applying external voltage to a pn junction semiconductor diode~~

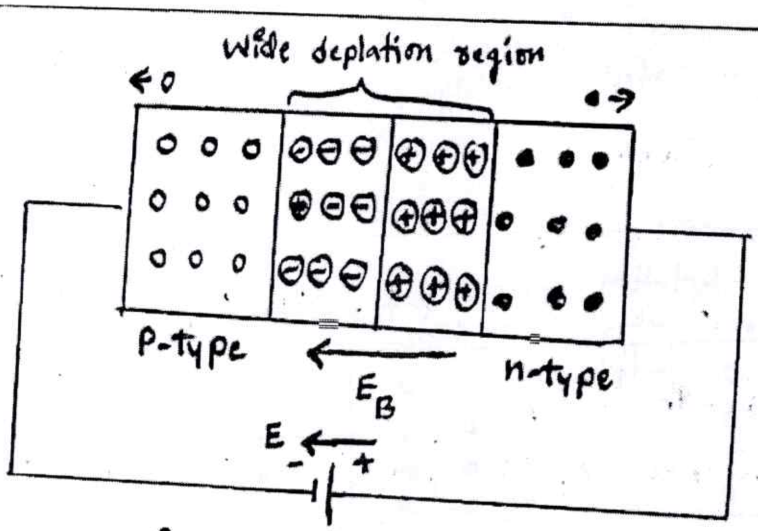
"The biasing the junction in such a direction that the external voltage cancels the potential barrier and permits the current flow is called "forward biasing"."

→ In forward bias, the positive terminal of the battery is connected to p-type and negative terminal of the battery is connected to n-type of semiconductor.

→ This applied forward potential is opposite direction to the electric field formed by the potential barrier and weaken it.

→ Therefore in this type of biasing potential barrier is eliminated hense the junction offers low resistance to the current and current flows in the circuit.

② Reverse bias :-



Reverse bias

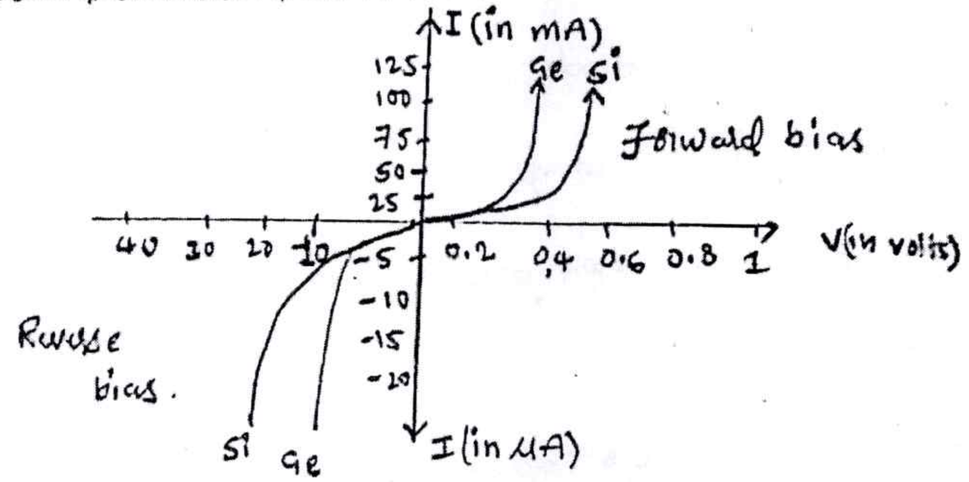
" Biasing the junction in such a direction that the external voltage increases the potential barrier and prevents the current flow is called "Reverse bias".

→ In the reverse bias, the positive terminal of the battery is connected to n-type ~~of~~ and negative terminal of the battery is connected to P-type of semiconductor.

→ This applied reverse potential is in the same direction of the electric field formed by the potential barrier and strengthen it

→ The resultant barrier offers high resistance to the current and prevents the flow of current in the circuit.

③ V-I characteristics of P-n junction :-



Forward bias :-

→ The current in forward bias increases slowly with increase in applied voltage initially

→ After a certain forward voltage current increases rapidly.

→ The voltage at with current increases sharply in forward bias is called threshold voltage

→ The value of threshold voltage for Ge is 0.3 V. and Si is 0.7 V.

Reverse bias :-

→ In the reverse bias, Initially the current is zero.

As The reverse voltage increases the current suddenly rises to its maximum (or) saturated value.

→ If Reverse voltage further increased breakdown of junction occurs. due to the ~~p~~ heat produced at junction.

Zener diode :-

" Zener diode is a heavily doped semiconductor device that designed to operate in reverse biased condition."

→ A normal p-n junction diode does not operate in breakdown region because the excess current permanently damages the diode

→ In normal p-n junction diode, when reverse voltage increased heat will produced, which damage the diode.

→ In Zener diode, Zener breakdown occurs because of their narrow depletion region

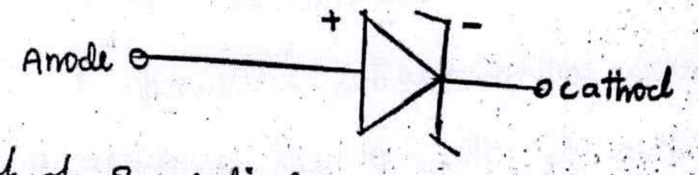
→ When reverse biased voltage ~~applied~~ increased the narrow depletion region creates strong electric field, which pull the electrons from the valence band

→ Those electron will gain sufficient energy from strong electric field and further break the covalent bond with parent atom.

→ so that free electrons are produced electric current

→ At Zener breakdown region, a small ~~region~~ increase in voltage results offers rapid increase of the electric current

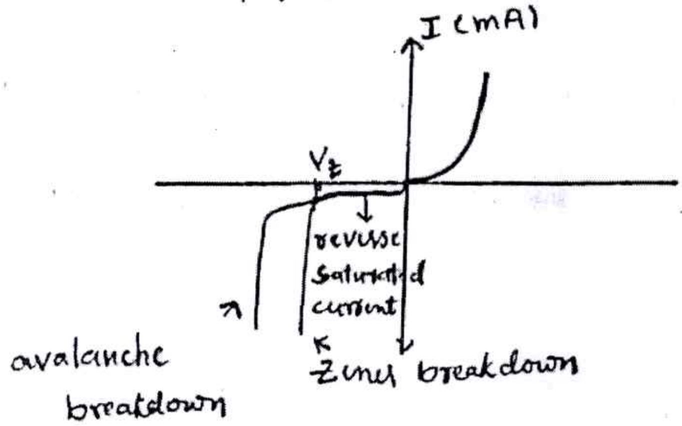
→ Zener diode exhibits a controlled breakdown that does not damage the device



circuit smbof of Zener diode

→ Zener diode will operate range 20V – 200V.

V-I characteristics of Zener diode :-



V_Z - Zener breakdown voltage

→ In forward bias, Zener diode acts as normal P-N junction diode

→ In Reverse bias, reverse voltage increases, the reverse current remains same and small.

→ At perticular voltage the reverse current increases suddenly, this voltage is known as Zener voltage (V_Z).

→ Zener breakdown voltage is lesser than the avalanche breakdown voltage

→ Doping concentration decides Zener breakdown voltage.

Advantages :-

① Low cost ② small in size ③ High accuracy

4) High power dissipation capacity.

Application :-

1) It is used as voltage regulators

2) It is used ~~as~~ in clipping and clamping ckts

3) It is used as various protection ckts

Bipolar Junction Transistor (BJT) :-

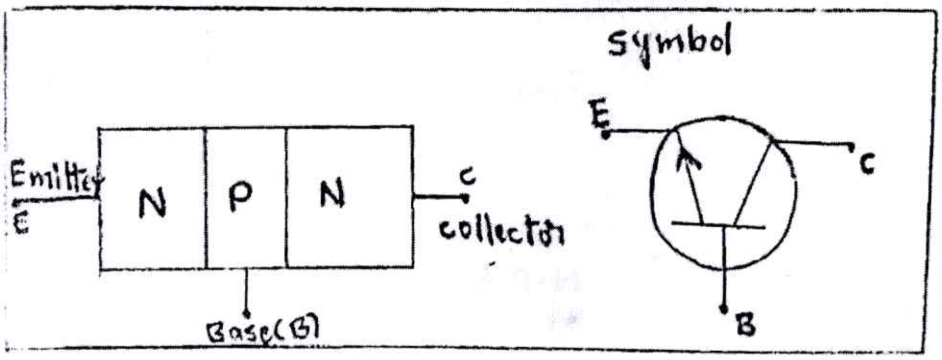
Bipolar Junction Transistor is simple sandwich of one type of semiconductor material b/w two layers of othertype of semiconductor

→ Thereare two types of transistor combinations are available ~~They~~ They are ① N-P-N transistor

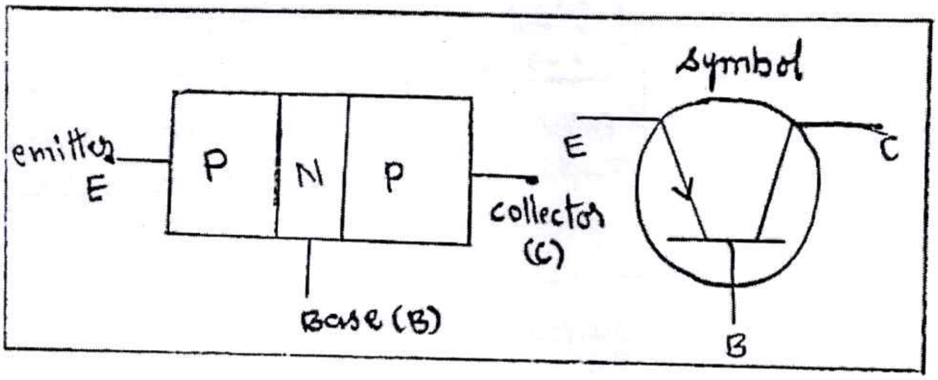
② P-N-P transistor

~~③~~

→ When a layer of P-type material is sandwiched between two n-type material, the transistor is known as N-P-N transistor, as shown in diagram



→ When a layer of N-type of material is sandwiched between two layers of P-type of material, the transistor is known as P-N-P transistor, shown in below diagram



→ Arrowhead of the symbol of the BJT gives us information about

① Location of the emitter

② Type of the transistor that is being represented

and ③ direction in which the conventional current flows

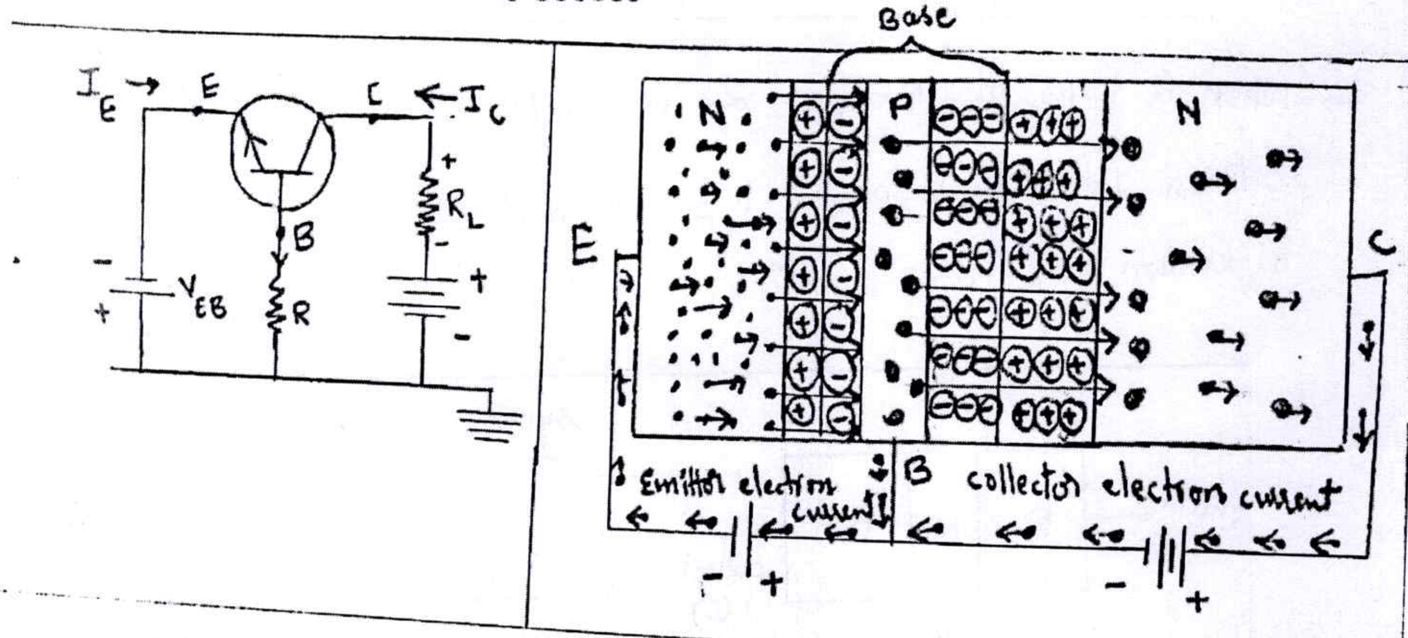
→ BJT (N-P-N (or) P-N-P) has following sections

① Emitter :- which supplies charge carriers for conduction, and it is heavily doped.

② Base :- It controls the flow of majority carriers, and it is thin and ~~heav~~ lightly doped.

③ Collector :- It supports the current flow (flow of majority charge carriers) in the transistor and it is modaratelly doped.

Working principle of BJT :- N-P-N



The Base-Emitter (BE) junction is forward bias and collector-Base(CB) is reverse bias junction. The width of the deplation region of the CB junction is higher than EB junction. The forward bias at the EB junction produces election to flow from the emitter to the base. The base is thin and lightly doped. it has very few holes and less amount of electron from the emitter is about 2% will recombine In the base region with holes, then from the base terminal it flow out. this initiates the base current flow due to the combination of electron and holes, the no. of elections will pass through the reverse bias, collector junction to initiate the collector current

→ From the Kirchoff law $I_E = I_B + I_C$

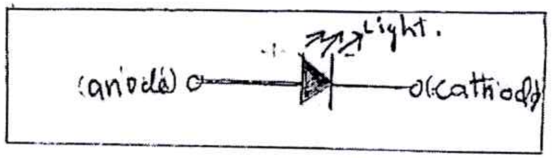
→ The operation of PNP transistor is same as NPN transistor only difference is holes instead of electrons.

Construction & Working of an LED :-

" Light Emitting Diode (LED) is a semiconductor light source.

→ LED is an opto-electronic device in which forward biased P-N junction emits light

→ Symbol of LED is



→ LED converts electrical energy into light energy.

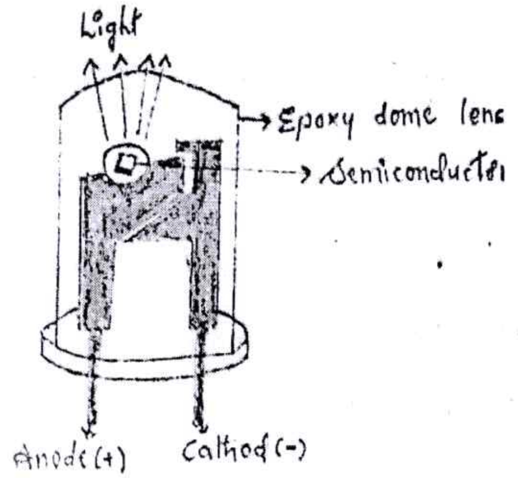
Construction :-

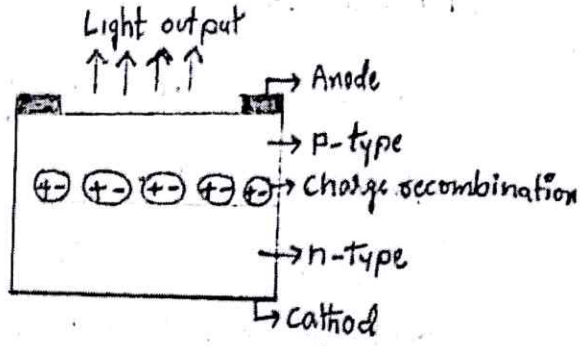
→ It is fabricated using III & IV compound semiconductors.
Ex :- GaAs, GaP etc.

→ LED's are available in different colours and it is possible by produce different wavelength of light.
Ex :- Red, Yellow, Green & Blue etc.

→ When an LED is made with GaAs, it will produce a red light

→ When an LED is made with GaP, it will produce a green light

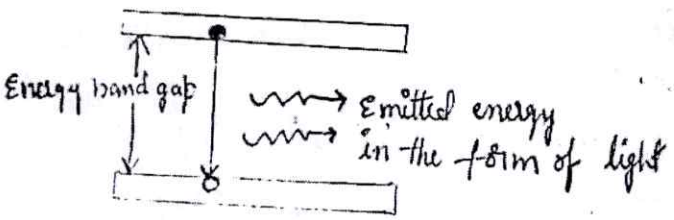


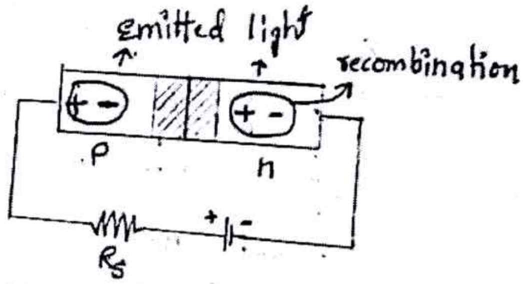


Cross-sectional view of LED.

Operation & Working principle :-

→ LED is works on the principle of electroluminiscene.





→ Whenever a P-n junction is forward biased, the elections cross the P-n junction deplation region from the n-type semiconductor and recombine with the hole in the p-type semiconductor material

→ When a free election recombine with hole, it falls from conduction band (higher energy level) to the valence band (lower energy level), the energy in the form of photons ($=E_g$) is released this process is called electroluminiscence

$$\therefore E_g = h\nu = h\left(\frac{c}{\lambda}\right) \quad \because \text{frequency}(\nu) = \frac{c}{\lambda}$$

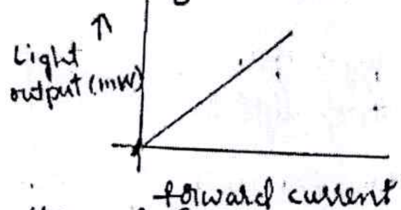
→ Forbidden energy gap (E_g) determines the wavelength of Emitted light, which determine the colour of LED.

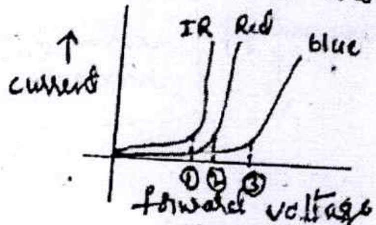
Charracteristics of LED :-

→ In LED's, the intensity of radiated light is directly proportional to the forward current of LED.

→ The forward voltage rating of most of LED's is from 1V to 3V and forward current rating is 20mA to 100mA.

→ In order of current the LED does not exceed to the safer value, to avoid this R_s is connected in series with the LED.





→ threshold frequency
Here ① for IR
② Red
③ blue

Advantages of LED :-

⟶ LED's are low voltage devices

⟶ Longer lifetime (more than 20 years)

⟶ LED's are small in size and light in weight.

⟶ Fast on-off swiching.

⟶ They can be operated over a wide range of temp. 0°to 70°C.

Applications of LED :-

⟶ LED's are low power devices, so they are used as power indicator.

⟶ LED's are majorly used as 7-segment, 16-segment and Dot matrix displays

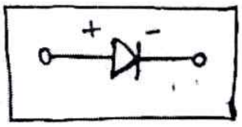
⟶ LED's are used in digital clocks, caliculators etc.

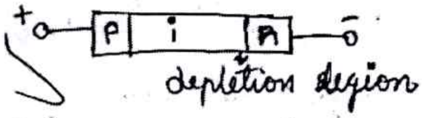
PIN Photo-diode :-

→ Pin photo diode is also known as positive intrinsic negative diode

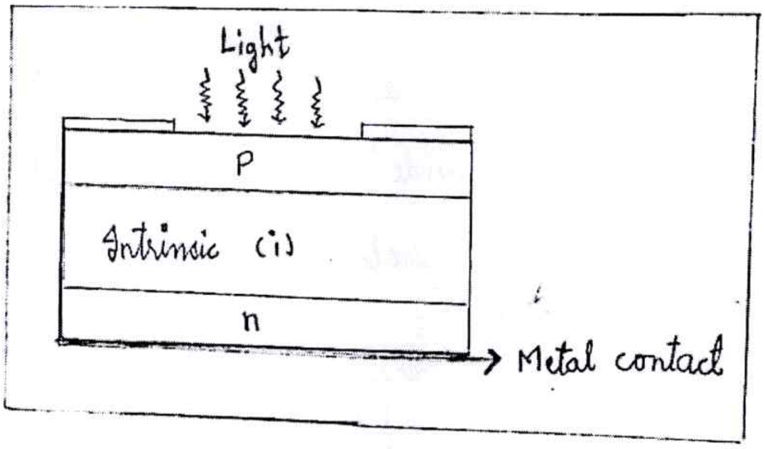
→ It is a device that consist of p and n type regions are separated by a very lightly doped intrinsic region (i)

→ Symbol of p-i-n photodiode is



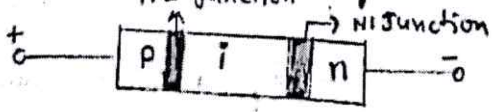


→ Due to intrinsic layer between p and n region it offers high resistance and low ~~capal~~ capacitance

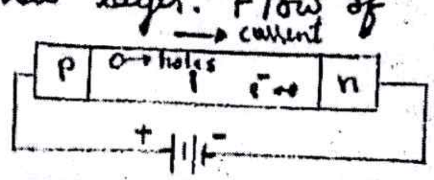


Working of PIN photodiode :-

→ In no-biasing condition, the depletion region formed b/w intrinsic region and n-region, and in b/w p-type and intrinsic region



→ If it is connected in forward bias, both types of charged carriers are injected into the intrinsic layer. Flow of charged carriers gives the current.



→ In forward biased PIN works as variable resistor

Under Reverse biased

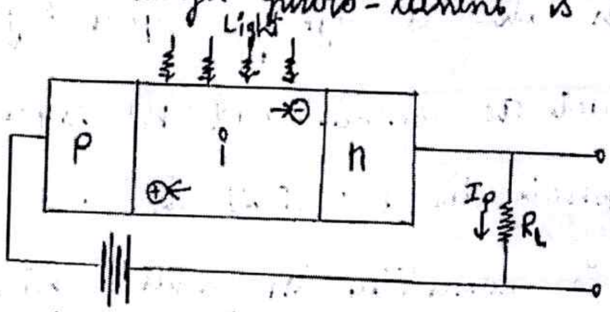
→ Under reverse biased condition, the depletion region could extend through the intrinsic region

→ Entire intrinsic region is free of charge carriers, so the intrinsic layer widens the depletion region and therefore increase area available for capturing light

→ When the light incident on this depletion region electron-hole pair are generated

→ High electric field into the region separates the charge carriers to move across the reverse biased junction, this gives rise the current flow in the external circuit

→ The depletion region is wide enough, most of the photons are absorbed and larger photo-current is produced



→ ~~Characteristics of PIN-photodiode~~ Advantages :-

① Low capacitance

② High breakdown voltage

③ sensitive to photodetection

④ Carrier storage

→ Applications :-

① High voltge rectifier

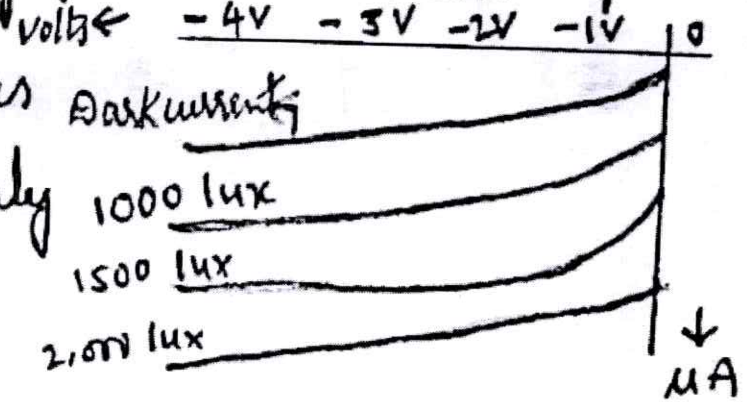
② RF swiches.

③ Photo detector

V-I Characteristics of photo diode

→ Reverse voltages are plotted along x-axis in volts and reverse currents are plotted along y-axis in microampere (μA)

→ When the light illumination increases reverse current is also increases linearly

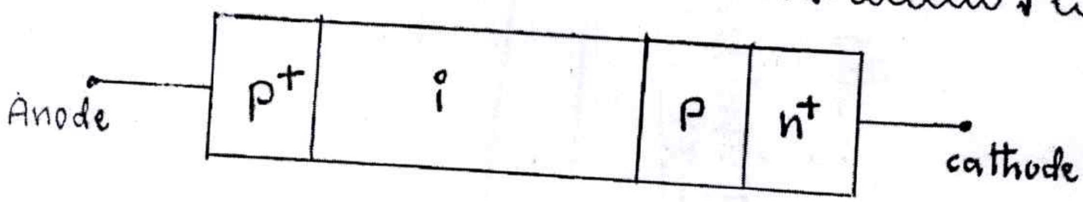


where; lux - unit of illumination

Avalanche photo-diode :-

Avalanche photo-diodes are high sensitivity, high speed semiconductor light sensors.

construction and working of Avalanche photo-diode :-



→ Avalanche photo diode is four layer device

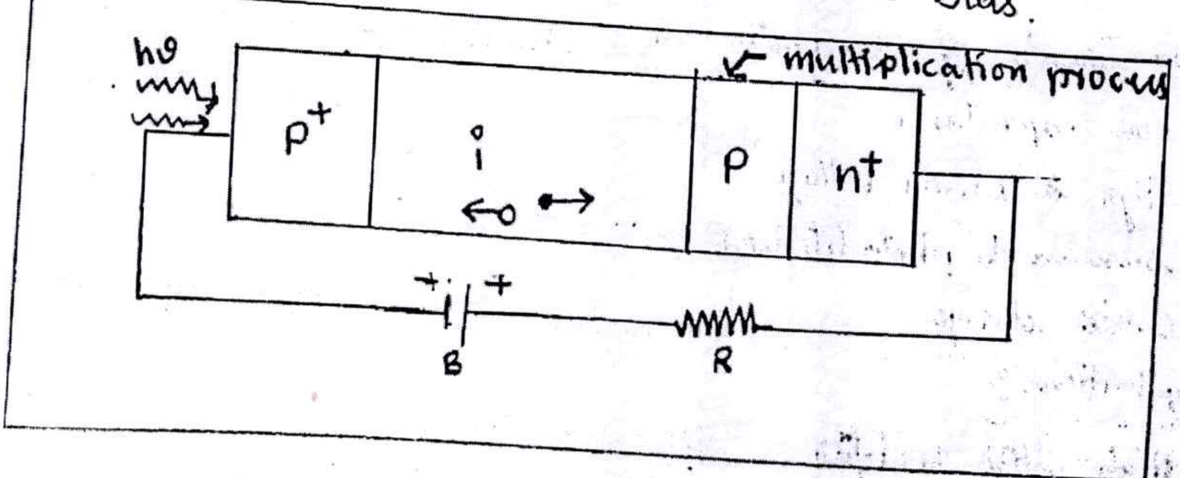
→ Here p^+ and n^+ regions are heavily doped due to this, there are very large no. of charge carriers are present and the resistivity is very low.

→ intrinsic (i) region is lightly doped region

→ p region is also a lightly doped region.

→ p^+ region act as anode and n^+ region act as cathode

→ Avalanche photo diode (APD) is act as photo detector, whenever it is connected in reverse bias.



→ When a light is incident on the p^+ region and after passing p^+ region it will enter into 'i' region.

→ Because of diode is reverse biased condition desplation region is widen.

→ light interact with semiconductor atoms of i region, then electron-hole pairs are generated.

→ these generated electron-hole pairs will experiences a very high electric field, so that electrons are drifted towards p-side region and holes are drifted towards the p^+ region.

→ The drifted electrons towards p-side region again experiences the high electric field ~~in~~ in between p and n^+ region

→ These drifted electrons can able to liberate the secondary electrons which are present in p and n^+ region

→ Generated secondary electrons get sufficient energy to liberate the one more pair of electron and hole

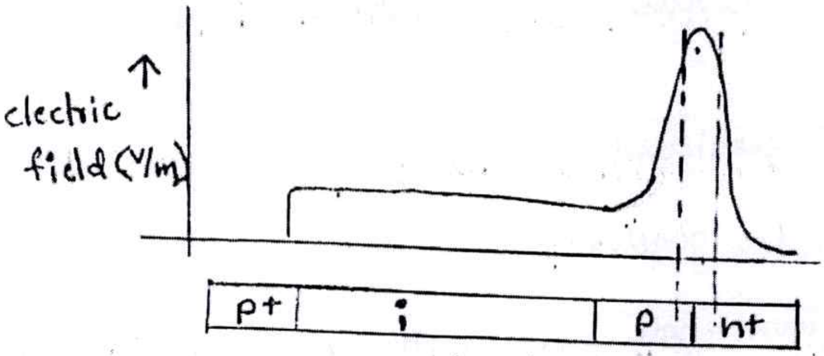
→ So, in this way electron-hole pairs will generated by Multiplication process this is known as Impact ionization

→ Multiple charge carriers are generated through Impact Ionization in the P and n^+ region.

→ In the process of impact ~~eno~~ ionization only electrons are participate and holes are drifted towards p^+ region.

→ Generated photo current is given by

$\boxed{I_p = q \cdot N e^{M}}$ where M - Multiplication process.



* Applications :-

① → Due to its high sensitivity. It can ~~defect~~ detect light having very low intensity.

② → High responding time. therefore high gain mechanism

③

* limitations (or) Disadvantages :-

① It requires very high voltage to operate

② Output is not linear due to avalanche process.

③ It will produce higher level of noise.

Solar cell :-

→ solar cell is the semiconducting device, which converts light energy into electrical energy

→ solar cell is works on the principle of "Photo-voltaic effect". hence it is also called as 'Photo-voltaic cell'.

→ In the solar cell, light source is not ~~ness~~ necessorily sun light, it can be used. lamp light (or) any artificial light.

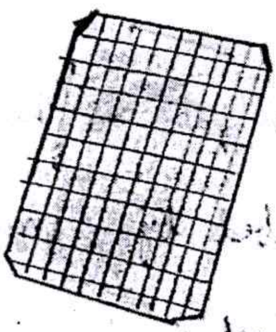
Material of solar cell :-

→ The most prevalent bulk material for solar cell is crystalline silicon and it is known as solar grade silicon

→ The thin-film technology reduce the amount of material required

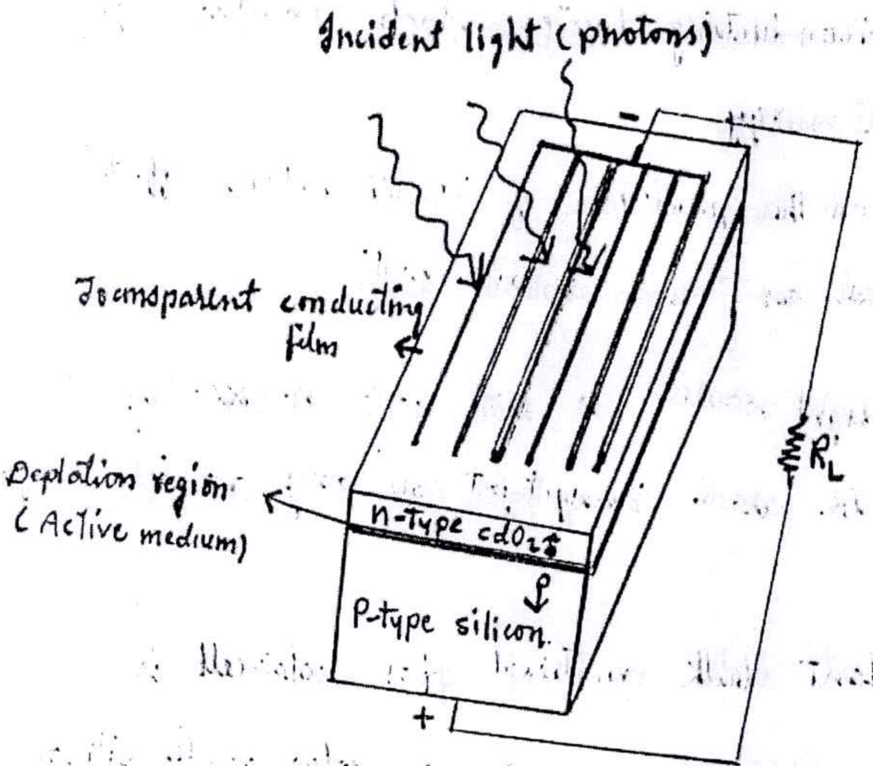
→ Cadmium Telluride [CdTe], copper indium gallium selenide (CIGS) and amorphous silicon (A-Si) are the three thin film technologies to create active material of solar cell.

→ Cadmium Telluride (CdTe) is most cost compare to other technologies



Solar panel

* construction of solar cell :-



Circuit diagram of solar cell

circuit symol of solar cell

→ A solar cell is basically a junction diode in which a thin n-type of cdO_2 is in contact with thick p-type of silicon layer.

→ n-type of layer is protected by transparent conducting film made by glass.

→ upper and lower surfaces of solar cell are in contact with two electrodes

* Working of solar cell :-

→ When the sun light is fall on the solar cell, photon's of energy $E = h\nu$ is absorbed by semiconducting material like silicon coated panel.

→ Those photons are reached the depletion region around the junction.

→ Then, the photons collide with the atoms, so that the electron-hole pairs are created.

→ The electric field across the depletion region forces the electrons to move towards n-side, where the holes are moved towards p-side.

→ There will be a potential differences between these two sides and the solar cell acts as small battery.

* Advanteges of solar cell :-

→ The first commertial use of solar cells nearly 50 years ago, was powering communication ~~satt~~ satellites in near earth orbit.

→ Today solar cells are using in personal electronic devices such as watchs, caliculators, computors and laptops etc. in homes and factories

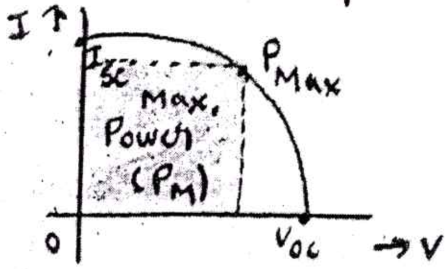
→ It is a polution free energy.

→ solar cells provides energy when and wherever we need it

→ It is highly scalable to match our electrical demond.

→ They are reliable and easy to maintain

* V-I characteristic of solar cell :-



Here - V_{oc} - Open circuit voltage (At 'o' current)

I_{sc} - short circuit current (Voltage across the cell is zero)

P_M - Maximum power

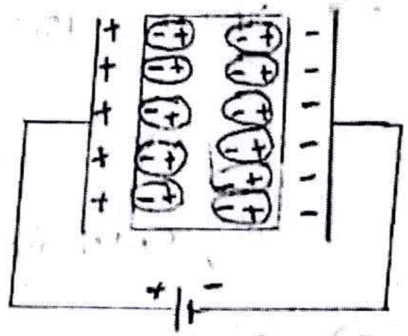
Dielectric Materials :-

→ Dielectrics are insulating materials

According to the band theory of solids insulating materials have large energy gap between valance band and conduction band and they donot have free electrons.

Eventhough, there are no free electrons in an insulators they exhibits enormous behaviour in an applied electric field (E) called dielectric polarization and such insulators are known as "dielectrics"

Ex :- Glass, mika, Polymers, oil and papers.



UNIT-III

Dielectric materials

Basic definition :-

permittivity :- Ability of a material to polarize in responds to the field

Dielectric constant :-

→ The dielectric characteristics are determined by dielectric constant.

→ dielectric constant is also called 'Relative permittivity'

and it is represented by 'ε_r'

"It is defined as the ratio between permittivity of medium and permittivity of free space"

$$\boxed{\varepsilon_r = \frac{\varepsilon}{\varepsilon_0}}$$

* polarizability :- It is a relative tendency of a charge distribution

→ it is represented by 'α'

→ The average dipolemoment of a system is proportional to the electric field applied

$\mu \propto E$

$\mu = \alpha E$

where - α - polarizability.

* Electric susceptibility (χ) :-

The electric susceptibility (χ) of a material is a measure of how easily it polarize in ~~respond~~ response to an electric field

$$\boxed{\chi = \frac{P}{E}}$$ where P- Dielectric polarization density.

* Non-polar dielectrics :-

Molecule which do not possess a permanent dipole moment. Molecules He, Ne, Ar, & Xe are Nonpolar and Molecules consisting of Two identical atomes

Ex: H_2, N_2, Cl_2 are nonpolar. Because they have same electronegative value.

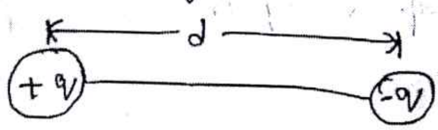
* Polar dielectrics :-

Molecule which have permanent dipole moment.

Ex :- HF because it has unequal covalent bond.

* Electric dipole :-

A system of consisting two equal and opposite charges separated by a distance is called "electric dipole".



dielectric polarization :-

When a dielectric is placed in an electric field, electric charges slightly shift from their average equilibrium positions and is known as dielectric polarization.

Types of Polarization :-

Dielectric polarization is classified into 4 basic types.

① Electronic polarization :

② Ionic polarization

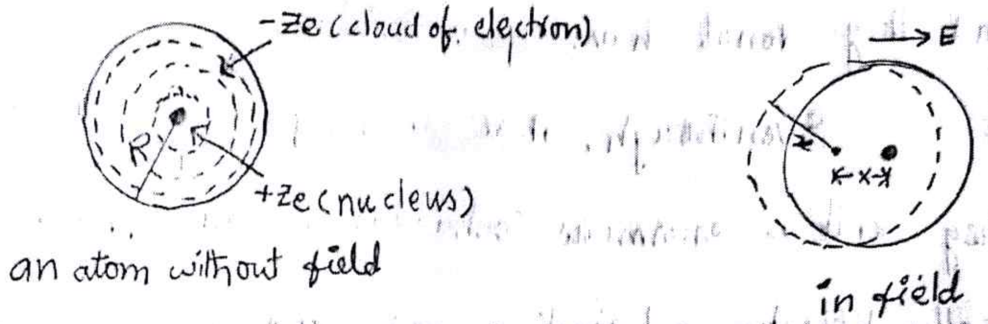
③ Orientation or dipolar polarization.

& ④ space-charged polarization

① Electronic polarization :-

→ When an atom placed inside an electric field, the centre of the positive charge (nucleus) is displaced along the applied field direction, while the centre of negative charge is displaced in opposite direction, thus the dipole is created.

→ When a dielectric material is placed inside an electric field such dipoles are created in all the atoms known as electronic polarization.



→ When electric field is applied Lorentz force is acting i.e, it tend to separate nucleus and electron cloud of atom from their equilibrium position

→ But coulumb attractive force tend to maintain the original position.

→ negative charge density of an atom of radius R is

$$\rho = \frac{-Ze}{\frac{4}{3}\pi R^3} \rightarrow ① \text{ (is doesn't change)} \qquad \left(\rho = \frac{\text{charge}}{\text{Volume}}\right)$$

Total charge in the sphere is

$$Q_e = \frac{4}{3}\pi x^3 \rho$$

from ①

$$Q_e = \frac{4}{3}\pi x^3 \left[\frac{-Ze}{\frac{4}{3}\pi R^3}\right]$$

$$Q_e = -Ze\left[\frac{x^3}{R^3}\right] \longrightarrow ②$$

Total positive charge of atom of radius x is

$Q_p = +Ze$

Coulumb's attractive force between nucleus and electron cloud which are separated by 'x'

$$F_c = \frac{1}{4\pi\epsilon_0} \frac{Q_e Q_p}{x^2}$$

$$F_c = \frac{1}{4\pi\epsilon_0} \frac{-Ze\left(\frac{x^3}{R^3}\right)(Ze)}{x^2} \Rightarrow \frac{-Z^2e^2x}{4\pi\epsilon_0 R^3}$$

Lorentz force b/w nucleus and electron cloud is

$$F_L = qE = -ZeE$$

At equilibrium

$$F_c = F_L$$

$$\cancel{-}ZeE = \frac{\cancel{-}Z^{\cancel{2}}e^{\cancel{2}}x}{4\pi\epsilon_0 R^3}.$$

$$E = \frac{Zex}{4\pi\epsilon_0 R^3} \rightarrow (3)$$

induced dipole moment

$$\mu_{ind} = Zex$$

interm of Polarizability

$$\mu_{ind} = \alpha_e E$$

$$E = \frac{Zex}{\alpha_e} \rightarrow (4)$$

from (3) & (4)

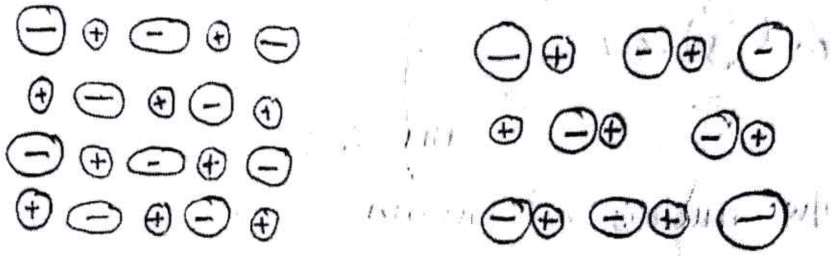
$$\boxed{\alpha_e = 4\pi\epsilon_0 R^3}$$

→ Electronic polarizability is depends on the volume of atom and independent on the temperature.

② Ionic polarization :-

Ionic polarization is caused by relative displacements between positive and negative ions in ionic crystal.

Ex: NaCl



No electric field   In field

→ Induced dipole moment is proportional to the applied field

$$\mu_i = \alpha_i E \quad ; \alpha_i - \text{Ionic Polarizability}$$

→ Ionic polarization is given by $P_i = N\alpha_i E$

$$P_i = \frac{Ne^2}{\omega_0^2}\left[\frac{1}{M} + \frac{1}{m}\right]E$$

m - masses of +ve ions

M - masses of -ve ions.

ω - angular velocity

→ Ionic polarization takes 10^{-11} to 10^{-14} s to build up

→ Ionic polarization is Independent of temperature.

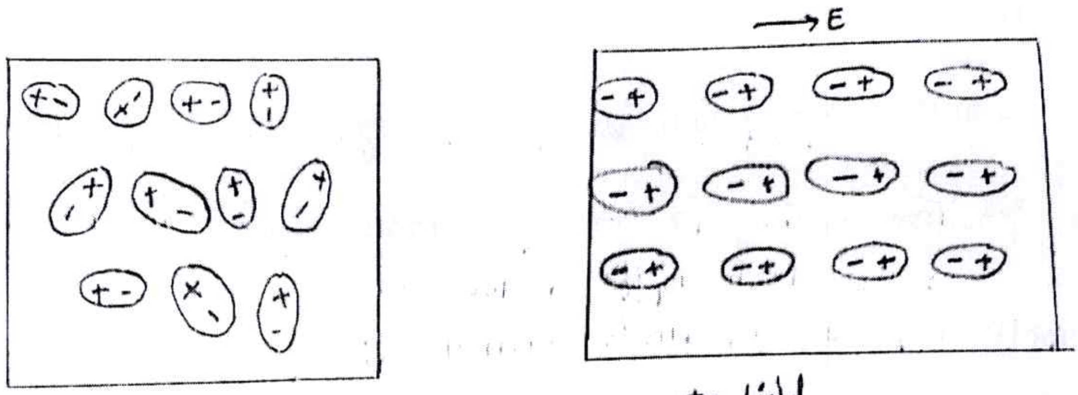
③ Orientation (or) dipolar polarization :-

The phenomenon in which polar substance the presence of electric field produces, alignment of polar substances in the direction of applied field.

→ In the absence of 'E' the orientation of dipole is random. In the presence of 'E' dipoles are align in the field direction.

→ Orientation polarization is strongly depend on temperature.

→ The build up time is about 10^{-10} s. or more.



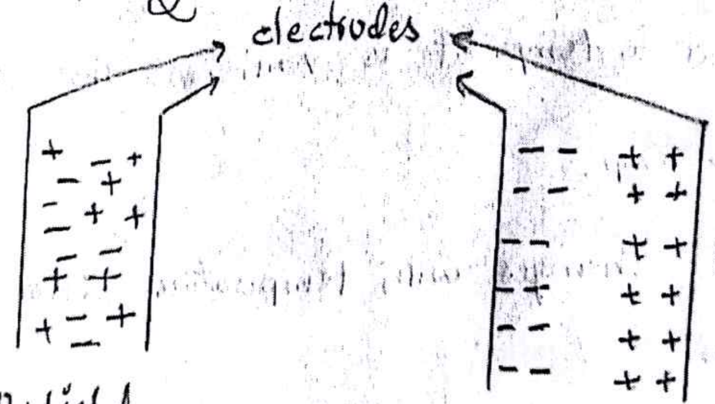
no field   In field

(4) space-charged polarization :-

→ space-charged polarization occurs due to the accumalation of charges at the electrodes.

→ this type of polarization occurs in heterogeneous dielectric materials.

→ space-charged polarization is also known as interfacial (or) Migrational polarization.



no field   in field

Ferroelectric materials:-

→ The dielectric materials which are exhibits spontaneous polarization in the absence of electric field. the phenomenon is called ferro-electricity effect. those material are called ferro electric material

→ All ferroelectric materials exhibits piezoelectric effect due to lack of symmetry.

→ It is also behaves pyroelectricity at strong electric field

→ Ferroelectricity was first discovered in Rochelle salt at a range of temperature of $-18°C$ to $22°C$.

Ex:- Barium Titanate ($BaTiO_3$), lead titanate ($PbTiO_3$)

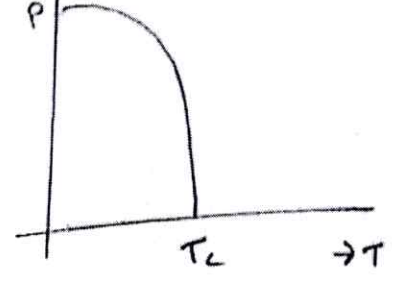
properties of ferro-electric material:-

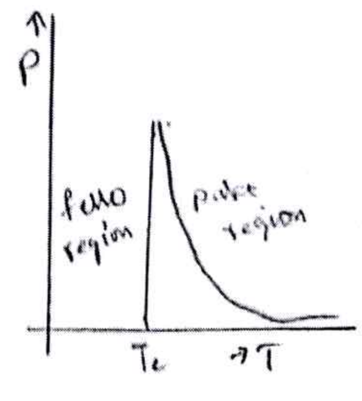
→ All ferroelectric materials posses spontaneous polarization below a certain temperature.

→ As the temperature increases the spontaneous polarization decreases and at a temp. it is vanishes. this temperature is known as Curie temp.

→ dielectric constant changes with temperature known as curie-weiss law.

$$E_r = \frac{C}{T-T_c}$$ C - Curie constant. T_c - Curie temp.





Applications of Ferro-electric material :-

① Thin film of the ferroelectric materials are used in non-volatile memory (RAM), RFID tags and optical waveguides etc.

② Making use of piezo-electric property, ferro-electric materials such as quartz, lithium niobate, barium titanate etc are used to make pressure transducers, ultrasonic transducers and microphones

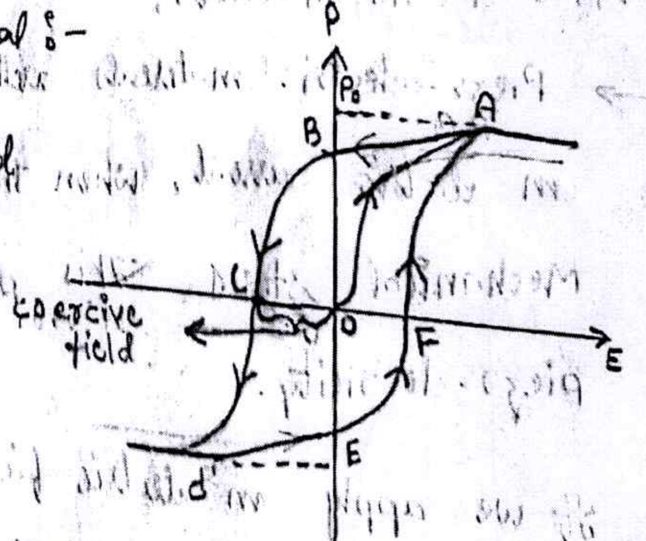
③ Pyroelectric materials such as barium titanate, lithium niobate and polyvinyl fluride are used to make high sensitive IR detectors

④ Ferroelectric semiconductors such as $BaTiO_3$, $SrTiO_3$, $BaTiO_3 - PbTiO_3$ and $SrTiO_3 - PbTiO_3$ are used to make posistors (which are used to measure and control temperature).

⑤ Ferro-electric ceramics are used in the manufacturing of capacitors to store electric charge in electrical / electronic circuits

* Hysterisis of a ferro-electric material :-

when an electric field is applied to the ferro-electric material "The polarization in the ferro-electric material always lags behind the applied electric field" is known as hysterisis of a ferro-electric material.



→ When applied electric field is increase, the polarization of ~~ferromagnetic~~ electric material is also increases rapidly after getting its maximum (At point A) then remains constant.

→ the Maximum polarization is called saturation point (P_0).

→ If the electric field is reduced back to zero, polarization will not travel in the initial path, create a new path and reaches to point B at zero electric field. called remanent polarization.

→ To reduced remanent polarization to zero, negative field to be applied. required negative field to remanent polarization becomes zero known as coercive field (-E).

→ If further negative field is increase, negative polarization takes place and reaches to its negative saturation and then remains constant.

→ If same cyclic process complited then DEFA curve will aptained.

→ the space occupied by Hysterisis is called Hysterisis loss that occurs in dielectric material.

* Piezo-electric materials:-

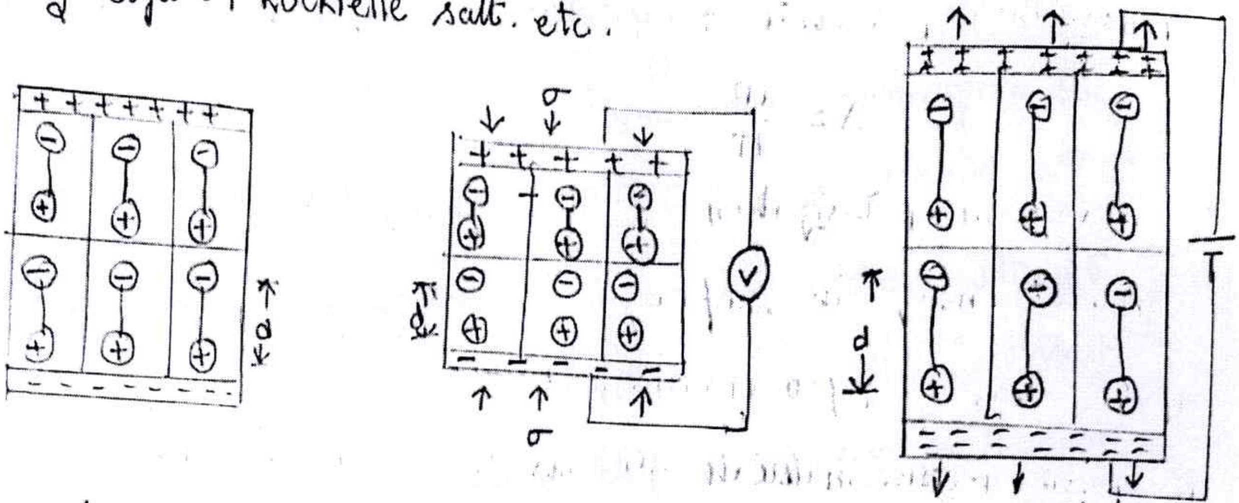
→ Piezo-electric materials are the materials that produce an electric current, when they are placed under Mechanical stress. This property is known as piezo-electricity.

→ If we apply an electric field current to these materials, then the materials become strained called inverse piezo-electricity

Scanned with OKEN Scanner

→ The shape of the material is change slightly (Max 40%)

Ex:- Quartz crystal, Rochelle salt. etc.



Applications of Piezo-electricity :-

→ Single crystal of quartz is very widely used for filter, resonator and delay line application.

→ Rochelle salt is used as transducers in gramophone pick-ups, ear phones, hearing aids, microphones, etc.

→ $BaTiO_3$, $PbTiO_3$ are used for high voltage generation, accelerometers transducers etc.

→ Piezo electric semiconductors such as GaS, ZnO and CdS are finding applications as amplifiers and of UV waves

→ Piezo-electric materials are widely used in scientific and industrial applications.

Pyro-electricity :-

Pyro-electric effect is the change of spontaneous polarization when the temperature of the specimen is changed

→ The Pyro-electric co-efficient (λ) is defined as the change in polarization per unit temperature change of the speciman

$$\lambda = \frac{dP}{dT}$$

→ change in polarization results change in external field and hence charge in surface

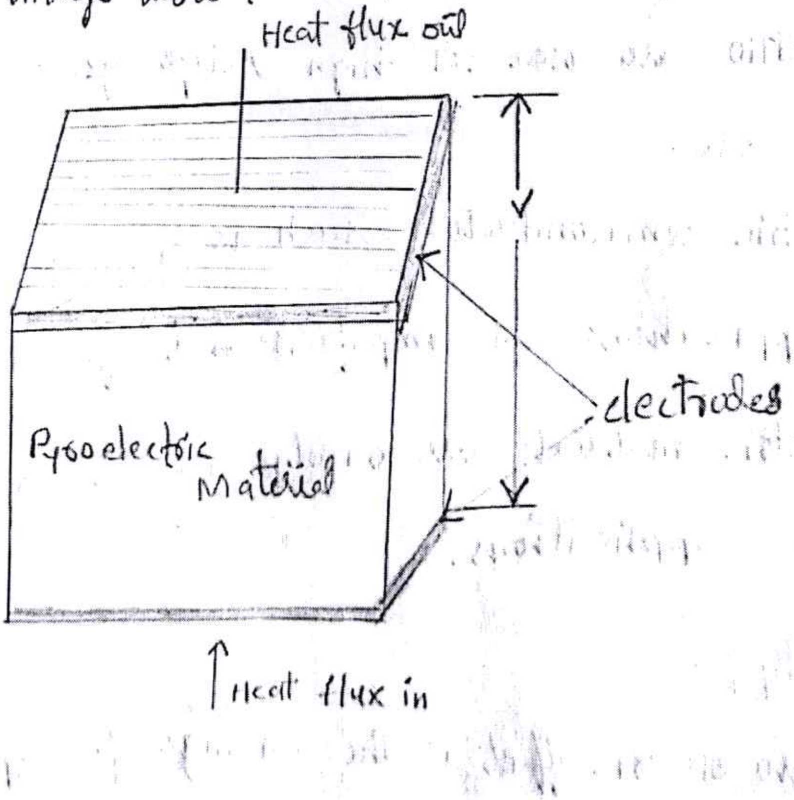
Applications of pyro-electric materials :-

① pyro-electric materials are used to make intruder - alarms.

② Fire alarms are ~~created~~ works on the principle of pyro-electric effect.

③ Pyro-electric detector can be used for radio metry

④ $NaNO_2$ and PZT ceramics are used in the construction of pyro electric image tubes.

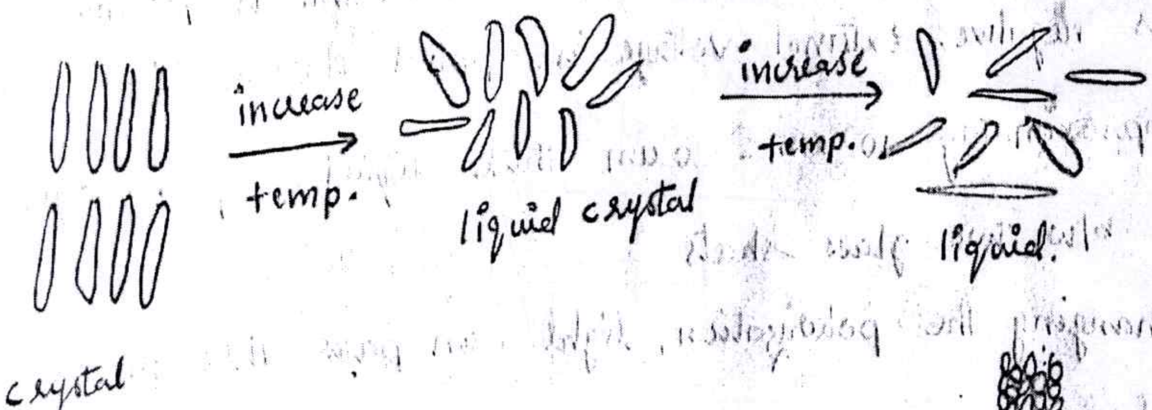


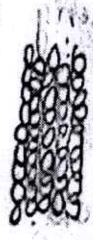
Liquid Crystal :-

→ In crystalline solids the molecules are aquire some position and orientation about an order. In an isotropic liquid the molecules are distributed randomly without any direction.

→ Liquid crystals are the substances which are exhibits the intermediate state of matter, whose properties are in between those of fluids and those of solid crystal at the same time

→ Liquid crystal may flow like a liquid, but its molecules may be oriented in a crystal-like way, they are also called "mesophases"





Nematic form

LCD's (Liquid Crystal Displays)

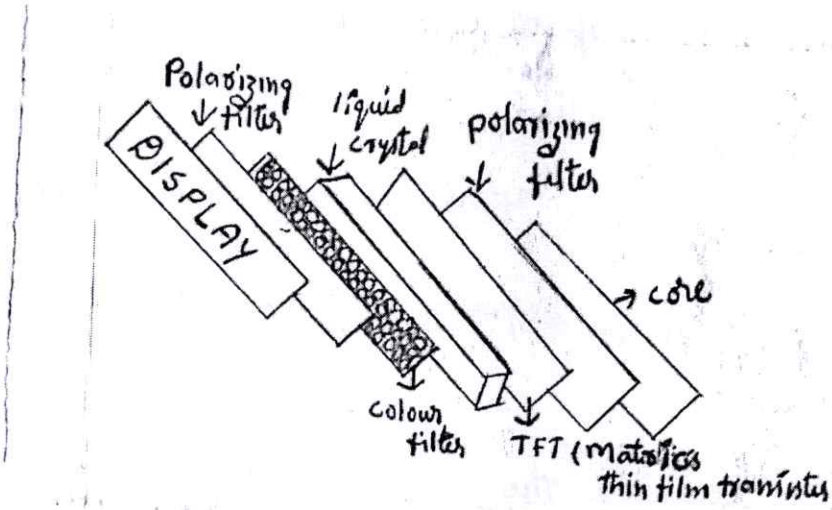
→ LCD's are light volves i.e a device for varying the quantity of the light from the source which reaches the screen.

→ LCD's are not light producers but they are light modifiers

→ LCD's are uses liquid crystal to produce a visible image

→ The twisted nematic and super twisted nematic effects are most widely used among all the LCD's

* construction of LCD's



> LCD consists of two polarized glass pieces

→ Two Indium-tin-oxide electrodes are used, one is positive and other is negative, external voltage is applied to LCD through these electrodes

→ An approximately 10 um - 20 um thick liquid crystal layer is placed b/w two glass sheets

→ By changing the polarization, light can pass through or be blocked

Working of LCD:-

→ LCD screen works on the principle of blocking light rather than emitting light.

→ LCD's are produces images when external light passes from of one polarizer to the next polarizer

→ The indium oxide conducting surface is a transparent layer which is placed on both sides of the ~~selected~~ sealed thick layer of liquid crystal.

→ Thus the no disturbing of the molecular arrangement when no external bias is applied

→ When the external bias is applied molecular arrangement is disturbed and conducting segment looks dark and other segment looks clear

→ In the positive LCD display the segments are dark and background whight. Polarizers are placed perpendicular to eachother

→ In the negative LCD display the segments are white and background is dark and the polarizers are ~~alighned~~ aligned eachother

* Applications :-

1) → Used in digital wrist watch

2) Digital images in digital cameras.

3) Used in numerical counters

4) Display screens in calculators

5) Mainly used in telivisions

6) Used in mobile screen

7) Used in vidio players

8) Used in image sensing circuits.

* Advanteges :-
1) It is thin and compact
2) Low power consumption
3) Less heat emitted during operation
4) Low cost

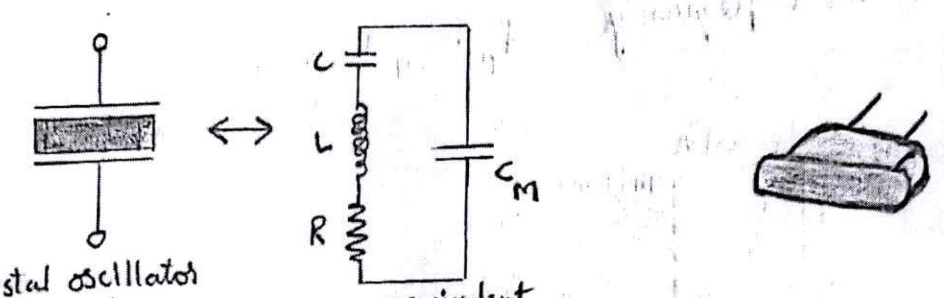
* Disadvanteges :-
i) Speed of operation is low
ii) Life span is less
iii) Restricted viewing angles.

→ Quality factor :- (or) 'Q' factor
→ Quality factor discribes how much an oscillator is underdaped.
→ It is defined as the ratio of the initial energy stored in the resonator to the energy lost in one radian of the cycle of oscillation
→ Higher 'Q' factor means slower oscillations and lower energy loss.

* Crystal oscillator :
→ Tuned circuits (LC (or) RC oscillators) are used for generating the frequencies from audio to RF range, but by using LC or RC oscillators frequency is not stable because it change when change in temperature, power supply voltage and slight change in component value

→ for high level of frequency stebility because of very high quality factor. we can used ~~quality factor~~ crystal oscillators in place of tuned circuits so that crystal oscillators are used as electrical resonant circuit.

Working principle :-



Coystal oscillator symbol

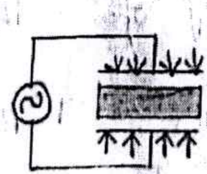
equivalent circuit

where C_M → capacitance of mounted electrode (shunt capacitance)

→ Crystal oscillator works on the principle of inverse piezoelectricity.

→ Crystal oscillators are made up of piezo-electric materal.

" Whenever some external voltage is applied to certain material then they produce the mechanical deformations".



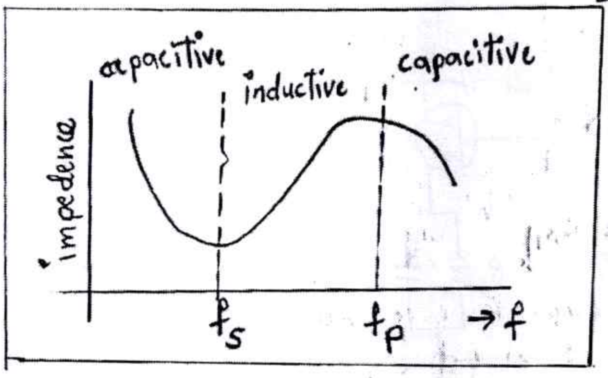
So. suppose if we apply the AC signals of particular frequency then these materials starts vibrating at the same frequency this effect known as 'inverse piezo-electricity'

→ Because of the shunt capacitor exist, the crystal has Two resonent frequencies.

i) Series resonant frequency (f_S) with low crystal impedence (effective resistance)

$$f_S = \frac{1}{2\pi\sqrt{LC}}$$

ii) Parallel resonant frequency $f_p = \frac{1}{2\pi}\sqrt{\frac{1+C/C_M}{LC}}$



As shown in the graph

→ At the series resonant frequency, the impedence, ~~the impedtr~~ offered by the crystal ~~with~~ will be minimum

→ At the parallel resonent frequency the impedence offered by the crystal is maximum

→ To stabilize the frequency of oscillator, the crystal may be operated at either series or parallel resonant frequency

→ It appears that f_p is higher than the f_s

→ Frequency is also depend on the thickness of the crystal.

i.e Frequency $\propto \frac{1}{\text{thickness}}$

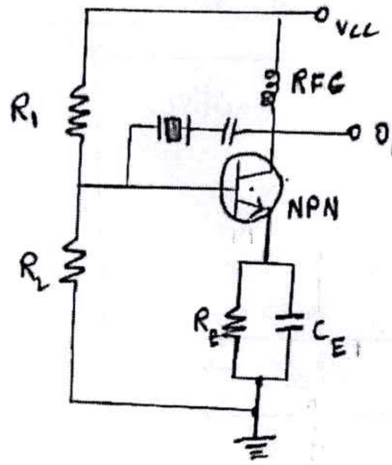
Operation of crystal oscillator :-

The operation can be studies as.

i) crystal operation in the series - resonant mode

ii) crystal operation in the parallel - resonant mode

i) crystal operation in the series- resonant mode :-



crystal operating in series mode.

→ In this series - resonant mode, transister (NPN) is used as an amplifier

→ Feedback is provided in the circuit from the collector to the base terminal

→ At series resonant, the impedente that is offered by the crystal will be minimum.

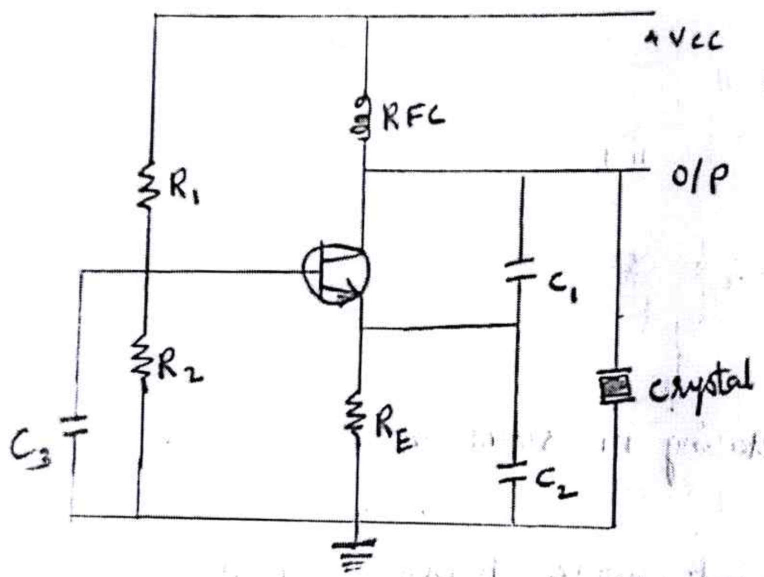
→ the feedback which is provided from the O/P to the I/P side will be maximum.

→ this circuit is commonly known as the pierce crystal. the resulting circuit frequency of oscillations is set by the series resonant frequency of crystal.

→ variations in the supply voltage, transistor parameter etc have no effect on the circuit's operating frequency, which is stabilized by the crystal.

→ Crystal frequency stability sets the circuit frequency stability which is good.

ii) Crystal operation in the parallel - resonant mode :-



crystal operating in parallel mode

→ Whenever the crystal is used in parallel resonant mode that it is operated between series and parallel resonant frequency

→ It is act as the inductor in the given circuit, so in the place of inductor we can use crystal in parallel resonant mode

→ The oscillator circuit with crystal operating resonant mode is act as modified Colpitt's oscillator

→ Combination of C_1 & C_2 and the crystal will act as LC circuit.

→ C_1 & C_2 are provide the frequency selectivity which is required for the given circuit.

→ Capacitor C_3 provides the AC short circuit across R_2 to ensure that the resistor transistor base remains at a fixed voltage level

→ The crystal parallel with C_1 & C_2 permits max. voltage feedback from the collector to emitter

→ The resultant feedback voltage is too small to sustain oscillations.

→ At the parallel frequency of the crystal, the oscillation frequency slebilized.

(iii) Advantages of a crystal oscillator :-

→ The circuit is very simple, since it does not require any tank circuits other than the crystal itself.

→ The frequency of oscillation can be changed by simple replacing one crystal with another.

→ The Q-factor is very high. The Q-factor of a crystal may range from $10^4 - 10^6$ whereas the L-C circuit may have a Q-factor only of the order of 100.

→ Most crystals will maintain frequency drift to within a few cycles at 25°C. A thermostatically controlled crystal oven is often used to ensure greater frequency stability by containing the crystal in an insulated enclosure. Therefore it is possible to achieve frequency drifts of less than 1 part in 10^{10}.

→ A crystal oscillator is compact and inexpensive.

(iv) Disadvantages of a crystal oscillator :-

→ The crystal oscillators have a very limited tuning range (or not at all). They are used for frequencies exceeding 100 KHz.

→ The crystal oscillators are fragile and, therefore, can only be used in low power circuits.

→ Crystals of low fundamental frequencies are not easily available. The frequency of oscillations cannot be changed appreciably.

(v) Application of crystal oscillator :-

→ The crystal oscillators are used in radio and TV transmitters

→ It is used as a crystal clock in microprocessors.

→ It is used in the frequency synthesizers.

→ It is used in special types of receivers.

* Magnetism :-

→ When the charges are moving, they can produce magnetic field. Where as a static charge can only produce electric field and it can not produce Magnetic field.

→ But permanent magnets exhibits magnetism due to atomic currents formed by the orbital rotation of electrons around nucleus and due to spin motion of electrons.

* Magnetic field :-

The space around a magnet in which magnetic properties can be detected. is called magnetic field.

Magnetic flux :-

The no. of magnetic lines passing through a given normal area is called magnetic flux (ϕ)

units – webers. (volt / s)

* Magnetic induction (or) Magnetic flux density (B) :-

The no. of magnetic lines passing through unit area perpendicular to the surface is called magnetic induction (or) magnetic flux density

$$B = \frac{\phi}{A} = \frac{\text{Magnetic flux}}{\text{area}}$$

units : weber/m^2 (or) N/A-m (or) Tesla

C.G.S - Gauss (10^4 Gauss = 1 Tesla)

* Magnetic Intensity (or) Magnetising force (H) :-

→ The force experienced by a unit north pole placed at a point in the field.

→ The amount to which magnetic field can magnetise a material is expressed by a physical quantity called magnetising force. It is a vector quantity.

$H \propto B$ (or) $H = \frac{1}{\mu} B$

$B = \mu H$ (in medium)

$B = \mu_0 H$ (in vaccume)

→ H does not depend upon medium of material

units : A/m

in CGS - Oersted.

* Magnetic permeability (μ) :-

→ The property of the medium to alow magnetic lines of force through it is called permeability (μ)

→ permeability is defined as the ratio of magnetic flux density to magnetising force

$$\mu = \frac{B}{H}$$

units : Henry/meter

Relative permeability (μ_r)

$$\mu_r = \frac{\mu}{\mu_0}$$

→ permeability in vaccume $\mu_0 = 4\pi \times 10^{-7}$ Henry/meter.

* Intensity of magnetization (I) :-

→ Magnetisation refers to the process of converting a non-magnetic sample

→ Intensity of Magnetisation is the measure of magnetisation of a magnetized sample

→ It can be defined as the magnetic moment per unit volum

$$I = \frac{M}{V}$$

M- magnetic moment $= m \times 2l$; here m- pole strength

2l - magnetic length

let, M is total magnetic moment of the volume 'V' then

A - area of cross-section

$$V = A \times 2l$$

units : ampere/meter ([redacted]) ; oersted (C.G.S

* Susceptibility (χ) :-

The ratio of intensity of magnetisation (I) to magnetising force (H) is called susceptibility (χ)

$$\boxed{\chi = \frac{I}{H}}$$

If H = 1 oersted $\Rightarrow \chi = I$

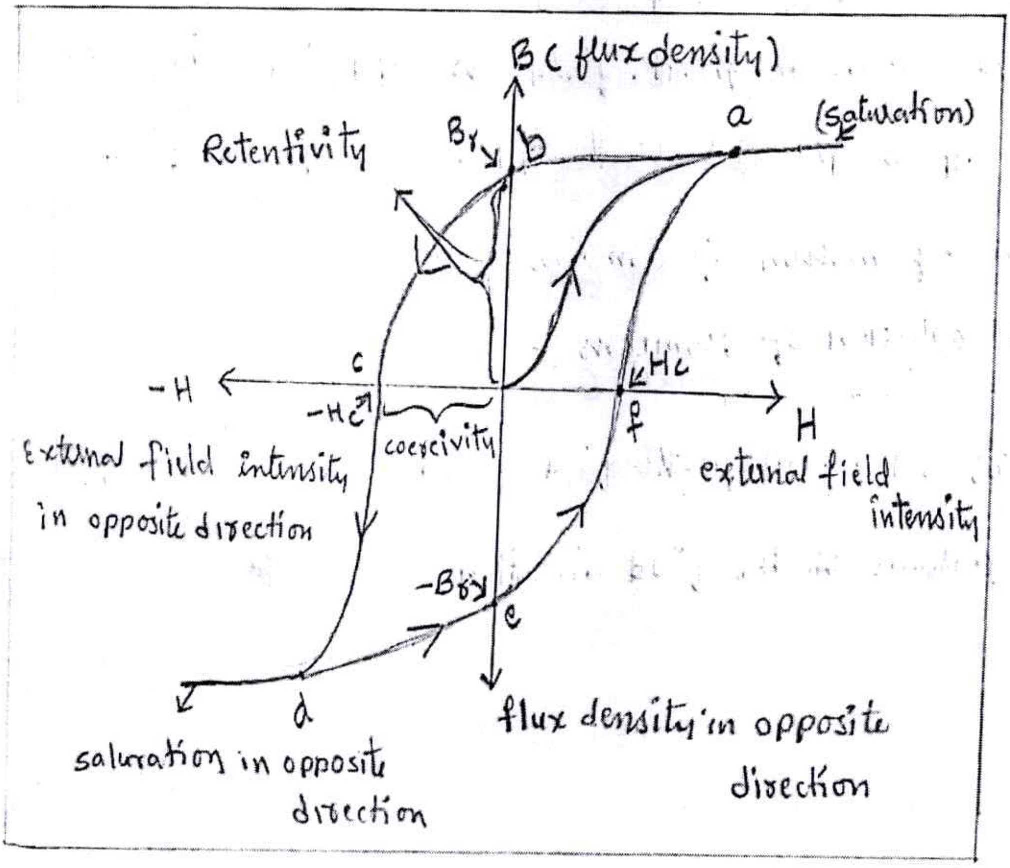
→ no units and no dimensions

* Hysteresis :-

"The lagging of ~~intensity~~ ~~of~~ magnetic intensity (B)/ magnetising force (H) behind the intensity of magnetic field (B)."

→ There are certain materials like Fe, Co, Ni and certain alloys of these materials which exhibit high degree of magnetization

→ Below the ferro magnetic curie temperature ferromagnetic materials exhibit the hysteresis in the B versus H curve as shown in diagram.



→ when the field intensity (H) is increased from zero, the ~~intensity~~ ~~of~~ flux density (B) is also ~~is~~ ~~also~~ increases proportiona-lly.

→ Further increasing the value of H, the value of B is saturated at a point a. i.e B is constant.

→ Then decreasing the value of H, the B value is also decreased, but at point b, the external field intensity (H) is zero (H=0) but B ≠ 0 and this value of magnetic induction is called residual magnetism (or) retentivity (B_r)

→ Retentivity of the material is a measure of remaining magnetic flux in the material when the magnetic field is removed.

→ When sufficient negative field is applied residual magnetisation (B_r) become zero. This value of magnetic intensity is coercive field ($-H_c$) at point "c".

→ Coercive field (or) coercivity ($-H_c$) of the material is a measure of required external field intensity (H) to destroy retentivity

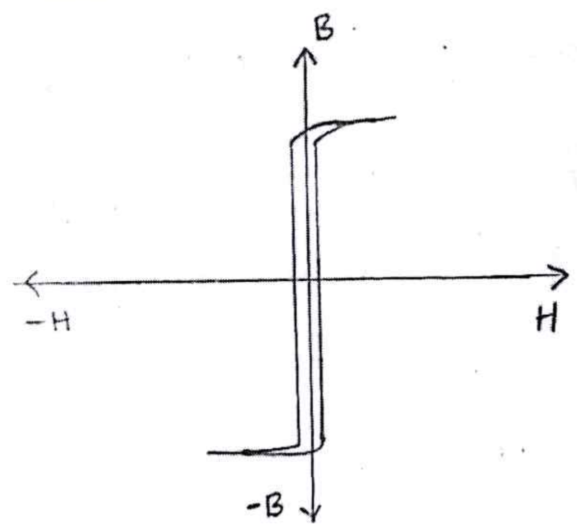
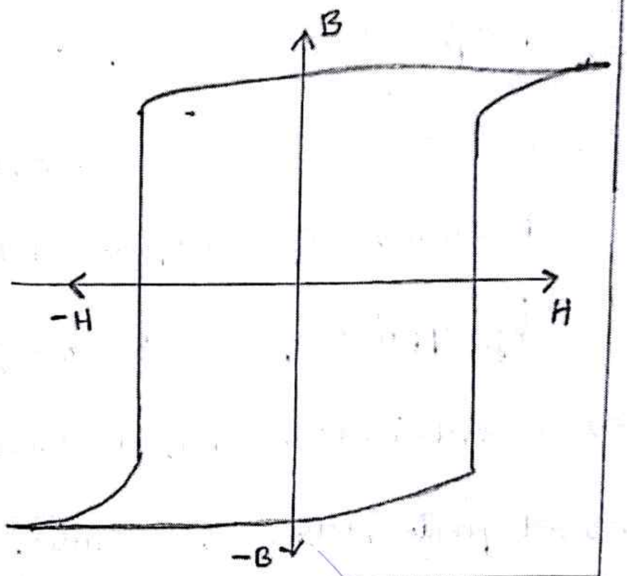
→ Further, if negative magnetic field is applied, B is increases in negative direction and reaches to it maximum value then constant this is known as negative saturation at point d.

→ Then, if negative field is decreased back to zero and increases from zero as shown in diagram, the curve 'defa' is obtained.

→ The path traced by this B-H plot is called Hysteresis loop.

→ The area covered by loop is known as "Hysteresis loss." in the form of Heat.

* Soft and Hard Magnetic Materials :-

Soft Magnetic Material	Hard Magnetic Material
1. soft magnetic materials are those that we can be easily magnetize and de-magnetize	1. Hard magnetic materials are those that are dificult to magnetize and de-magnetize
2. Hysterisis loop for these materials will be thin and long	2. Hysterisis loop for these materials is wide as shown in fig.
	
3. Hysterisis loss in the form of heat is less	3. Hysterisis loss in the form of heat is large
4. Magnetic permeability and Magnetic susceptibility are high	4. Magnetic permeability and Magnetic susceptibility are low
5. These are used in preparation of magnetic core material	5. These are used in preparation for permanent magnets
6. Applications :- soft magnetic materials used in Transformers, electric motors magnetic amplifiers, magnetic switching circuits, ~~Digital computers~~ etc	6. Applications :- Hard magnetic materials are used in digital computers, magnetic detectors, magnetic separators, magnetic tapes etc.
7. Ex :- pure iron, Alloys of Iron-silicon Iron-cobalt, Iron-nickel	7. ex :- Alnico [Alloy of Al, Ni, Co, Cu, Fe] Tungsten steel alloys, platinum cobalt-alloy. etc.

* Magnetostriction :-

→ The behaviour of ferro-magnetic material in which their dimensions and shapes are changed when they are magnetized is called magnetostriction.

→ ferro-magnetic material may either expand or compressed in the direction of applied magnetic field.

→ When external magnetic field is removed, they will recover to its original dimensions

→ Magnetostriction was first discovered by Jemes P. Joule (1818-1819)

→ Magnetostriction has inverse effect also. i.e if the physical dimensions of magnetostrictive materials ~~&~~ are changed by applied field, a change in magnetization also occurs

→ E. Villari (1836-1904) discovered the opposite effect.

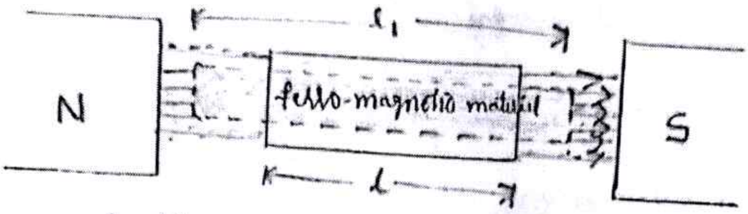
→ Magnetostriction is caused by the rotation of domains of ferro-magnetic material under the action of magnetic field.

→ Magnetostriction is calculated in terms of magnetostriction co-efficient(λ)

$$\boxed{\begin{aligned}\lambda &= \frac{\text{change in length}}{\text{original length}} \Rightarrow \frac{\delta l}{l} \\ \lambda &= \frac{l'-l}{l}\end{aligned}}$$

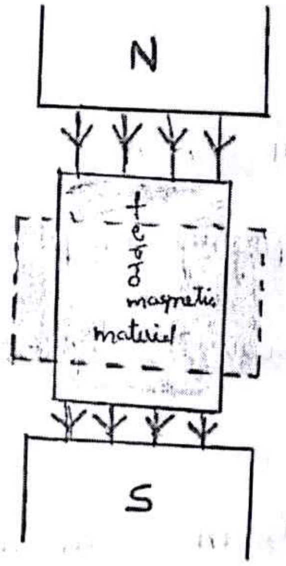
* positive magnetostriction :-

When ferro-magnetic material placed in external magnetic field, if the length of the magnetic material is increased then this is called positive magnetostriction



* Negative magnetostriction :-

When ferro-magnetic material placed in an external magnetic field, if the length of the magnetic material is decreased then this is called negative magnetostriction.



* Types of Magnetostriction :-

i) Longitudinal :- When change in the dimension is in the direction of applied field.

ii) Transverse :- When change in the dimension is in perpendicular to applied field

iii) Volume :- When change in the dimension is perpendicular as well as parallel to applied field.

* Applications of Magnetostriction :-

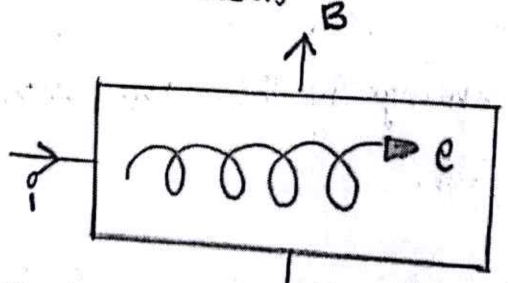
1) Magnetostrictive materials are used to create sensors that measure a magnetic field or detect a force
2) Magnetostrictive materials are used in medical devices and industrial vibrators. Ultrasonic cleaning devices, underwater ~~sensors~~ sonar, vibrations or noise control systems.
3) Magnetostrictive materials are used to generate audio-frequency oscillations.
4) Magnetostrictive transducers i.e. it converts electrical energy to strain in the material.
5) It is useful for under water projectors and sound detectors.

Magneto resistance :-

"It is a phenomenon in which the change of a material resistivity ~~of~~ a ~~substance~~ by applying magnetic field."

→ 1st Magneto resistance was discovered by William Thomson (Lord Kelvi in 1856.

→ Magneto-resistance is observe in semiconductor, non-magnetic and Magnetic materials



→ In a conductor (Iron) resistance is caused by the collision of electron or atoms. when we applied magnetic field, electrons are moving in a loop instead of linear so that.

the collision between the electrons (or) atoms increases as a ~~res~~ result resistance increases

→ Magnetic field and flowing current are parallel then the resistance increases to its maximum

→ Magnetic field and flowing current are perpendicular then the resistance is decreased.

→ This dependance of resistance on magnetic field is is called magnetoresistance.

→ When magnetic field increase, magnetoresistance increases

* Types of Magnetoresistance :-

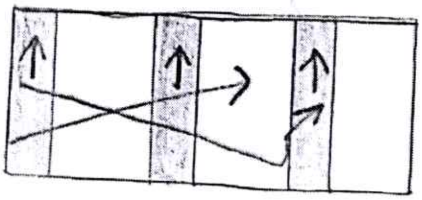
i) Giant Magnetoresistance

ii) Extraordinary Magnetoresistance

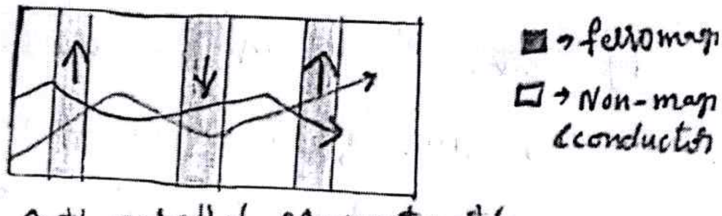
iii) Tunnel Magnetoresistance.

i) Giant Magnetoresistance (GMR) :-

→ Albert fert and peter Gruberg discovered GMR in 1988 They won Noble prize for discovering GMR in 2007.



Parallel Magnetization



Anti-parallel Magnetization

→ This effect was explained based on dependance of electron scattering on the spin orientation

→ GMR is a quantum mechanical magnetoresistance which observed in multilayers composed of alternating ferro-magne and non-magnetic conductive layers.

→ change in electrical Resistance is depends on whether the magnetization of adjacent ferro-magnetic layers are in parallel or in anti-parallel adjestment

→ For the parallel allignment the overall resistance is low and for anti-parallel allignment the overall risistance is high.

→ The magnetization direction can be controlled, by applying external magnetic field

* Applications:-

GMR used in

1) Magnetic field sensors, which are used to read data in hard disc drivers

2) GMR, Bio-sensors have bio-medical application

3) Micro-electromechanical systems (M.E M S) and other devices

4) GMR multilayer structures are also used in magneto-resistance random access memory (M RAM) as cells that store one bit of information

ii) Extraordinary Magnetoresistance (EMR):-

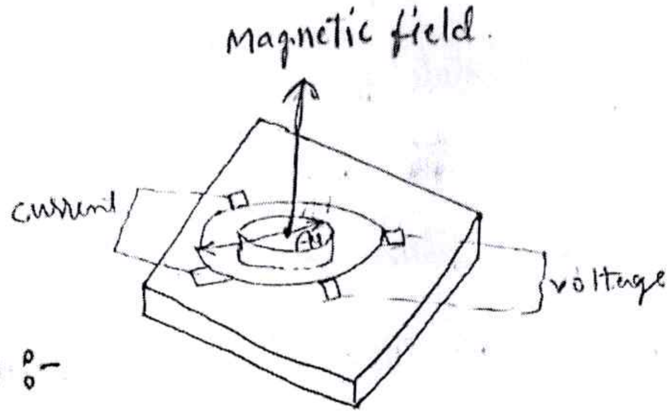
→ EMR effect is discovered in 2000.

→ The magnetic field effect of EMR is much greater than GMR

→ EMR effect occurs in semiconductor metal hybrid system when a transverse magnetic field is applied.

→ In the absence of magnetic field the resistance of semiconductor metal hybrid system is very low.

→ In the presence of strong magnetic feild, the resistance of semiconductor metal hybrid system is high.

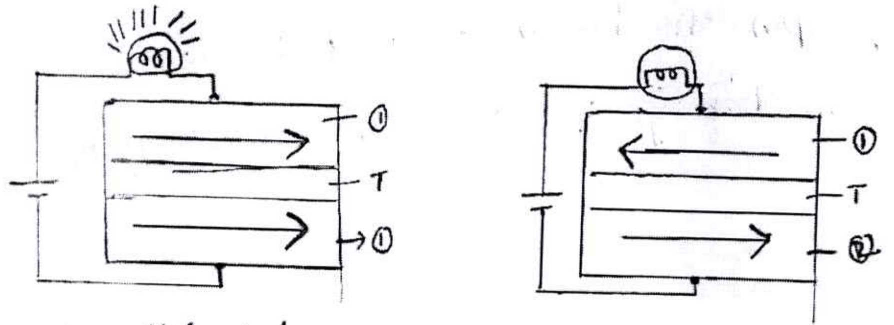


Applications :-

1) An EMR sensors are used to reading a very narrow and shart magnitic field.

2) An EMR has some power applications.

iii) Tunnel Magnetoresistance :- (TMR)



• ① & ② - Ferro magnetic electrode

• T- Tunnel Barries.

Parallel state   Antiparallel state

→ M. Julliere discovered the Tunnel Magnetoresistance (TMR) in 1975

→ Tunnel magnetoresistance occurs in Magnetic Tunnel Junction

→ TMR is a component consist of two ferro magnets separated by an very thin (few nanometers) insulators

→ The electrons will flow from one ferromagnet to another through the Tunnel barrier (insulator)

→ Amount of current flowing is depends on orientation of magnetization

* Assumptions of TMR

1) In tunneling, electron spin is assumed to be conserved.

2) Origination of electrons from one spin state of ferromagnet are accepted by unfilled state of the same spin of another ~~ferro~~ ferromagnet.

→ When both ferromagnetic films are magnetized parallel, the minority spin tunnel to the minority states and the majority spins tunnel to the majority state.

→ When both ferromagnetic films are magnetized antiparallel, the majority spins of 1st ferromagnet film tunnel to the minority states in the 2nd film and vice versa

3) The conductance of spin orientation is proportional to the product of effective density of states of two ferromagnetic electrodes.

Applications of TMR:-

1) Magnetic random-access memories (MRAM) are a new non-volatile memory technology is used for ~~sto~~ strong data bits using magnetic states.

2) Useful for sensing application.

* Magnetoresistor:- Magnetoresistor is a device which exhibits magnetoresistance effects which is used to measure magnetic field strength and direction.

→ It is made up of lithium antimonide or lithium arsenide semiconducto

→ Magnetoresistors are operate ~~with~~ without any physical contacts.

* Applications of Magnetoresistors :-

→ Magnetoresistors are used in the hard disk of a computer, an electronic compass, to measure current.

→ In computers for magnetic data read/write
and it is used in
→ Bio-sensors, magnetic field sensors.

→ contactless switches

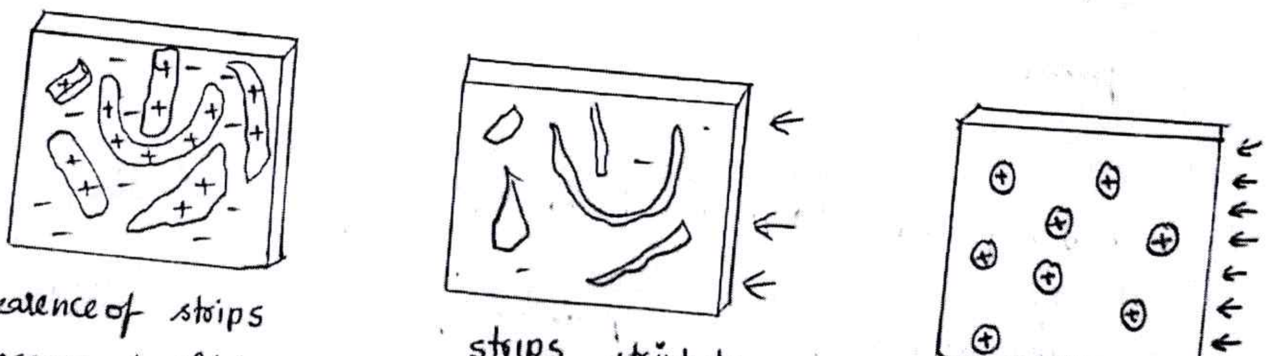
* Magnetic Bubble memory :-

→ Magnetic bubble memory is a non-volatile computer memory and it is in the form of thin film using soft magnetic material.

→ Magnetic bubble memory is a thin film in which small magnetic domains behaves as bubbles. in entire film.

→ each bubble can store one bit of data which not disappear when power is ~~to~~ turned off.

→ When magnetic field is applied the magnetic domains shrinkdown into a tiny circles.

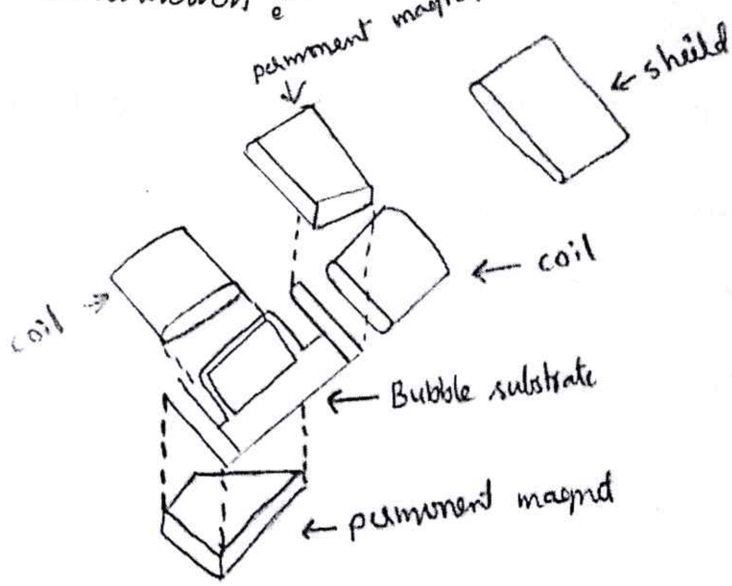


appearence of strips - absence of field

strips shrink down magnetic field is perpendicular to the film

high field circular domains

construction :-



→ bubble memory is a package of the bubble memory chip, magnetic field coils and permanent magnets.

→ A rotating magnetic field is created by two mutually perpendicular coils causes the data in form of magnetic bubbles to move serially through the magnetic field

→ Two permanent magnets provides non-volatility and allow for the stable existence of magnetic-bubble domain.

→ The chip is composed of a non-magnetic crystalline substrate. upon which is a thin crystalline magnetic epitaxial film is grown.

Material :-

→ To form Magnetic bubbles, ~~orthoferrites~~ orthoferrites, hexagonal ferrites, synthatic garnets and amorphous metal film are used.

→ synthatic garnets support to form small magnetic bubbles

Magnetic field sensors :-

→ A magnetic sensor is a transducer that converts a magnetic field into an electrical signal.

→ Magnetic field sensors either utilize an internal magnet or directly detect a permanent or electromagnetic field

→ Magnetic sensors are the solid-state devices are used in detecting and sensing the distance, speed, rotation, angle, and position by converting magnetic information into electorical signals.

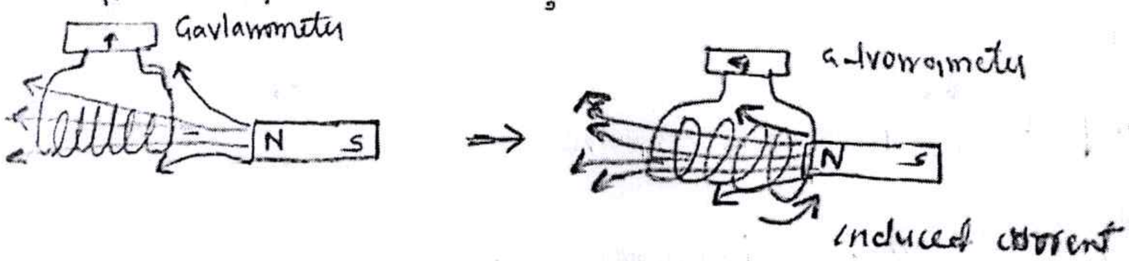
→ These converted signals are processed by electorical circuits.

→ Magnetic sensors measure magnetic field in terms of flux, intensity and direction.

→ They are used to monitor item location, directions, revolutions angle and so on.

→ Based on technology or elements used. different types are available.

i) Coiled type Magnetic sensor :-



→ A coiled Magnetic sensor can detect the magnetic field variations when bringing a magnet into close contact with a coil, Induced current is generated.

→ Magnetic flux density can be determined by observing the induced EM force and induced current.

* EM - electromotive force.

→ Working :-

→ The external magnetic feild provides a bias to form stable bubbles. permanent magnets create external magnetic feild

→ The generated bubbles can store the data in the form of bit whenever the altering external magnetic field is applied

→ bubbles domains moves along the predetermined path by the deposition of 'v' shaped soft magnetic material on the chip of magnetic epitaxial film.

Advantages :-

i) The power usage of bubble memory is less

ii) The functional packing density is high

iii) It is more durable then disc memory since it has no moving parts

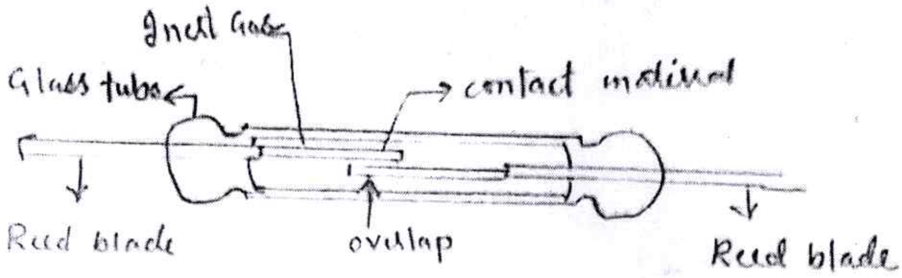
~~iv)~~

disadvantages :-

i) Manufacturing process is expensive and complicated

ii) They were not widely used since other non-volatile memory formats are introduced ex. EEPROM.

ii) Reed switches :-



→ The contacts of a reed switch emerge from left and right ends of a glass tube enclosing two reeds.

→ These reeds are made up of magnetic material. which are separated by a gap.

→ the glasstube is filled with N_2 gas or other inert gas to prevent the deterioration of the contacts.

→ when two reeds are magnetized the heads of the reeds are attached to each other.

→ Reed switches are used in door and window sensors, in burglar alarms

→ power supply is not needed.

→ sensing range is large.

→ Reed switches used in laptops.

iii) Magnetoresistance effect sensors :-

→ Magnetoresistance effect sensors are works on the principle of changing of resistance by applying magnetic field.

1) Anisotropic - magnetoresistance sensor :-

→ AMR sensors are precise and contact-less devices that measure the changes in the angle of a magnetic field.

→ AMR sensors provide accurate and reliable data without physical contact.

... sensors :-

→ Giant Magnetoresistance sensors sensitivity is b/w two to five times greater than that of an AMR sensor

→ GMR sensor can detect minute charges of magnetic flux density

3) TMR sensors :-

→ TMR sensors are works based on the prencaple of TMR effect

iv) Hall effect sensors :-

→ Hall elements are used to convert the stored energy in a field of Magnet into an electrical signal with the application of a current-carrying wire.

and other magneto sensors are also available

ex :- SQUID, Magnetic induction, magneto-elastic, eddy current sensors.

Multiferroics :-

It is a coexistance of any two ferroic (ferroelectric, ferro magnetic, ferro-elastic and ferrotoroidic) ordering simultaneously.

→ The ferroic material exhibits long range of order in at least one macroscopic ~~prop~~ property and devolops a dipole with conjugate field.

→ The simultaneous existance of ferroelectricity and ferro-magnetism is limited by certain factors.

i) symmetry : symmetry of the material allow both ferroelectricity and Magnetism

ii) Electrical properties :- matereals must be must be insulators then convert as metallic

iii) chemistry :- ferroelectric materials have ions in a d^0 state. ferromagnets have partially filled d orbitals.

→ Multiferroics are significant for the following reasons

1) Magnetic bits can be controlled by electric bits.

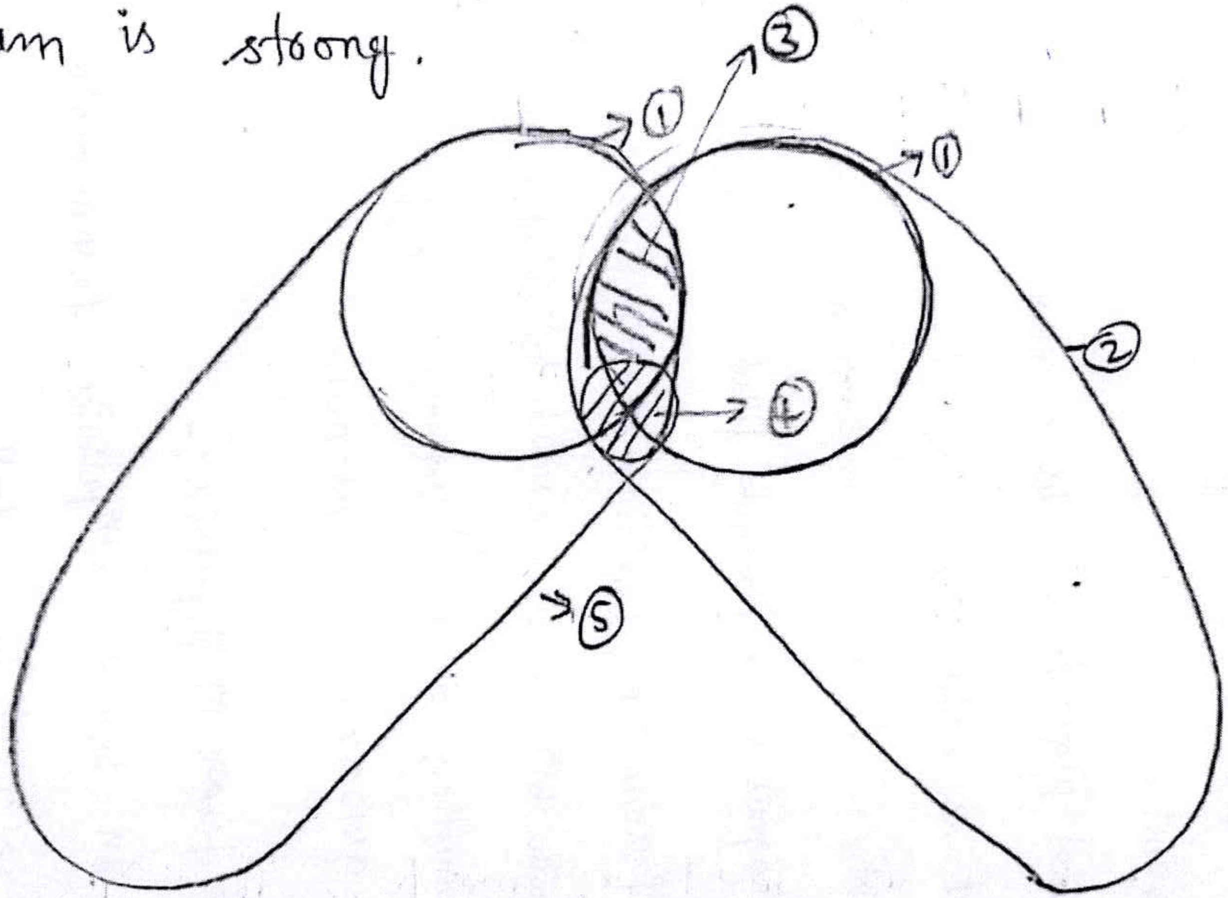
2) combination of ~~A~~ ferromagnetic & ferro electric materials may give rise novel properties.

a) Type 1 ~~ferro~~ Multiferroics :-

In type 1 multiferroics ferro magnetic and ferro electric ordering to occur independently. the sources for both ferromagnetic and ferroelectric materials are different, weak coupling b/w them.

Type ② Multiferroics :-

In type-1 multiferroics ferroelectricity as well as magnetic transitions occuring simullaneously. Coupling b/w them is strong.



- ① ferromagnetic
- ② ferro-electrical polarizer
- ③ - Multiferroic
- ④ - Magnetoelectric
- ⑤ Magnetically polarized.

* Applications of Magnetic materials :-

① Magnetic fields (or) electric field is used in Mass-spectrometer to identify different materials. It can be used ~~for~~ to determine the elemental composition of ~~a~~ a sample.

② Magnetic resonance imaging (MRI) :-

MRI is a test that uses powerfull magnets, radio waves and a computer to make detailed picture inside the body.

③ Magnets are used to store the data in computers.

④ In speaker and microphones, magnets are used to convert electrical energy to mechanical energy.

⑤ In compasses magnets are used to align it's self with a magnetic field

⑥ Magnets are also used to make jawellary

NANOTECHNOLOGY

UNIT-IV 1

→ The term "Nano" was derived ~~by~~ from the greek term "Nanos", which means "Dwarf" or extremly small.

→ 1 nano means 1 billionth of 1 metre

$$\boxed{1nm = 10^{-9} m}$$

→ The particles that is in the range of 1 nano is known as nano particles

→ Usually the nano particles are the particles in the range of 1 nano metes to 1000 nano meters

→ 1 nano metre is approximately the length of the 10 Hydrogen atoms or if 5 silicon atoms are lined up is equal to 1 nm

** → Nano scale is a measuring scale of nano particles that of the range of 1 nm to 1000 nm

ex:- Proteins, DNA, inorganic nano particles are in the range of nano scale (i.e 1nm to 1000 nm)

Nano material :-

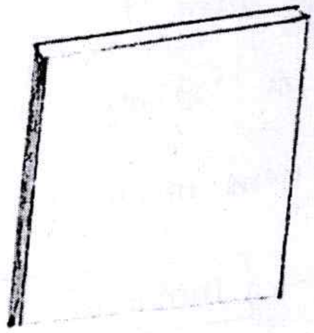
Material having any one or morethan one dimension in nanoscale (1 - 1000 nm) is called nano material

→ Nano material are divided into 3 parts

i) 1D nano material :-

Only one dimension is in nano scale other 2 dimensions are normal.

Ex :- Quantum well (thin film coating)



ii) 2D nano material

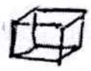
→ Two dimensions are in nano scale

Ex :- Quantum well wire

iii) 3D nano material

→ All 3D's are in nanoscale

Ex :- Quantum dot (or) nano ring.



* Nano-science :-

→ The study of the fundomental properties and related phenomenon of nano materials (or) nano particles is scalled nano-science.

* Nano-technology :-

In 1974, Norio Taniguchi (Japan) invent nanotechnology

→ Nano-technology is the study of devoloping of the devices by using of the applications of the nano material.

Ex :- LED TV screen is made by Quantum dots.

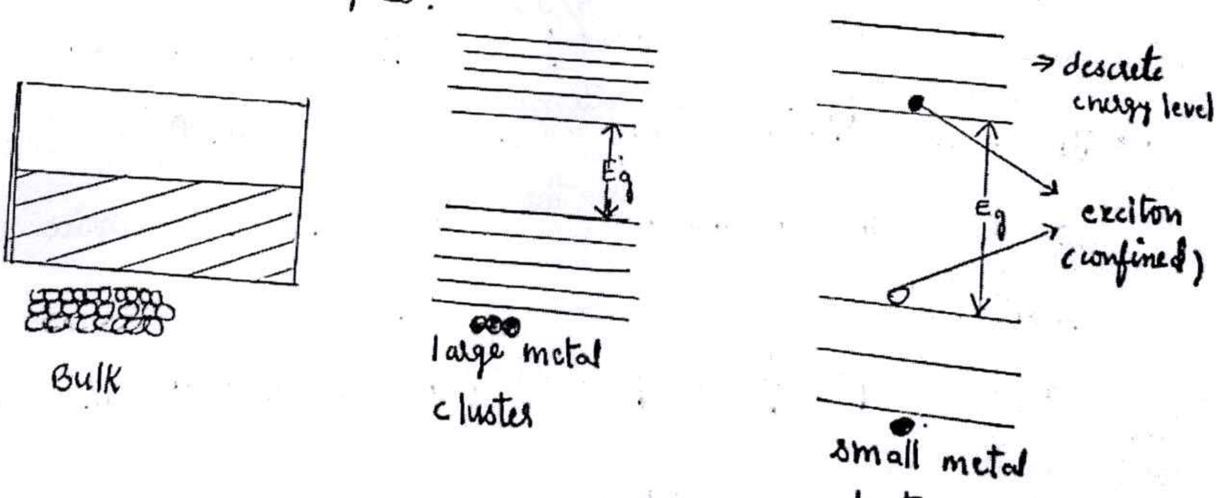
* Quantum size effect :-

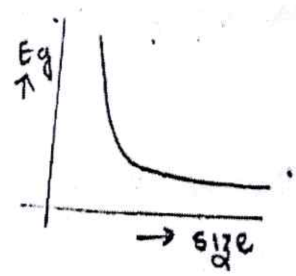
When we reduce the size of the material to nano range then the properties of the material like chemical properties, physical properties, electrical properties, magnetic properties and change in colour etc. are changes this effect is known as quantum size effect

* Quantum confinement :-

When the size of the matter (semiconductor) degree decreases then the energy gap increases due to which electron hole (exciton) confined in a descreate energy level this confinement of electron-hole is known as "Quantum confinement"

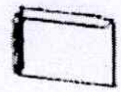
→ Quantum confinement is a quantum size effect
→ When the size of the material reduce then the moment of electron decreases. because of the increase in "Eg". Then the excitons are devoloped.



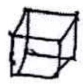


* Degree of freedom (D_f) :- Independent direction of motion of electron
* Degree of confinement (D_c) :- no. of degree of confined motion of electron

$$\boxed{D_f + D_c = 3}$$

i) Quantum well :- 1D is confined ; remaing two are normal 

ii) Quantum wire :- 2D are confined ; remaing one is normal 

iii) Quantum dot :- all 3D are confined 

Surface to Volume ratio :-

→ Nanomaterials have a relatively larger surface area when compared to the same mass of material in a larger form

→ due to this larger value of surface to volume ratio of nano material, they are more chemically reactive.

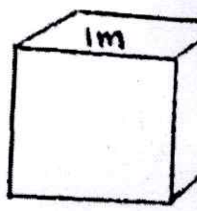
→ Surface properties such as energy levels, electronic structure and reactivity can be quite different from interior states

→ In nano materials many atoms are will be near interfaces, so that the materials in the nano form is more chemically reactive.

Ex :- concept of surface area to volume ratio in a cube is

→ A cube has a surface area of $6m^2$ [$1m \times 1m \times 6$ side] and volume of $1\ m^3$

∴ surface area to volume ratio is 6/1



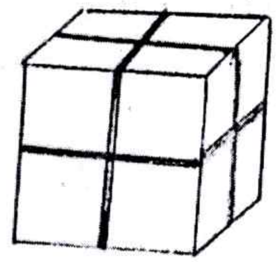
2) Same cube cut in 8 pieces

→ Then surface area of each cube is

$1.5\,m^2\,(0.5\,m \times 0.5\,m \times 6)$

Total surface area $1.5\,m^2 \times 8 = 12\,m^2$

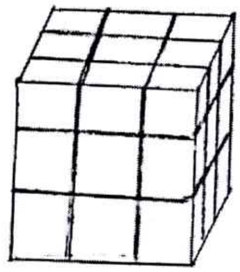
$\therefore$ surface area to volume ratio is $\frac{12}{1}$



3) Same cube cut into 27 pieces

→ Total surface area is $[6 \times 1/3 \times 1/3] \times 27 = 18\,m^2$

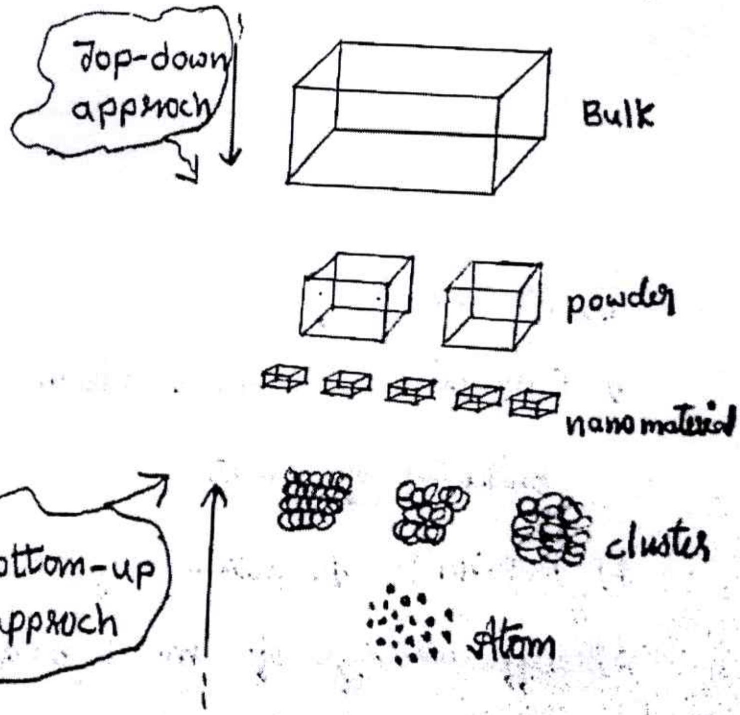
$\therefore$ surface area to volume ratio is $18/1$



* There are two general approches for synthesis (fabrication) of nano materials

i) Top-Down approch

ii) Bottum-up approch



i) Top-down Approch :-

A technique in which breaking down bulk material into nano material

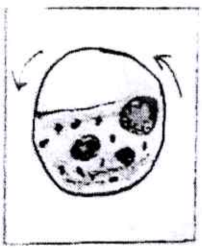
1) Ball Milling method :-

This technique was devoloped by Benjamin in 1960.

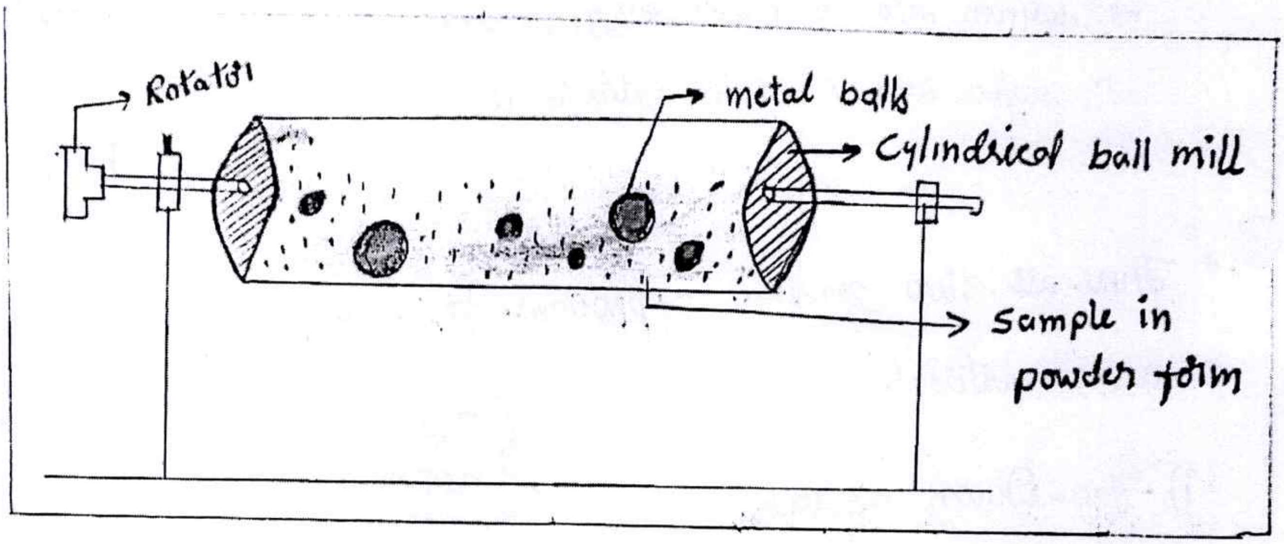
It is a top-down apporach for the synthesis of nanomaterial

→ In this technique powder sample is redued to nanometer range by mechanical deformations.

* construction :-



cross-sectional view



It is consist of

1) Cylindrical ball mill made by slarium steel which is poor conductor of heat

2) Rotator :- To rotate cylindrical ball mill

3) different size of metal balls made by hard steel and tungsten carbide of few millimeter of diameter

→ The powder sample crusted by this hard balls

4) Powder of substance whose nano material will form.

* Working :-

→ We fill 60% of volume of cylinder by powder of substance and metal balls

→ Then rotate the ball mill by using rotator.

→ velocity of ~~of~~ rotating cylinder is responsible for this process i.e if velocity of cylinder is increase then impact is also increase

→ Velocity of cylinder neither too high nor too low

→ The grinding periods is within the range of 1 minute to some ion

* Disadvantages :-

i) All the particles are not broken down to require particle size

ii) During the process, contamination of by milling tools and atmosphere can be a problem.

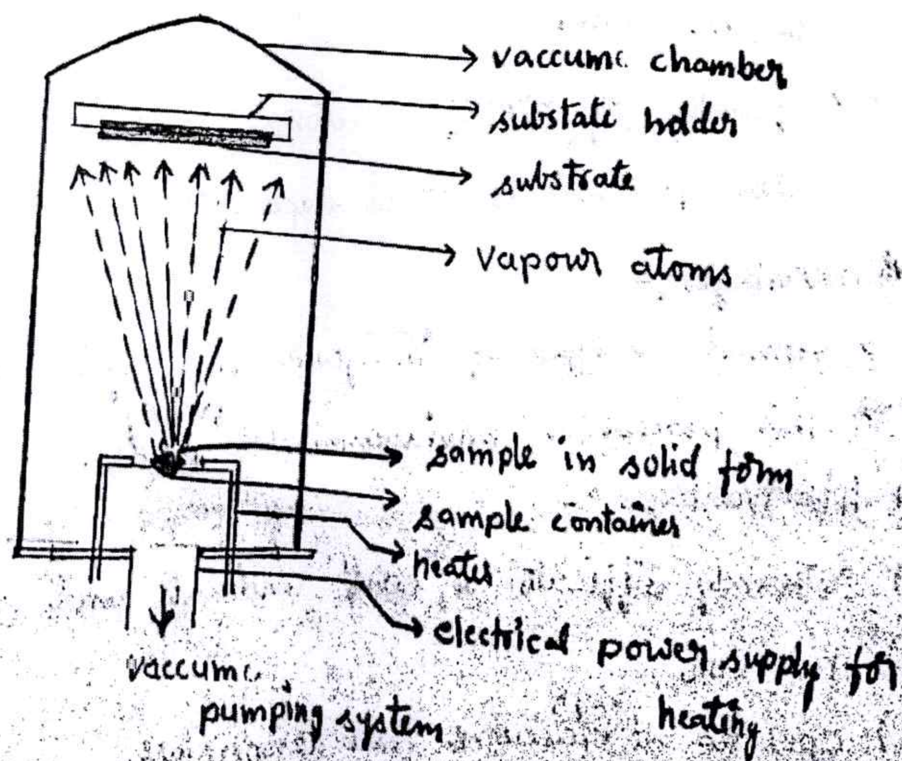
* Advantage :-

1) The main advantage is high production rate of nano-particles

2) physical vapour deposition (PVD) method :-

PVD methods is a vaporization coating technique where raw materials are in solid form.

* construction :-



→ Physical vapour deposition (PVD) method is consist of sample containes in which we can place solid form of sample and substrate holder to deposite the . nano form of sample.

→ Heating allengement is place to heat the sample by using electrical power supply.

→ This total atter system is placed in vaccume chamber which having one vaccum in/vaccum out way.

Working :-

→ The solid form of sample to be deposited as coating is taken in sample container

→ By using electrical power supply heat the sample then sample gets heated and then evaporate, this process is called evaporation.

→ These vaporized atoms of sample move to the substate to be caoted

→ finally the vaporized atoms are deposited at substrate holder this process is called deposition

* Advantages :-

1) → Almost all type of inorgonic and organic materials can be used.
2) → this process is envirounmental friendly process

* Disadvantages :-

1) Extreamly difficult to coat undercuts and similar surface features.
2) High cost.
3) operates at high vaccume and temperature.

Scanned with OKEN Scanner

4) PVD require skilled operator.

5) The rate of coating deposition is very slow.

* Applications :-

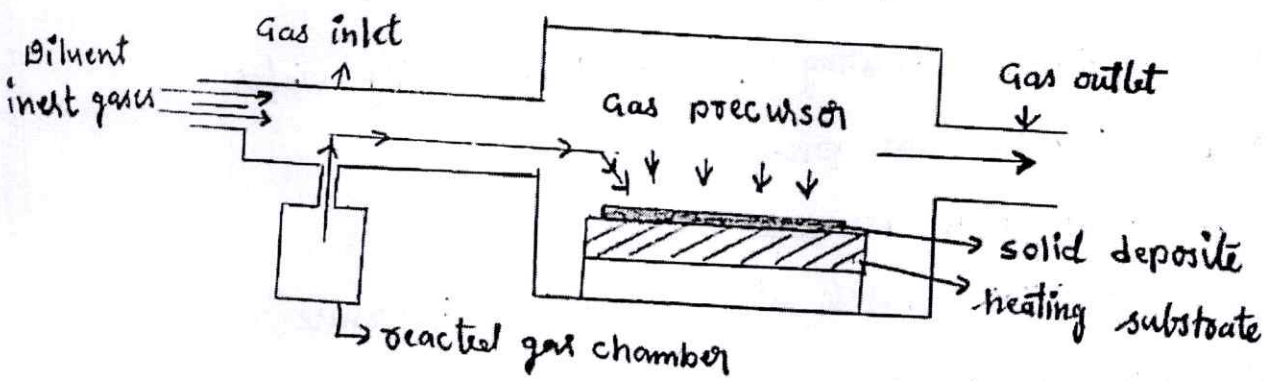
i) PVD coating are generally used to improve hardness, wear resistance and oxidation resistance.

ii) coatings are usually useful in wide range of applications in Medical or surgical, fields.

3) Chemical vapour deposition (CVD) method :-

CVD is a formation of a non-volatile (not vapourized naturally) solid film on a surface by a reaction of vapour phase chemicals (gaseous precursor) that contain the required constinuent

* construction :-



It consist of a reactor chamber having gas inlet, gas outlet eitherside as shown in diagram and heating substate in which the this ~~film~~ film of wafer form is deposite on the substrate. the reactord gas chamber is attached at the inlet so as to enter gas precursor into the reactor chamber.

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Working :-

→ To produce nanomaterial wafer form, a required reactent in the gaseus form and diluent inert gases are introduced in the reactent chamber from gas inlet.

→ The reactemts are absorbed on the surface of substrate and undergo chemical reactions with the substrate to form the film

→ The gaseus by product of the reactent reactions are desorbed and evacuated from the gas outlet.

* Types of CVD based on temperature :-

1) Hot-wall CVD :- heating system heatsup not only wafer but also the walls of the reactor.

2) Cold-wall CVD :- heating system heatsup only wafer.

* Types of CVD based on pressure :-

1) APCVD (Atmospheric pressure CVD)

APCVD is operate at Atmospheric pressure

2) Low-pressure CVD :-

which operate at low pressure than APCVD.

* Advantages :-

1) CVD is used to deposite high quality film.

2) It is extreamly usefull in the process of atomic layer ~~of~~ deposition for depositing extreamly thin layer of material

3) GaAs films are used in some integrated circuits and photo-voltaic devices.

4) fabrication of carbon nanotubes.

ii) Bottom-up Approach :-

A technique in which materials and devices buildup atom-by-atom

1) Sol-gel process :-

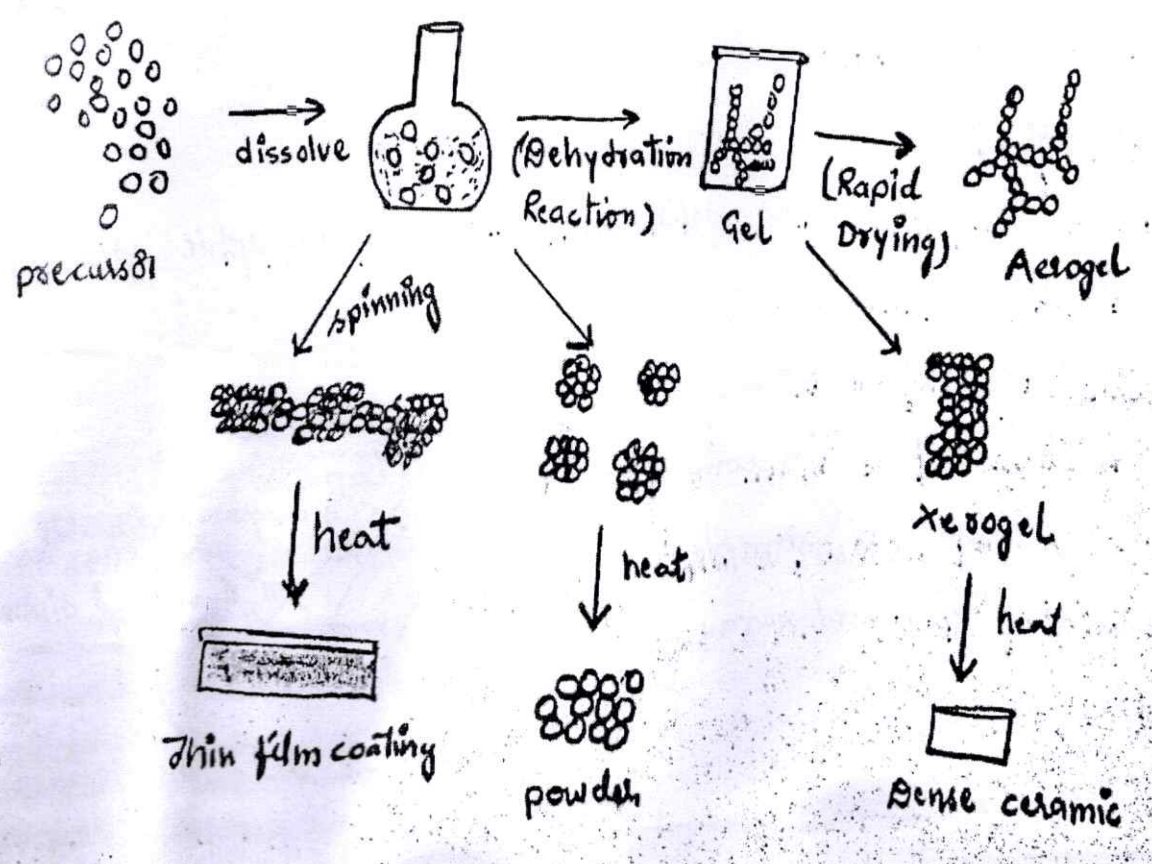
sol-gel is a colloidal chemistry technology

→ The 'sol' is the name of the colloidal solution made up of solid particles, few hundred nm diameter suspended in a liquid phase

→ The 'gel' ~~is a process~~ can be considered as a solid micro-molecule immersed in a solvent.

→ 'solgel' is a process in which chemical transformation of a liquid into a gel state.

→ The main benefits of sol-gel processing are the high purity and uniform nanostructure achivable at low temp.



* Disadvantages :-

1) → controlling the groth of the particles is very difficult.

2) → stopping the newly formed particles from agglomaration is difficult.

* Advantage :- sol-gel synthesis is superior of all the available processes as it can produce

1) Thin bond - coating
2) thick coating
3) high purity product

* Applications :-

1) It can be used in ceramics manufacturing processing for producing very thin films of metal oxides.
2) This method is derive the materials of optics, electronics, energy, space, bio- sensors, medicine and separation technology.

* Characterization technique

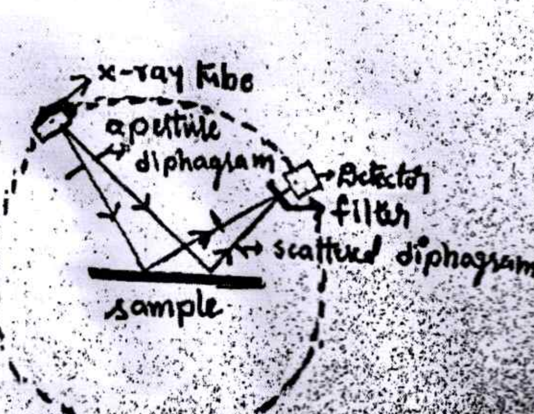
→ The structure and properties of nano particles are characterized by TEM, SEM & XRD

1) XRD Technique :-

→ XRD technique used to determine the crystalographic structure of a nano-material.

* Expreimental arrengement :-

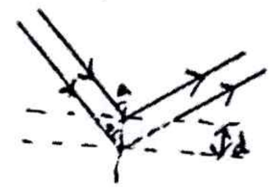
→ XRD is consist of 4 main component such as x-ray source, sample, filter (receiving optics) and x-ray detector



* Analysis :-

→ x-ray beam difraction (XRD) analysis is based on Bragg's law and Bragg's angle

Bragg's law ⇒ $n\lambda = 2d\sin\theta$.



→ When a beam of x-ray is incident on the sample, x-rays are scattered by each atom in the sample

→ If the scattered beams are in phase they interfare contructively ~~constructively~~ and give maximum intensity

→ If the scattered beams are in out of phase they interfare distouctively therefore the density of atoms within the sample can be analyzed.

Applications :-

i) Identification :- Phase identification, investigation of low/high temp. phases, solid solution and determenation of unitcell parameters of new materials

ii) Texture analysis :- The determination of the preffered orientation of the crystallities in polycrystalline aggregates is refered to as texture anatysis.

Advantages :-

→ It is powerfull and rapid test for identification of an unknown material

→ It requires minimum sample preparation

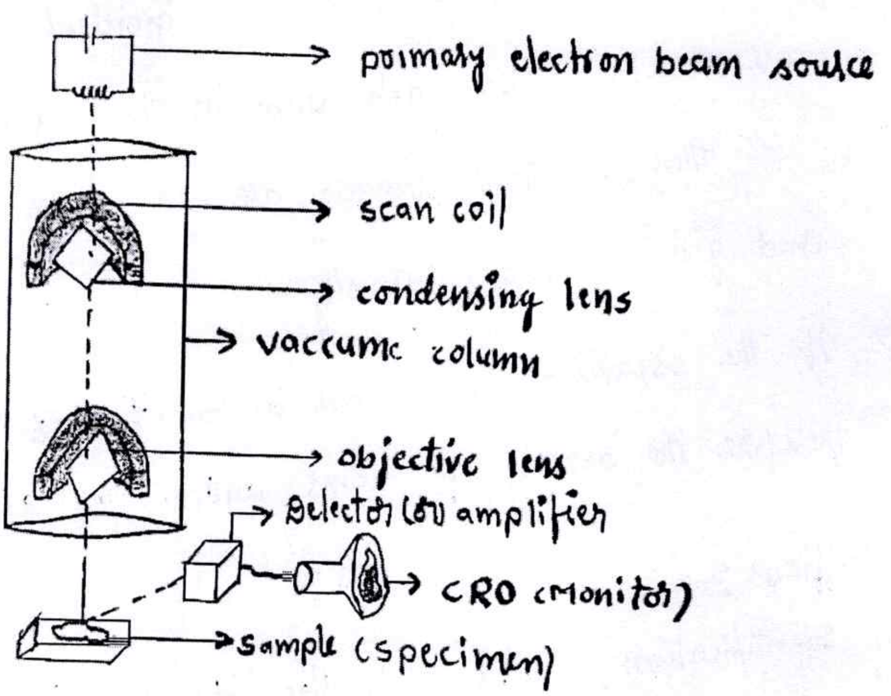
→ XRD units are widely avollable

→ The data interpoitation is relatively straight forward.

* Scanning electoon Microscope (SEM) :-

→ In scanning election Microscope (SEM), the electoons are used to form an image for a resolution better than 1nm, and it has higher magnification, larger depth of field.

→ construction :-



SEM is consist of

i) vaccum column :- electron beam is fall on the sample without any deviation by other atom

ii) condensing lens :- it is used to focus the electron beam on objective lens.

iii) Objective lens :- it is used to focus the electron beam on the sample.

iv) Scan coil :- It is used to rotate the condensing lens and objective lens.

Principle :- In SEM, the specimen is exposed to a narrow electron beam from an electron gun, which rapidly moves over (or) scan the surface of the specimen

This causes the release of a shower the secondary electrons from the speciman surface

→ Density of electrons (or) atoms can be analysis in the image.

→ Zero density (no-atoms) then black colour is form in image

→ Gray colour is form when less no. of atoms are present.

Scanning process:-

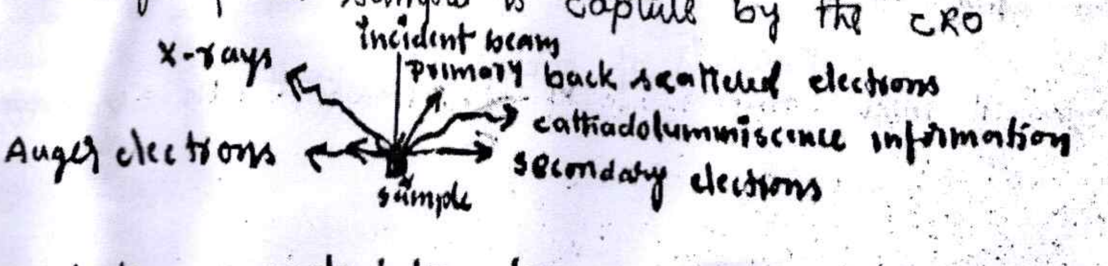
→ The electron beam which has the energy range from 0.2 kev to 40 Kev is focused by two lenses (condensing and objective) to a spot about 0.4 nm to 5 nm. in diameter of sample

→ When the primary electron beam interact with the sample, energy is exchange between the electron beam and the electron of the sample.

→ then electron from the sample are emitted out and known as secondary electrons

→ These secondary electrons are captures by the detector and amplified.

→ Then the image of the sample is capture by the CRO



electron-sample interaction

Transmission electron Microscope [TEM] :-

→ TEM can be used to study the growth of layers and to analyze, the quality, shape, size and density of quantum well, wires, dots.

→ TEM is used to reveal the internal structure of material

→ 1st TEM was built by Max Knoll and Ernst Ruska in 1933 and 1st commertial TEM is in 1939

→ in 1986 Ruska was awarded by the Noble prize in physics for devoloping TEM

→ By using TEM the magnification of the sample image is greaterthan 300K times ~~possible~~. possible.

four componants of TEM :-

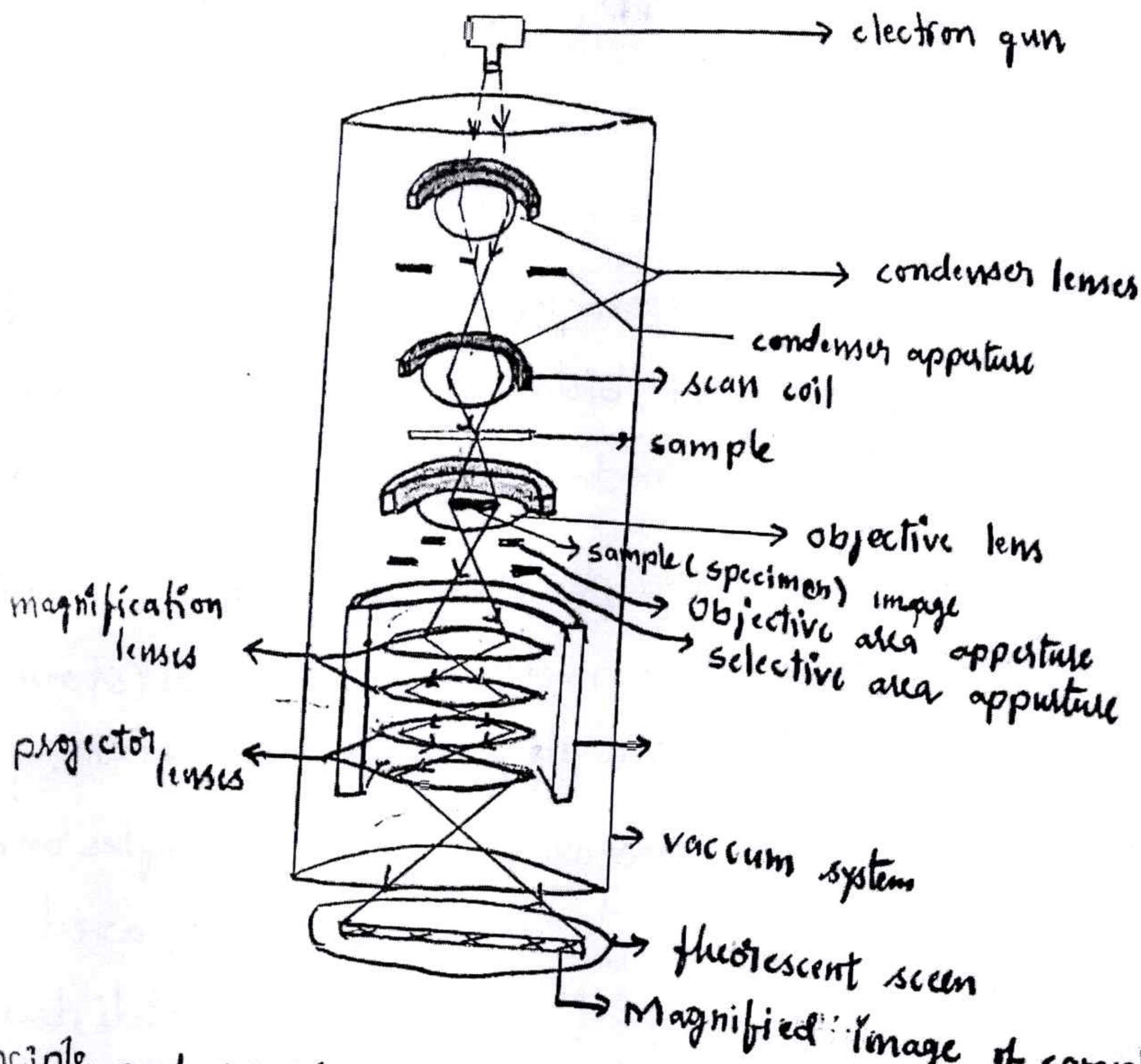
i) electron gun is used to produce fine electron beam.

ii) A set of condenser lenses to focus the electron beam into specimen.

iii) A set of Magnification lenses to used to create the final magnification image on the flourescent screen

iv) An objective lens is used to form 1st image of the specimen.

→ All these componants of TEM are kept in vaccum system.



Principle and Working of TEM :-

A beam of high velocity electrons accelareted under vaccum, focused by condenser lens on to the sample and then emerged electron beam is then focused by objective lens, final image forms on a fluorescent screen or camera for the image viewing

TEM Application :-

→ Transmission electron Microscope is ideal for life science nanotechnology, medical, biological and material research, forensic analysis, gemology and metallurgy, industry and education.

→ TEMs provide topographical: (accurate representation of the physical features of an area), morphological (structure of things), compositional and crystalline information.

→ The images allow researchers to view samples on a molecular level, making it possible to analyze structure are texture.

→ Useful in the study of crystals and metals, but also ha[s] industrial applications.

→ TEMs can be used in semiconductor analysis and productio[n] and the manufacturing of computer and silicon chips.

→ Technology companies use TEMs to identify flaws, fractu[res] and damages to micro-sized objects; this data can help fix problems and / or help to make a more durable, efficient product.

Advantages :- A transmission electron Microscope has number of advantages.

~~1) TEM~~

1) TEM offer the most powerful magnification.

2) TEM have a wide - range of applications and can be utilized in a variety of different scientific, educational and industrial fields.

3) TEM provides information on elements and compound structure.

4) TEM provides images are of high-quality and detailed in their nature.

5) TEM yields information of surface features, shape, size and structure.

6) TEM is easy to operate with proper training.

Disadvantages :-

1) TEMs are large and very expensive.

2) Laborious sample preparation and operation and analysis requires special training.

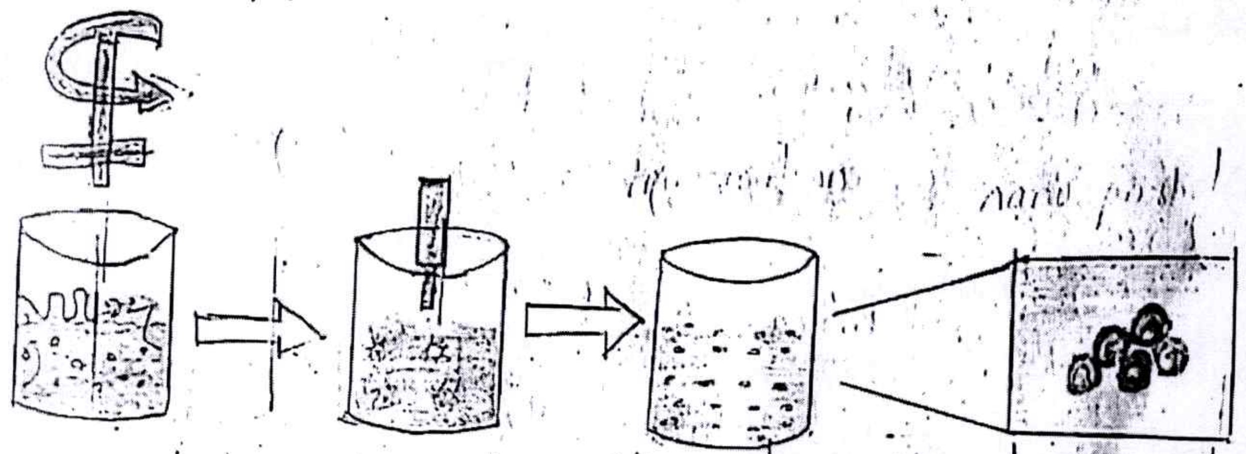
3) Samples are limited to those that are electron transparent, able to tolerate the vacuum chamber and small enough to fit in the chamber.

4) Images are black and white.

Precipitation synthesis Method :

The precipitation technique involves the precipitation of Metal in the form of hydroxide from a Salt precursor with the help of a base in a solvent.

Principle: Two or more chemicals are mixed to react each other. The product will settle down as precipitate.



Mixing of reactants Macroemulsion Miniemulsion Nanoparticles

Experimental methods:- An example of copper oxide nanoparticles synthesis is used to explain the general concept of precipitation.

a) copper Sulphate pentahydrate ($CuSO_4 5H_2O$) is mixed with Hydroxyl ammonium chloride ($NH_2OH HCL$) in distilled water.

b) The mixture is cooled in a cold-water bath with constant swirling

c) The precipitation is settled down and the supernatant liquid poured off.

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$$2CuSO_4 + 2NH_2OH\,HCl + 6NaOH \rightarrow Cu_2O \downarrow + N_2 + 2Na_2SO_4 + 7H_2O + 2NaCl$$

d) The precipitate is washed several times with distilled water until it is chloride free.

e) The precipitate is dried at 200°c — 250°c

f) When the precipitate is heated to 300°c in open air, CuO nano-particles are formed.

$$Cu_2O \longrightarrow CuO$$

Below fig. shows the precipitation method.

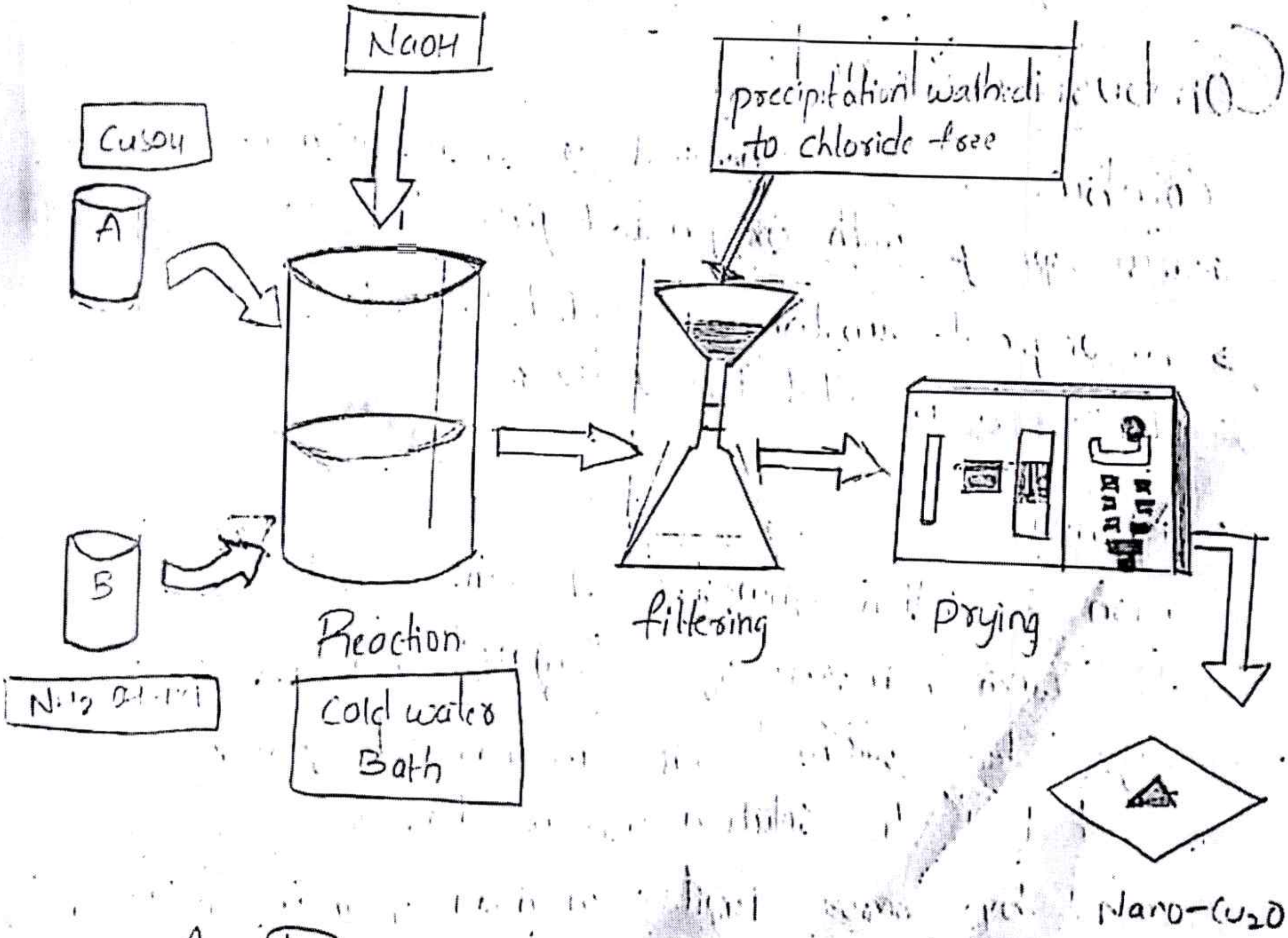

fig. Precipitation Method.

Uses:

1. Tumor and cancer diagnosis treatment.
2. Magnetic Resonance imaging for diagnosis and treatment.
3. Magnetic drug target.

Advantages:-

1. It is a simple, low cost and rapid method of preparation of nano particles.
2. In precipitation method reaction temperature is low.
3. This method gives fine and uniform size particles.

Combustion Method:

Combustion is a chemical process in which a substance reacts rapidly with oxygen and gives off heat.

→ The original substance is called the fuel, and the source of oxygen is called the oxidizer.

→ Method:

Solution combustion synthesis (SCS) method was discovered by KC patil when a mixture of $Al(NO_3)_3 9H_2O$ and urea solution are rapidly heated around 500°C in a muffle furnace. It was observed that the solution mixture has undergoes vaporization followed by vigorous ignition with an incandescent flame

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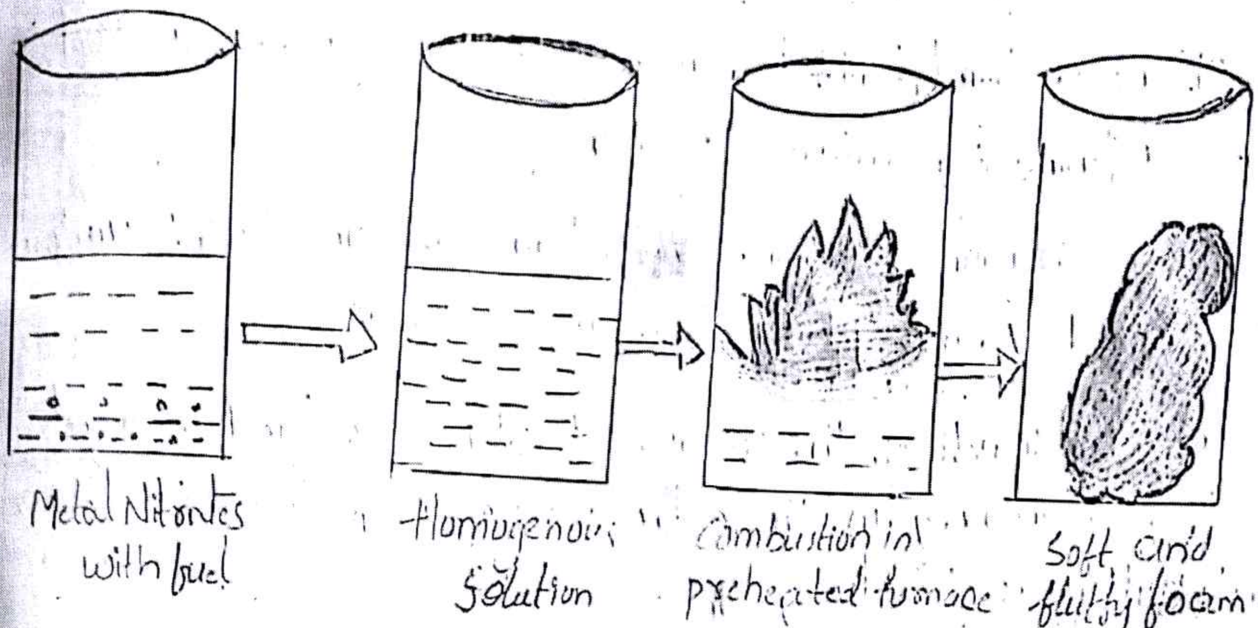
luminous white product which was identified as α-Al_2O_3.



principle :- This method is based on utilization of heat Energy produced during the Exothermic Spontaneous, redox, reaction between an oxidizes.

→ The oxidizer can be of any metal nitrates and reducing agent may be organic fuel, such as glycine, oxalic acid, urea, Sugar, EDTA, Etc..

Metal Nitrate + fuel ⟶ nano metal oxide + gases.

In order to calculate fuel quanity, the total oxidizing valency of the fuel must match the total reducing valency of metal nitrate.

Procedure:-

a) The uniformly mixed solution of all the reactants is kept in a furnace maintained at 500°c.

b) The solution undergoes Evaporation and concentrated, uniformly mixed Viscous-gel type Substance is obtained.

c) After sometime, the Viscous-gel catches fire and propagates spontaneously in the redox mixture in the form of either a flame or Smoldering type.

d) The Combustion (under) lasts for about 1 to 2 minutes.

e) During the propagation a large quantity of gases and high temperature are produced, and it results in the formation of nano metal oxide.

Advantages:

→ time and Energy Efficiency

→ Raw materials are usually less Expensive.

→ Equipment is Simple.

Application:

→ SCS is used to fabricate Various materials for many applications of catalysis, luminescent, fuel cells, Energy conversion, and Energy storage.

→ It is also applied to synthesize thin films of metal oxides.

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mplicated garnets are also widely synthesie ~~thin.fil~~ by SCS

→ It is also useful for Semiconductors and optical materials, nano-ceramics, thin-films

Applications of Nano Materials:

1. Tougher and harder Cutting tools: Cutting ~~and~~ tools made of nanocrystalline materials are much stonger, harder, wear-resistant and Erosion-resistant and last longer.

2) Ductile, machinable ceramics: Ceramics are very hard, brittle, and hard to machine. So, they are difficult to use.

3) Elimination of pollutants: Nano materials can be used as catalysts to react with harmful, and toxic gases as Carbon monoxide and nitrogen oxide in automobile catalyst. Converts power generation Equipment.

→ Avoid Enviromental pollution from burning tools (petrol).

4) High Energy density Batteries: Nanocrystalline materials prepared by sol-gel tenchniques are useful for seprator plates in batteries, because of foam.

5) High Sensitivity Sensors: Sensors made of nanocrystalline materials are Extremely sensitive to the change in their Environment.

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6) Sun Screen: Many Sunscreens Contain nanoparticles of Zinc oxide or titanium oxide. Smaller particles are less visible.

7) Self-cleaning glass: Glass with nanoparticles makes glass photo-catalytic and hydrophilic. Hydrophilic means that when water makes contact with glass, it spreads across the glass evenly which helps wash glass clean.

8) Clothing: Fabrics with a thin layer of Zinc oxide nanoparticles, gives better protection from UV radiation.

→ clothes having nanoparticles in the form of little hairs that help repel water and other materials.

9) Scratch-resistant coatings: Addition of aluminum Silicate nanoparticles to scratch-resistant polymer coating used for cars to eyeglass lenses.

Lasers & Fiber optics

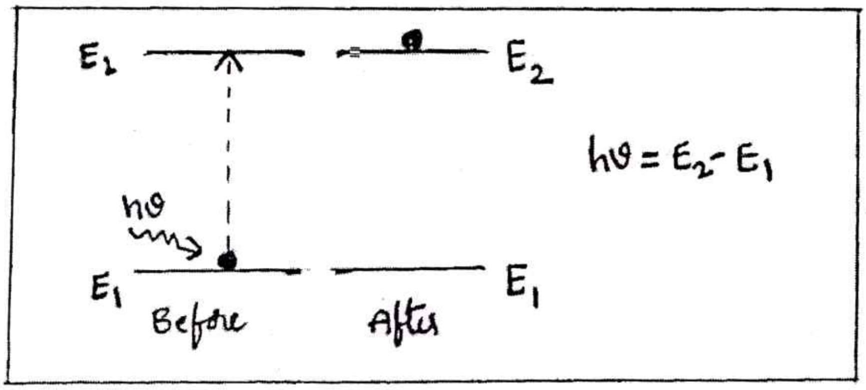
ee quantum processes :-

→ In general the electron in an atom occupy the lowest energy level.

→ When the radiation interact with matter, the photon energy can be absorbs by the electron, then the electron may be excited to higher energy level

→ Thin interaction with matter can be explain by three types

① Absorption :-

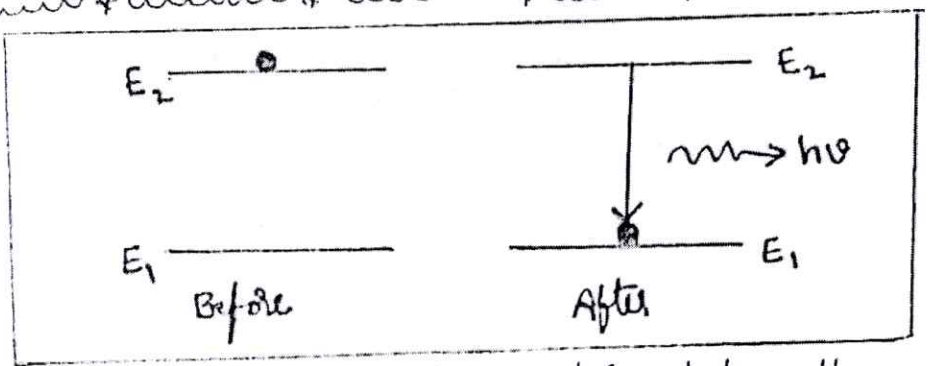


→ If a photon is incident on an electron in its ground state(E_1) the electron absorbs the photon and is raised to its excited energy state (E_2). Here photon energy $E_2 - E_1 = h\nu$ is required.

→ If the photon energy is not equal to energy difference between E_2 & E_1, the photon is not absorbed and the atom is remains in the ground state.

→ This process is known as Absorption.

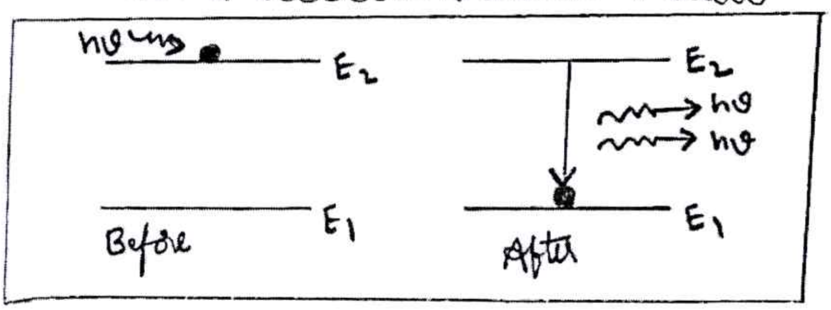
② Spontaneous emission of radiation :-



→ When the electron in the excited state after spending of the lifetime (10^{-8}s) in excited state, the electron make a transition from excited state to its ground state by emitting of radiation of energy $h\nu$, this phenomenon is known as spontaneous emission.

→ The photons of this case have various wavelength and they are out of phase. thus the photons are incoherent.

③ Stimulated emission of radiation :-



→ In this process a photon having energy ($E_2 - E_1 = h\nu$) is incident on the excited electron and that photon forces the excited electron to make a transition from E_2 to E_1 before spending of its lifetime on the excited state.

→ In this process electron emits two photons, while falling on ground state.

→ The emitted photons in this case have the single wavelength, and they are in phase. Thus the photons are coherent.

LASER beam characteristics :-

→ Laser beam has following unique characteristics over ordinary light. They are

i) Monochromaticity :-

Monochromatic light beam means a light containing single colour (or) wavelength

→ ~~Ordary~~ ordinary light is a mixture of different frequencies (or) wavelengths.

→ In laser, all the emitted photons possess the same frequency and Energy, so the laser beam has single wavelength

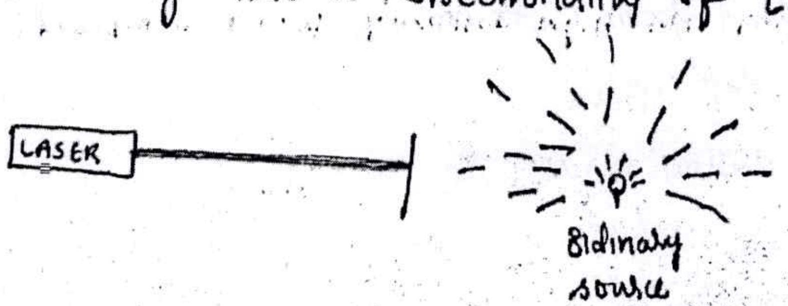
→ Therefore the laser is monochromatic and consist of very narrow range of frequencies.

ii) Directionality :-

→ Ordinary light source emit photons in all directions

→ LASER emits photons in only one direction.

→ LASER beam can travel very long distances without spreading. this is directionality of LASER.

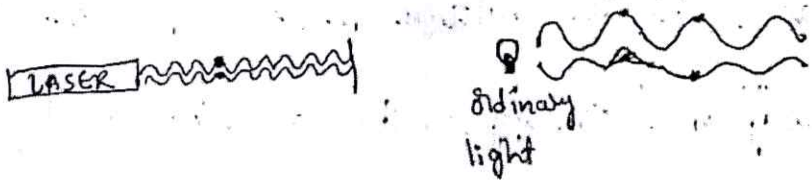


3) coherence :-

→ when the light particles (photons) are in the same phase (or) constant phase difference then the light waves are said to be coherence.

→ The photons of ordinary light source are out of phase.

→ In LASER, photons are emitted but due to the stimullated emission so that, photons of Laser beam are highly coherent.



4) High Intensity :-

→ The intensity of a wave is the energy per unit time flowing through a unit normal area

→ In ordinary light, the photons spreads in all directions

→ But in LASER, photons spreads in a small region of space having small wavelength range

→ Hence the laser has high intensity when compared to the ordinary light.

Einstein's co-efficients and Relation between them:-

i) Absorption:-

The rate of probability to occur absorption process from state 1 to state 2 depends on properties of energy states 1 & 2 and is proportional to incident energy density $\rho(\nu)$ of the radiation frequency of the incident radiation on the atom

Thus

$$P_{12} \propto \rho(\nu)$$

$$= B_{12}\,\rho(\nu)$$

Where B_{12} is proportionality constant, represent the properties of energy state

B_{12} is known as Einstein co-efficient of absorption

ii) Spontaneous emission :-

The rate of probability of occurs spontaneous process from state 2 to 1 depends only on the properties of energy states 1 and 2. this process is independent of energy density $(\rho(\nu))$ of frequency

Thus

$$(P_{21})_{spontaneous} = A_{21}$$

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where A_{21} is proportionality constant, represent properties of energy states 1 & 2

A_{21} is known as Einstein's co-effient of spontaneous emission.

3) Stimulated Emission :-

The rate of probability of occur stimulated emission process from state 2 ~~on~~ to 1 depends on properties of energy states 1 and 2 as well as proportional to stimulated energy density $\rho(\nu)$ of frequency 'ν' incident on the atom.

thus

$$P_{(21)\,stimulated} \propto \rho(\nu)$$
$$= B_{21}\,\rho(\nu)$$

Here B_{21} is proportionality constant, represent ~~proportion~~ properties of energy states.

B_{21} is known as Einstein's co-efficient of stimullated emission.

The Total transition probability of atoms from state 2 to state 1 can be written as;

$$P_{21} = (P_{21})_{spontaneous} + (P_{21})_{stimulated}$$

$$\boxed{P_{21} = A_{21} + B_{21}\,\rho(\nu)}$$

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Relation between Einstein's coefficients :-

let N_1 & N_2 be populations of energy states 1 & 2 respectively in a system of atoms. which is at thermal equilibrium at a temperature 'T'

The no. of atoms that take transitions per unit volume from state 1 to 2 in unit time can be written as.

$$N_1 P_{12} = N_1 B_{12} \rho(\nu) \longrightarrow (1)$$

Here $B_{12} \rightarrow$ Einstein co-efficient of stimulated absorption.

The no. of atoms that take transitions per unit volume from state 2 to state 1 in unit time can be written as.

$$N_2 P_{21} = N_2 [A_{21} + B_{21} \rho(\nu)] \longrightarrow (2)$$

At equilibrium, the no. of transitions from state 1 to 2 (upward transition) will be equal to the no. transitions state from 2 to 1 (downwards transition)

$$\therefore N_1 P_{12} = N_2 P_{21}$$

from eq (2)

$$N_1 B_{12} \rho(\nu) = N_2 [A_{21} + B_{21} \rho(\nu)]$$

$$N_1 B_{12} \rho(\nu) = N_2 A_{21} + N_2 B_{21} \rho(\nu)$$

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$$[N_1 B_{12} - N_2 B_{21}]\rho(\nu) = N_2 A_{21}$$

$$\rho(\nu) = \frac{N_2 A_{21}}{[N_1 B_{12} - N_2 B_{21}]}$$

$$\rho(\nu) = \frac{\cancel{N_2} A_{21}}{\cancel{N_2} B_{21}\left[\frac{N_1}{N_2} \times \frac{B_{12}}{B_{21}} - 1\right]} \rightarrow (3)$$

According to Boltzmann's distribution law, the distribution of atoms among the energy levels E_1 & E_2 at thermal equilibrium

$$N_1 = N_0 \exp\left(\frac{-E_1}{KT}\right) \quad \& \quad N_2 = N_0 \exp\left(-\frac{E_2}{KT}\right)$$

where N_0 - population in the ground state & K is Boltzmann's constant.

$$\frac{N_1}{N_2} = \exp\left[\frac{E_2 - E_1}{KT}\right] \Rightarrow \exp\left[\frac{h\nu}{KT}\right] \rightarrow (4)$$

sub (4) in (3) $\rho(\nu) = \frac{A_{21}}{B_{21}}\left[\frac{1}{\exp\left(\frac{h\nu}{KT}\right)\left(\frac{B_{12}}{B_{21}}\right) - 1}\right]$

$$\boxed{\cancel{\rho(\nu) = \frac{A_{21}/B_{21}}{\left(\exp\left(\frac{h\nu}{KT}\right)\left(\frac{B_{12}}{B_{21}}\right) - 1\right)}}} \rightarrow (5)$$

According to Planck's law the energy density of radiation is given by $\rho(\nu) = \frac{8\pi h\nu^3}{c^3} \times \frac{1}{(\exp(h\nu/KT) - 1)} \rightarrow (6)$

comparing eq ⑤ & ⑥.

$$\frac{A_{21}}{B_{21}} = \frac{8\pi h\nu^3}{c^3} \rightarrow ⑦$$

$$\frac{B_{12}}{B_{21}} = 1 \rightarrow \boxed{B_{21} = B_{12}} \rightarrow ⑧$$

eq. ⑦ & ⑧ are the relation b/w einstein co.efficient

<u>Conclusion</u> :- i'

① From eq ⑦

$$\boxed{\frac{A_{21}}{B_{21}} \propto \nu^3}$$

i.e the ratio of the Einstein Coefficient of spontaneous emission to Einstein Coefficient of stimulated emission is directly proportional to the cube of frequency of incident Photons. This shows that the rate of spontaneous emission increases rapidly with the energy difference between two states.

② From eq ⑧

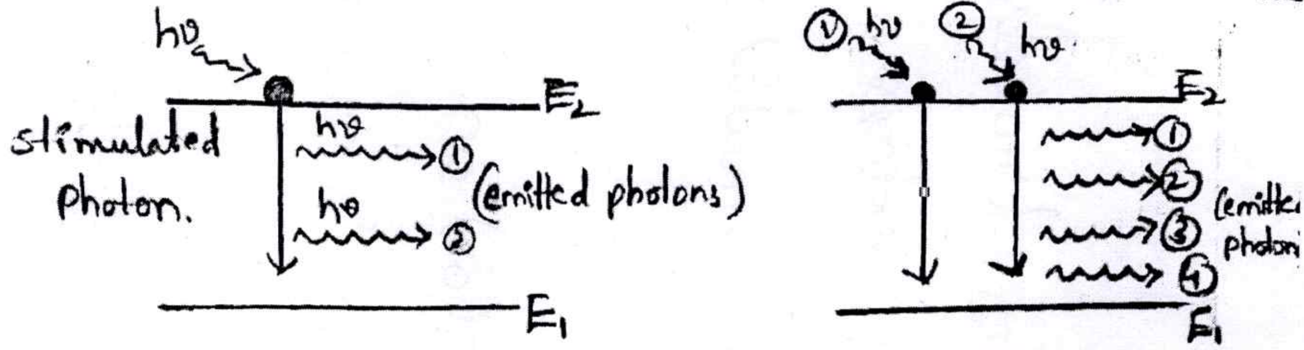
$$\boxed{B_{21} = B_{12}}$$

i.e thermo dynamically it was proved by Einstein's that the Probability of stimulated emission and absorption are equal.

Principle and working of Laser :-

① Lasing action :-

In stimulated emission, the emitted photon travels in the same direction, as that of the incident photon as shown in diagram, these two photons again stimulate two more excited electrons, as a result four photons are released. In a similar way, a chain reaction (or) an avalanche effect is produced this phenomenon is known as lasing action. So, a monochromatic, intense and coherent beam is obtained. this is called laser beam, and this is the principle of working of Laser.

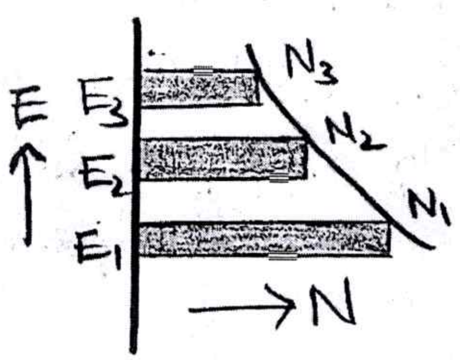


2) Population inversion :-

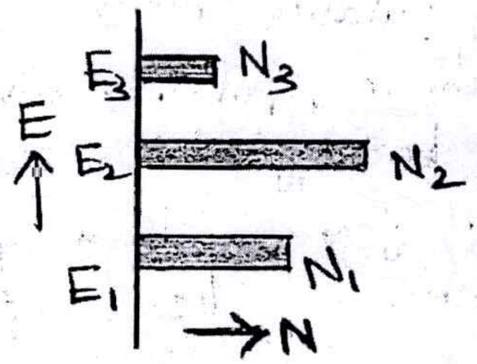
"The stage of making the population of the higher energy level to be greater then the population of the lower energy level is known as population inversion.

$\boxed{\text{i.e } E_2 > E_1 \text{ and } N_2 > N_1}$

→ Usually the no. of particles (or) population of higher energy level is less than the population of lower energy level. Consider three energy level system E_1, E_2 & E_3.



normal population



Population inversion.

In normal condition, $E_1 < E_2 < E_3$ and $N_1 > N_2 > N_3$. E_1 is the ground state, its life time is unlimited. E_3 is the highest energy state with very less lifetime of an atom (10^{-8} s; most unstable state) and E_2 is the intermidiate energy level with more life-time of an atom ($10^{-3}s$) compare to that of E_3. Hence E_2 is metastable state. When suitable from of energy is supplied to the system in suitable way then the atom excite from ground state to excited state (E_2 & E_3) due to unstability, excited atom will come back to the ground state, after spending its life time of respective energy levels E_2 & E_3. If this process is continued, then atoms will excite continously to E_2 & E_3, because of E_3 is most unstable state, atoms will fall in E_2 immideately. At a stage, the population in E_2 will become more than the population in ground state. This situation is called population inversion.

3) Pumping :-

The population inversion can not be achived thermally to achieve population inversion, suitable from of energy must be supplied. The process of supplying suitable from of energy to a system, to achieve population inversion is called pumping.

→ Most commonly used pumping methods are.
① optical pumping ② direct electron excitation (or) electric discharge ③ In-elastic atom - atom collision. ④ chemical reaction.

Life time :- The duration of time ($10^{-8}s$) spent by an electron in the excited state is known as lifetime of that electron.

Lifetime of an electron $= 10^{-8}s$.

Metastable state :- The excited state, which has long life time is known as metastable state.

→ The lifetime of electron in metastable state in $10^{-3}s$.

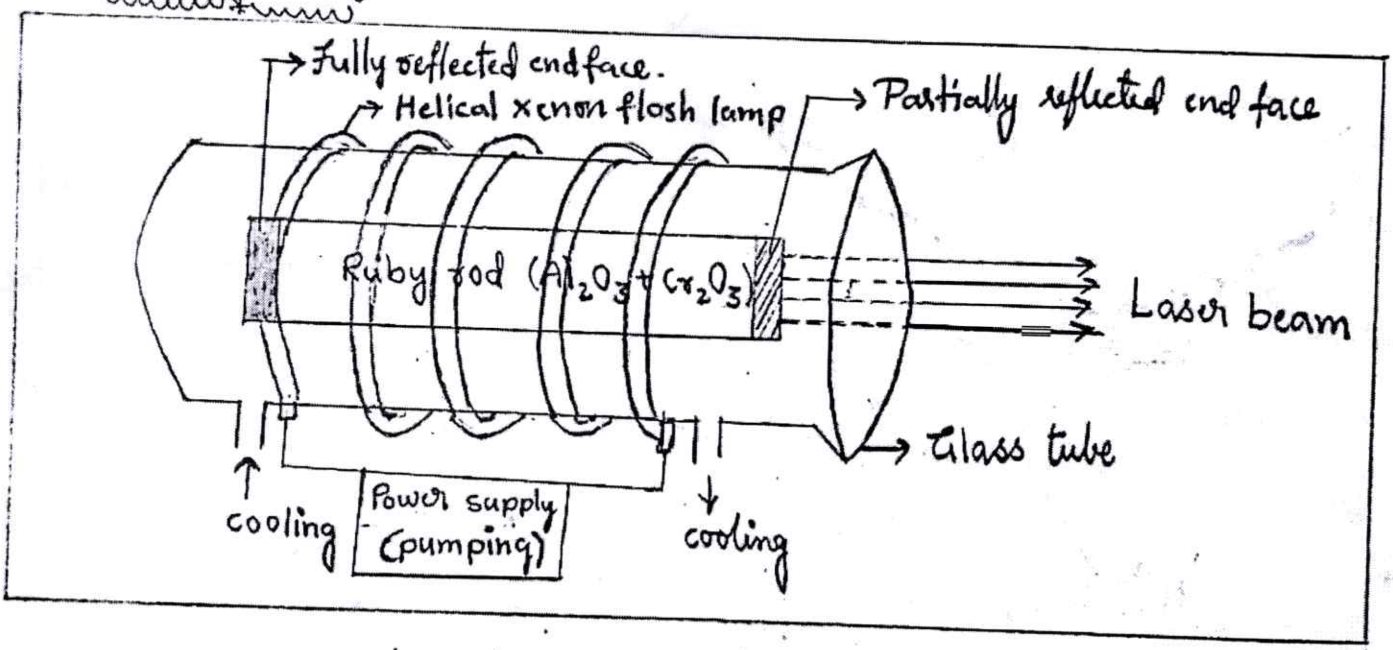
Ruby laser :- Ruby laser is a solid state, 3- level laser system developed by H.T. Maiman in 1960. It produces pulsed laser.

i) Source of energy (Pumping) :- A helical xenon flash tube with power supply source.

ii) Active medium :- A rod of Ruby crytal.

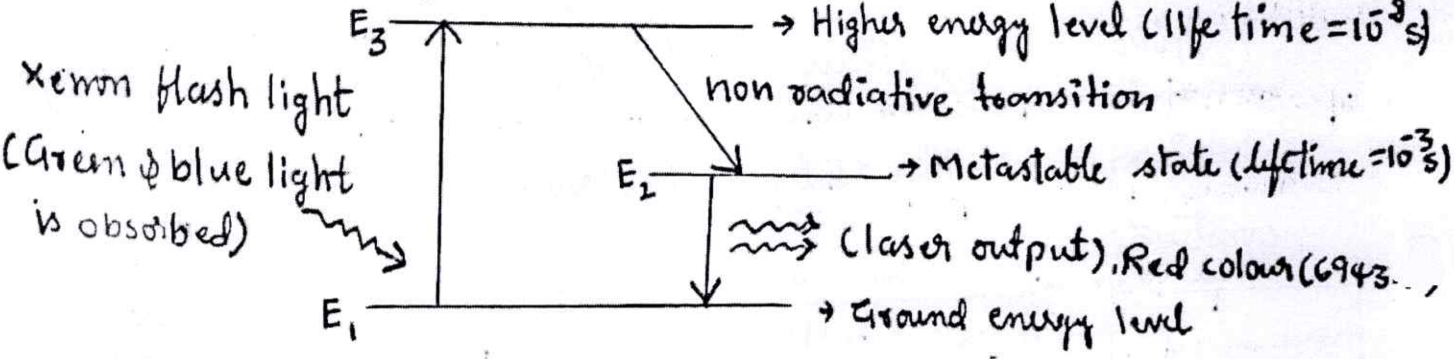
iii) Optical Cavity (or) Resonator :- Arengement of silver polished mirrors on eithes sides of the ruby rod.

Construction :-



A Ruby laser consist of a cylindrical ruby rod made up of Al_2O_3 which is doped with 0.05% weight of Cr_2O_3 and whose length is few centimeters and diameter is 0.5cm. The active material in the ruby are chromium ions Cr^{3+}. The end faces of the rod coated with silver in such a way that one end face becomes fully reflecting while the other end is partially reflecting, so that the two ends will act as optical (or) resonator cavity. The ruby rod is surrounded by a helical xenon flash tube which provides the pumping light to raise the chromium ion (Cr^{3+}) to upper energy level.

<u>Working</u> :- below energy diagram illustrating the operation principle of ruby laser



In normal state, the Cr^{3+} ions are in ground energy level. When the ruby crystal is irradiated with light of xenon flash. the Cr^{3+} ion absorbed light at wavelength around 5600 A° (5000A° - 6000A°) which will be either green or blue colour, then the Cr^{3+} ions are excited to the levels E_2 and E_3. few chromium atoms return to ground level (E_1) and other level E_2.

The transitions from E_3 to E_2 are non-radiative i.e chromium atoms gives part of their energy to the crystal lattice in the form of heat, that must be removed away from the system by providing some cooling arrangement to increase the efficiency of laser production.

from the excited state (E_3), the atoms spontaneously falls to the metastable state E_2. If pumping occurs continuosly

The accumatation of atoms takes place more and more in E_2 through E_3, which gives population inversion between E_2 and E_1 as a result stimulated emission takes place between E_2 and E_1, this emission gets multiple reflection between fully and partially reflected mirrors then strengthen and emitted laser beam of wavelength 6943 A° in red colour. one flash of xenon tube is used to get population inversion which causes laser beam, till the next flash of xenon tube repeats the process, thus the Ruby laser is not continuous, it is a pulsed laser

Uses of Ruby laser :-

→ Ruby lasers are used in optical holography.

→ Ruby lasers can be used for measurment of plasma properties such as electron density and temperature.

→ Melanin of the skin and tattos can be removed using this lasers.

CO_2 (carbon-di-oxide) laser :-

* Type : Molecular gas laser
* Source of energy (pumping) : Electrical discharge method
* Active media : CO_2 : N_2 : He gas mixture
* Optical Cavity : Quartz discharge tube (Arrengement of mirrors)

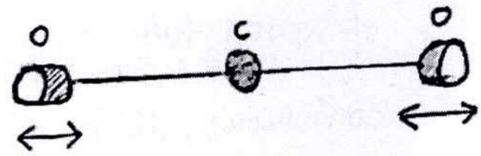
It is a one of the most powerfull and efficient laser which was designed by C.K.N. Patel in 1963.

* fundamental modes of vibration of the CO_2 molecule :-

There are three fundamental modes of vibrations

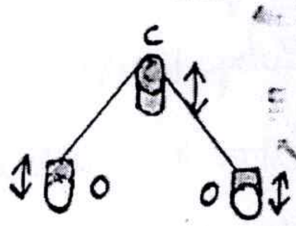
(i) Symmetric stretching mode :- Here the carbon atom is stationary and the oxygen atoms oscillates (or) vibrates along the axis of the molecule simultaneously approaching (or) departing

→ Here quanta of frequency is (1 0 0)



(ii) Bending mode of vibrations :- Here the atoms will not be linear, rather the atoms will vibrate perpendicularly to the molecular axis

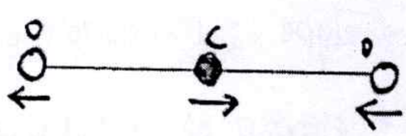
→ Here quanta of frequency (0 2 0)



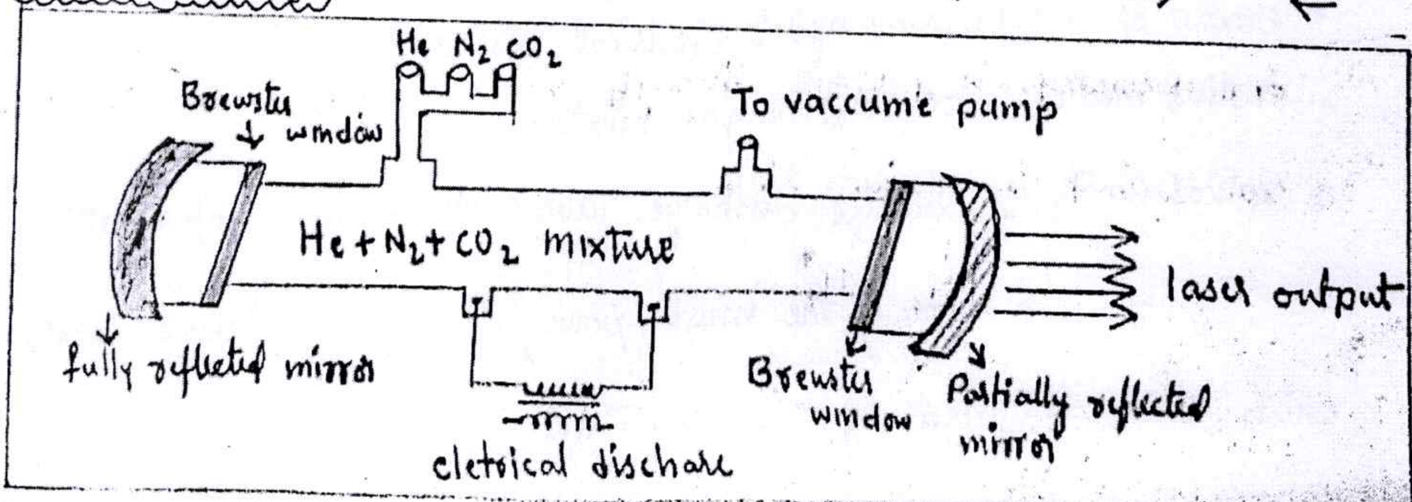
(iii) Asymmetric stretching mode :-

Here all the three atoms will vibrate, but oxygen atoms vibrate in the opposite direction to the vibration direction oxygen atoms

→ Here quanta of frequency (0 0 1)



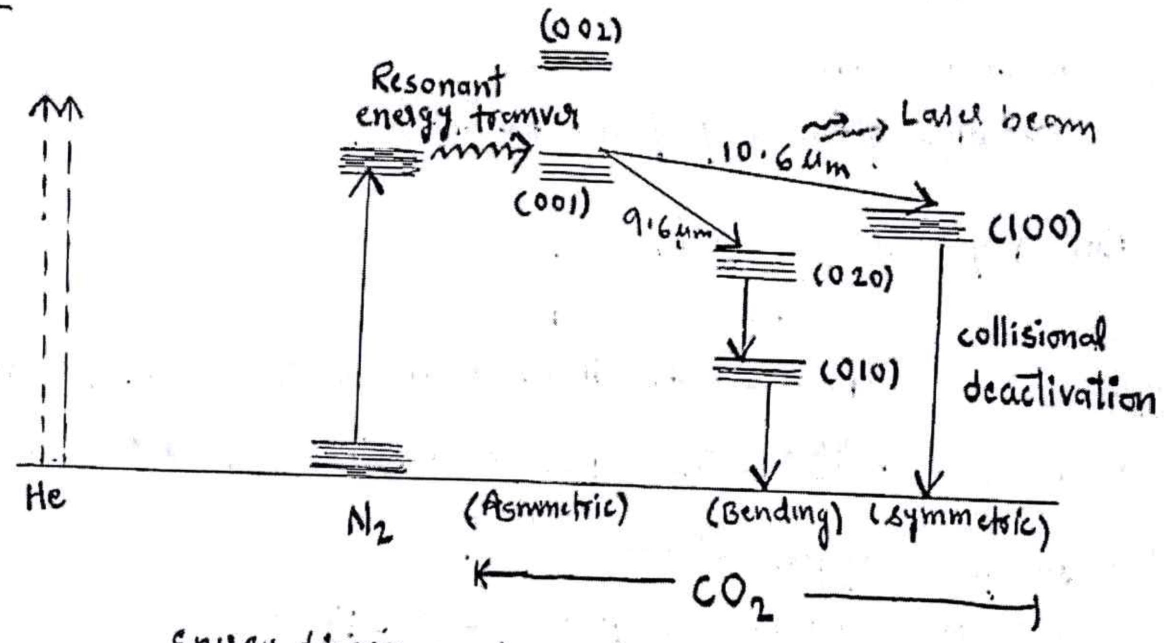
* construction :-



It is consist of a discharge tube in which CO_2 is taken along with nitrogen and helium gasses with their pressure level of 0.33 : 1.2 : 7 mm of Hg for CO_2, N_2 and He respectively. N_2 helps to increase the population of atoms in the upper level of CO_2. While He helps to depopulate the atoms in the lower level of CO_2 and also to cool the discharge tube.

The discharge is produced by D.C. excitation, at the ends of the tube, brewster windows are placed as shown in diagram to polarize laser beam. One end of the resonant cavity has fully reflected mirror and other is partially reflected.

* **Working** :-



Energy diagram of CO_2 laser.

① The discharge is passed through the tube first, the N_2 atoms are raised to excited state.

$$\bar{e} + N_2 \rightarrow N_2^*$$

② The N_2 atoms undergo resonant energy transver with CO_2 atoms and raises $CO_2(001)$ to excited state due to closer energy level of $CO_2(001)$ and N_2

$$N_2^* + CO_2 \longrightarrow CO_2^* + N_2$$

③ When transition takes placed between (001) to (100). laser of wavelength 10.6 μm is emitted as shown in energy diagram

④ Simillarly when transition takes place between (001) and (020) laser beam of wavelength 9.6 μm is emitted which can be absorbed by quartz tube.

⑤ Since (001) → (100) has higher gain that (001) → (020) transition usually the laser beam of wavelength 10.6 μm is produced more

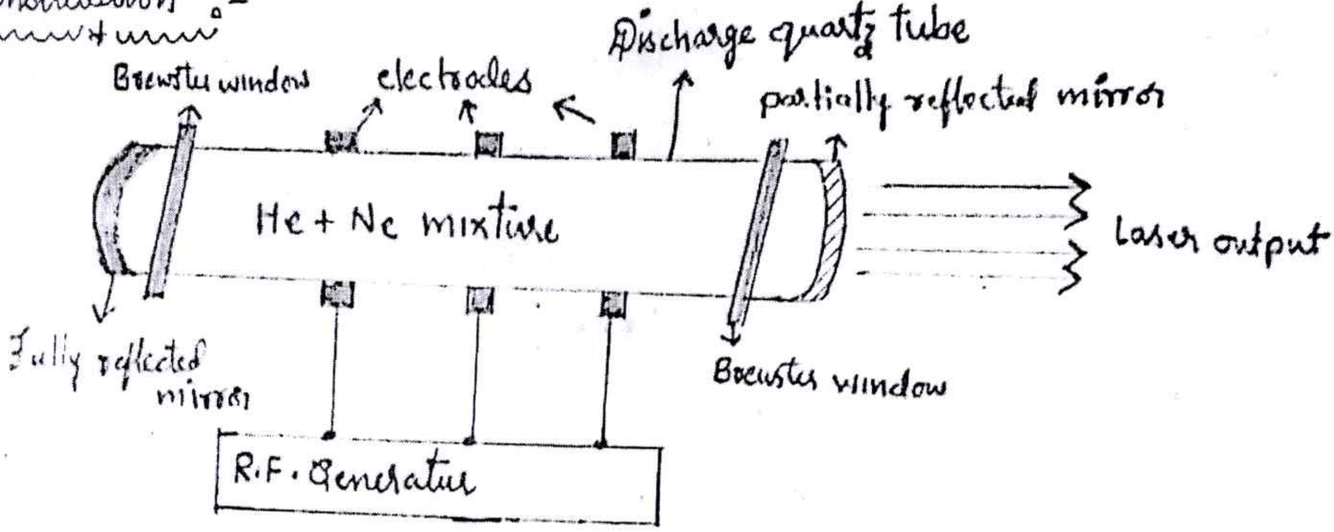
6) This type of CO_2 laser is known as TEA laser (Transversed Excited Atmospheric Pressure laser)

He-Ne laser :-

Helium-neon (He-Ne) laser is a gaseous system of lasem. and it is used to produce continuous laser beam.

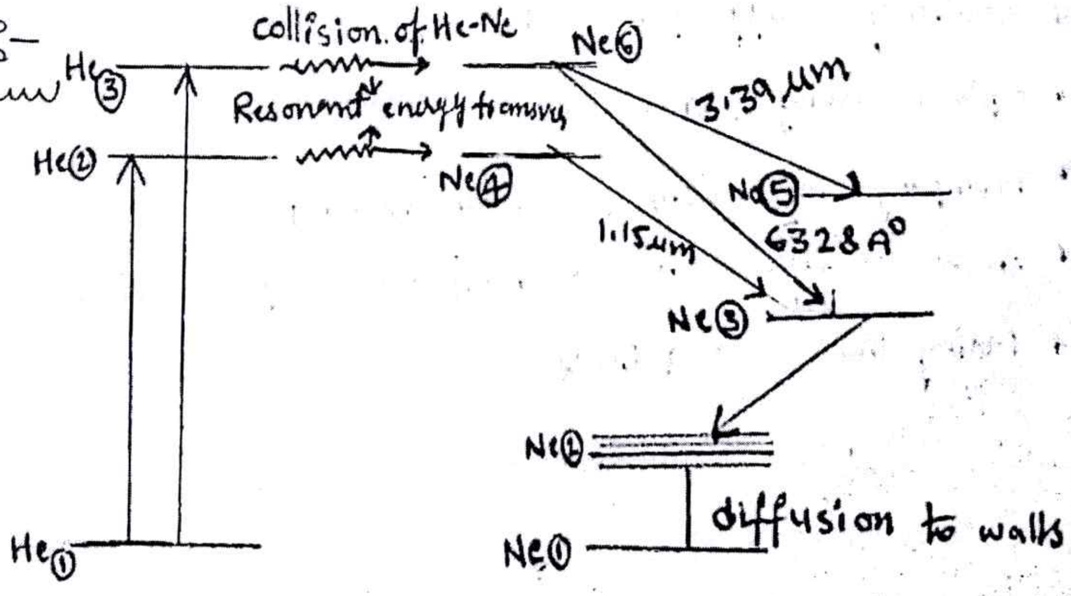
* Source of energy (pumping) : R.F. oscillator
* Optical cavity : Arrengement of reflector
* Pumping mechanism : Electric dischaage
* Active medium : Helium-neon (He-Ne) gas mixture
* Lasing lavel : 4 levels.

construction :-



He-Ne laser consist of a fused quartz tube with a diameter of 1.5 cm ~~of Hg~~ and 180 cm length. It is filled with He-Ne gas mixture with 10:1 ratio. Helium is maintained under a pressure of 0.1 mm of Hg and Ne is at a pressure of 1 mm of Hg. Hence He atoms are majority and neon atoms are minority. Three electrods are connected to the power supply which excite the active medium. Brewster windows are connected ~~as~~ to the quartz tube to polarize the laser beam and one end of the quartz tube is connected to fully reflected mirror and other is partially reflected mirror.

Working :-



① When an electric discharge is passed through the He-Ne gas mixture, helium atoms are excited to higher energy levels to i.e He② & He③, due to the collision with electrons.

② neon atoms contain 6 energy levels they are Ne①, Ne②, Ne③, Ne④, Ne⑤ and Ne⑥. Here Ne④ and He② and Ne⑥ & He③ have same energy and lifetime. The states He② & He③ are metastable states

③ Excited He atoms then collide inelastically with ground state neon atoms and transver their energy to neon atoms

④ Then neon atoms excited to their metastable states Ne⑥ & Ne④, after collision the He atoms are return to its ground state (He①).

⑤ The population invesion is created between Ne⑥ & (Ne⑤, Ne③) group, and also between Ne④ & Ne③. so there by 3 possible transition.

i) Ne⑥ → Ne③ Transition :- This transition generates laser beam of red colour of wavelength 6328 A°.

ii) Ne⑥ → Ne⑤ Transition :- During this transition an electromagnetic radiation of wavelength 3.39 μm is emitted

iii) Ne④ → Ne③ Transition :- During this transition an electromagnetic radiation of wavelength 1.15 μm is emitted.

⑥ Whereas 3.39 μm & 1.15 μm transitions are in I.R regions and 6328 A° transition is in visible region.

(7) Quartz tube absorb 1.15 um and 3.39 um radiations. then 6328A° wavelength beam gets multiple reflections in between two mirrors and gain sufficient energy and then emitted out.

Uses :-

1. It gives continuous laser beam.
2. This laser is highly directional, monochromatic, coherent and stable.
3. He-Ne laser is usefull in making holograms and interferometer experiments
4. Cooling is not required

Semiconductor material & construction :-

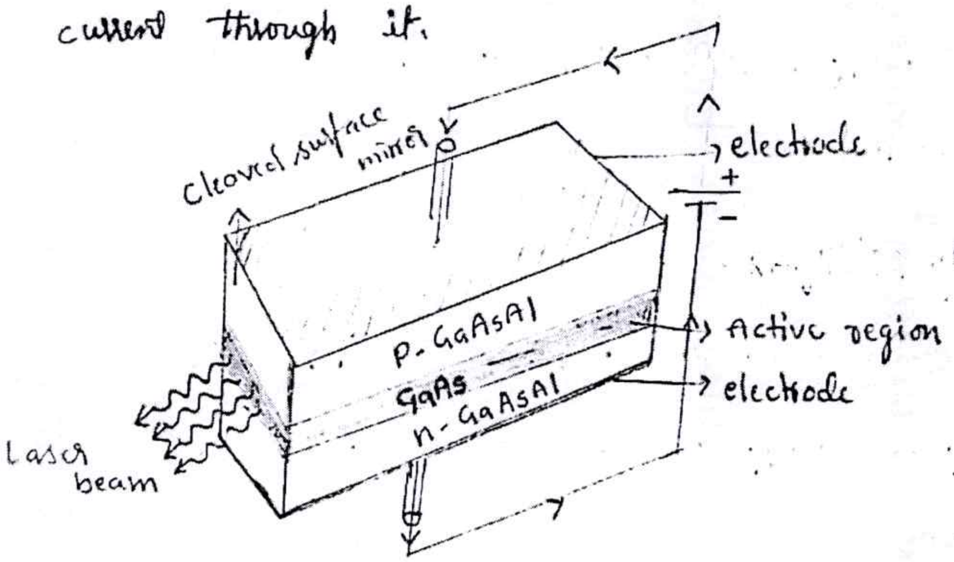
→ Laser diodes are made using direct bandgap semiconductor.

→ Gallium Arsenide (GaAs) diode is an example of semiconductor laser.

→ GaAs is sandwiched in between a n-type GaAs Al and P-type GaAsAl layers as shown in diagram

→ Laser diode is a ~~heavy~~ heavily doped p-n junction diode

→ The resonant cavity is provided by polishing opposite faces of GaAs crystal, The pumping occurs by pasing electrical current through it.



→ Semiconductor lasers are available in two types. They are.

① Homojunction diode laser (same Refractive index of P&n junctions)

② Heterojunction diode laser (different layers of P&n junctions)

→ For both types of diode lasers working principle is same but construction is different.

Working principle

Whenever the p-n junction is forward biased.

Absorbtion :-

→ In absorbtion, the valence elections, which are present in the valence band jump into higher energy level (conduction band).

→ Now, there are holes at valence band and electrons are at conduction band.

spontaneous emission :-

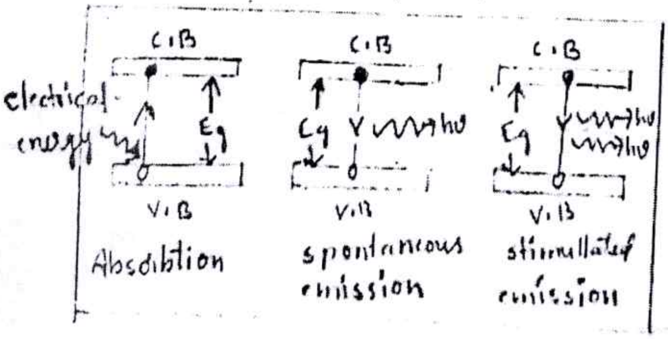
→ After spending the lifetime (10^{-8}s) elections from conduction band will tend to move to valince band by emitting a photon of energy (equal to E_g). this process is known as spontaneous process.

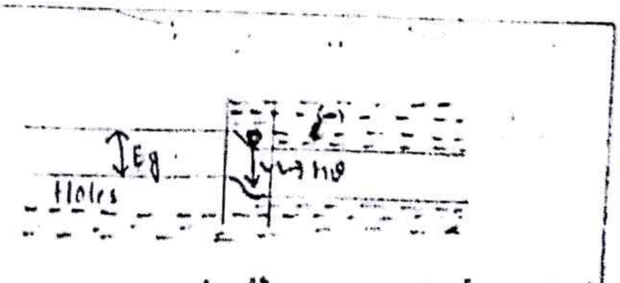
stimulated emission :-

→ In stimulated emission, a photon strikes election in conduction band and gain energy and recombine with hole by emitting extra photon.

→ Therefore there are two photons having same energy and phase are released in stimullated emission.

→ Due to the plane polished surfaces, multiple reflections in cavity are performed. hence highly directional coherent light is emitted.





Energy band diagram under forward bias

Nd: YAG Laser :-

neodymium (Nd) : Yttrium alluminium garnet ($Y_3Al_5O_{12}$) laser is a solid state laser, having 4 - energy level system.

i) Source of energy (pumping) :-

Xenon or Krypton flash tube with power supply source

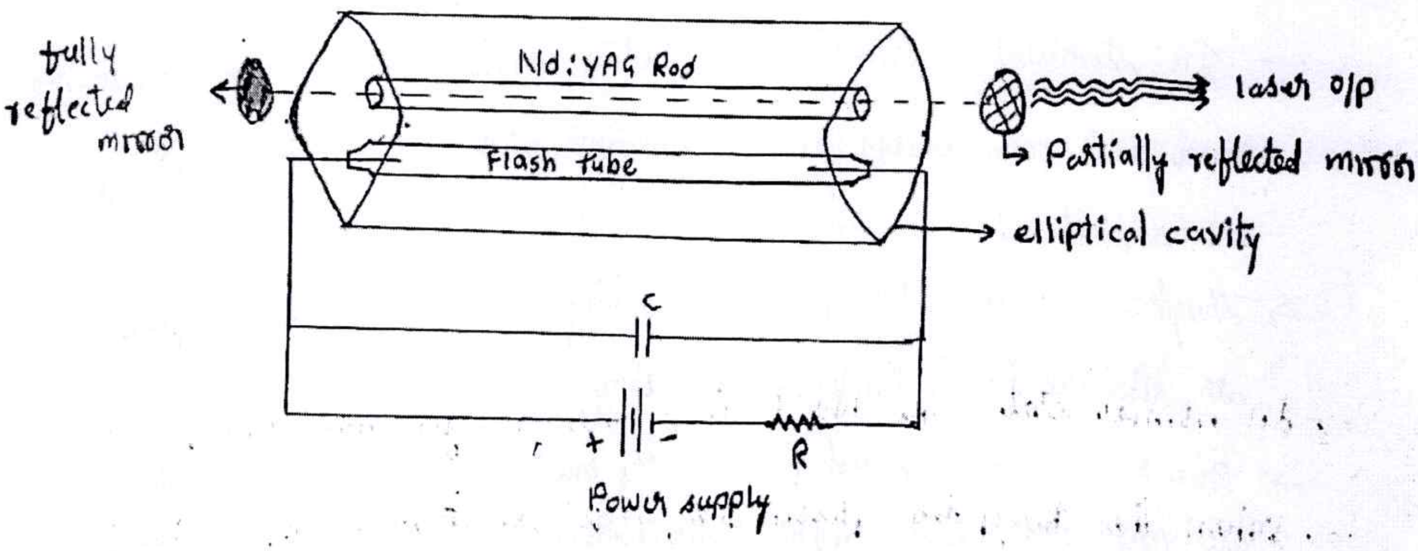
ii) Active medium :-

A rod of YAG crystal doped with Nd. and active material is Nd^{3+} ions

iii) Optical Cavity (or) Resonator :-

Elliptical cavity having silver polished mirror

construction :-

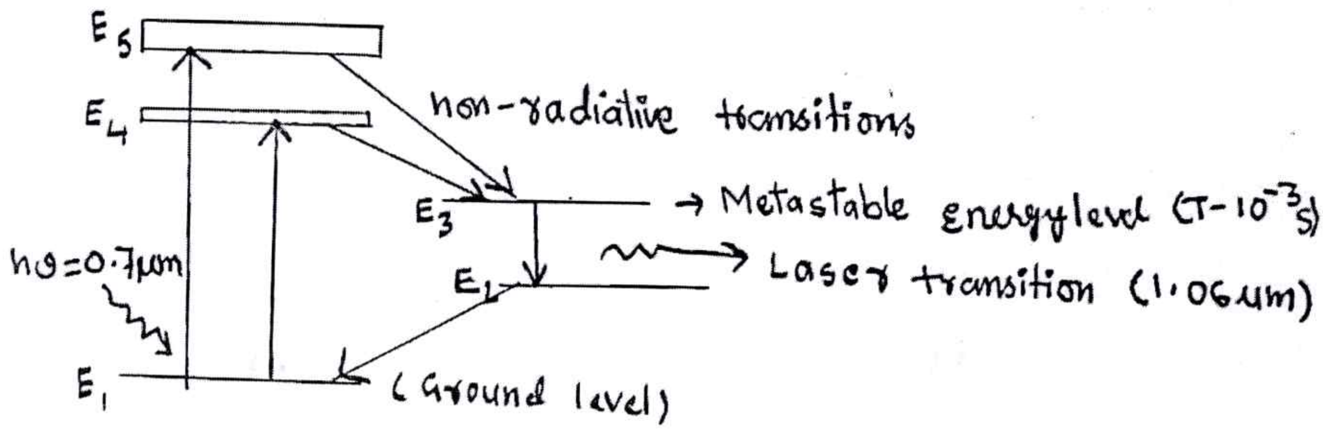


A Nd: YAG laser is consist of an elliptically cylindrical YAG crystal rod is doping with 0.725% of weight of neodymium. and whose length is 10mm and 12 mm in diameter. The active material of Nd: YAG laser is neodymium (Nd^{3+}) ions, the end faces of this rod is coated with silver in such a way that one end is acted as fully and another is partially reflected mirrors (resonator), Krypton flash tube is arrange which provides pumping light to raise the Nd^{3+} ions to upper level.

Working :-

→ The crystal atoms donot participate in the lasing action but serve as a host lattice. Y^{3+} ions are replaced by neodymium ions (Nd^{3+})

below diagram explains the operation principle of Nd:YAG laser.



→ In normal state the Nd^{3+} ions are in ground energy level

→ When the Krypton flash lamp is switched on Nd^{3+} ions are excited to the upper energy level (E_4 & E_5)

→ Then the Nd^{3+} ions take a transition from E_5 & E_4 energy levels to E_3 by non radiative transition.

→ The population inversion is occur in between E_3 & E_2

→ Then 1.06 um laser beam is emitted by transition from E_3 to E_2

→ This laser beam gets multiple reflections in between fully and partially reflected mirror and strengthen then emitted from partially reflected mirror

* Advantages :-
  1) It consume low power
  2) It has good mechanical process
  3) High output
  4) Easy to operated.

* Argon ion Laser :-

Argon ion laser was devoloped by William Bridges in 1964. it is an ion Laser of 4 energy level system.

i) Characteristics :-

→ Type of Laser – It is a gas laser

→ Active medium – Argon gas.

→ Pumping method - electric discharge

→ et energy level – 4 level of pumping

→ Power output – 100 watts

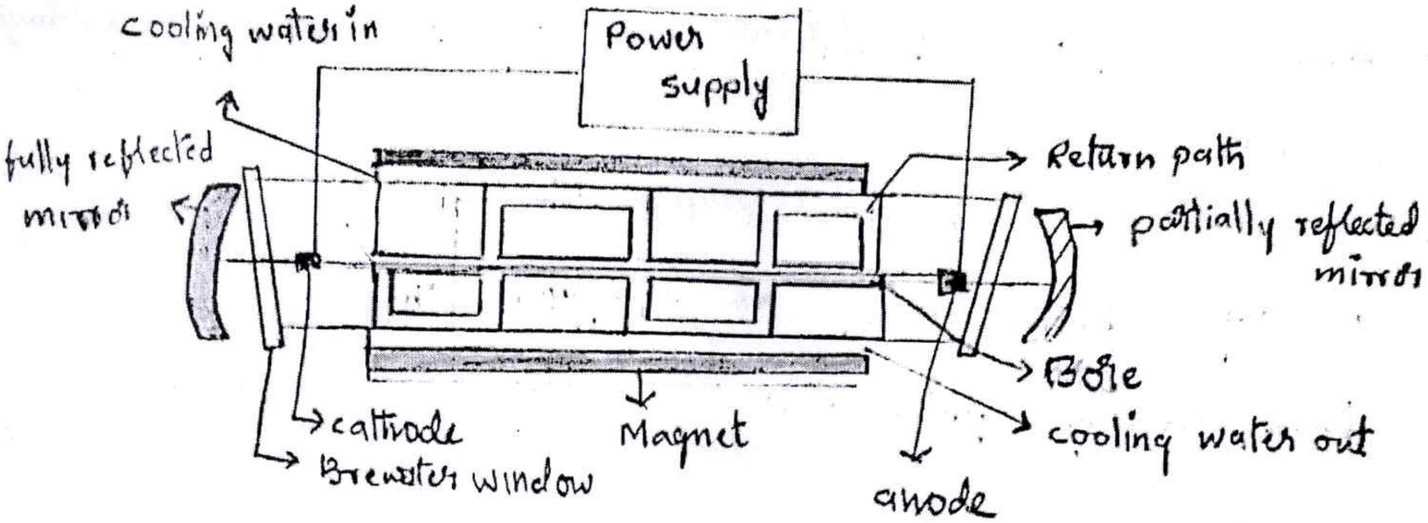
→ Nature of output – continuous wave and pulsed wave.

→ Wavelength of output – It emitts multiple wavelength mostly blue (4881 A°) and green (5145A°) light.

– In visible region ranging from 4089A°

→ In UV region 740A°.

ii) construction :-



→ It is consist of a narrow water cooled ceramic tube, the electrodes are arrenged at the ends of the capillary tube

→ The gas is circulated freely between the anode and cathode spaces via return gas path

→ The discharge is surrounded by magnet which supports the circutale the gas through exactly from the centre of the tube

→ two Brewster windows either side of the tube are arrenged to polarized the laser beam

iii) working :-

→ An initially high voltage pulse, is ionized the Argon atom from its ground energy level. Then Argon ion raises to a group of its high energy level is about 35 eV.

→ The possible transitions of Ar ion from high energy level to low energy levels are

1) when Ar ion take transition from higher energy level(4P) to lower energy level(4S) multiple wavelengths are emitted, but high intense wavelength are 4881Å (blue) and 5145Å (green

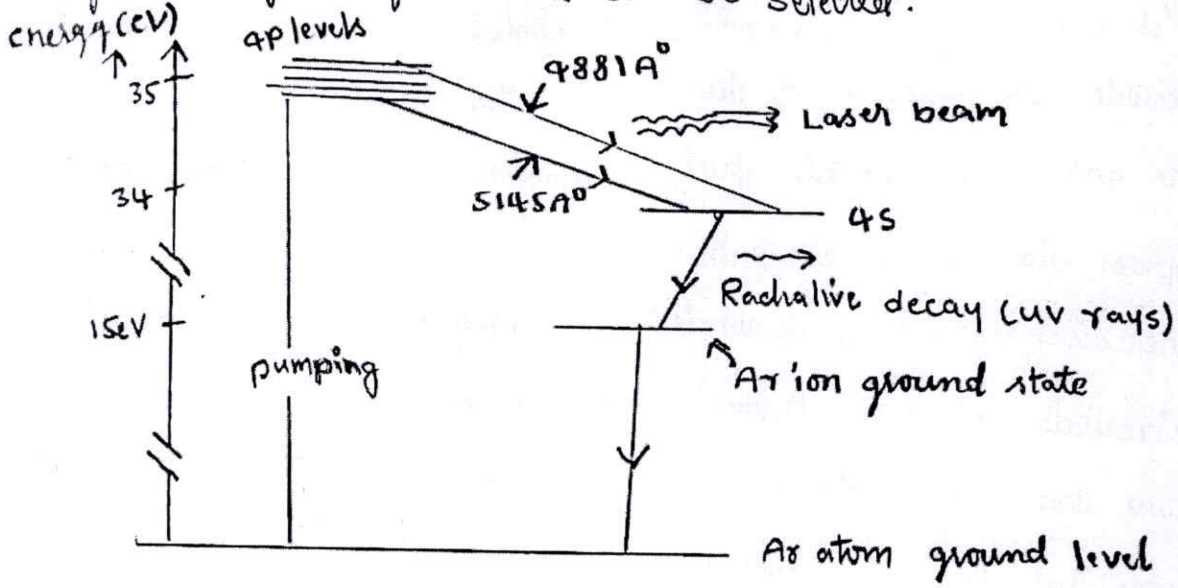
2) Ar ion quickly drops from the lower energy level to ground energy level. of Ar ion the wavelength of 740 A° (UV rays) is emitted

→ The ground state ion can recapture the electron become natural atom

→ during the operation positive ions tends to collect at cathode

→ Total system can be cooling by water cooling arrengement

→ Any wavelength of LASER can be selected.



iv) Advantages :-

1) → Width of the spectrum is large as it emits multiple wavelength.

2) → o/p is very high

3) → high-gain system

4) → divergence of beam is very small.

v) Disadvantages :-

1) cost is high

2) Efficiency is small

3) large power supply is required

vi) Applications :-

1) Ar lasers are used to treat glaucoma & diabetic eye deseases

2) Ar lasers are used in Raman spectroscopy.

3) Ar lasers are used in Holography.

4) Ar lasers are used in laser light shows.

Applications of Lasers :-

i) Lasers in scientific ~~seac~~ research :-

① lasers are used to clean delicate pieces of art: develop hidden finger print.

② lasers are used in the fields of 3D photography called holography.

③ Using lasers in internal structure of micro organisms and cells are studied very accurately.

④ Lasers are used to produce certain chemical reactions

ii) Lasers in Medicine :-

① The healing action of a laser beam is used to remove diseased body tissue.

② Lasers are used for elimination of moles and Tumours, which are developing in the skin tissue.

③ Argon and CO_2 lasers are used in the treatment of livers and lungs.

4) Laser beam is used to correct the retinal detachment by eye specialist

iii) Laser in communication :-

1) More amount of data can be sent due to the large band with of semiconductor laser.

2) More channels can be simultaneously transmitted

3) Signals can be tapped.

4) Atmospheric polusion concentration, ozone concentration and water vapour concentration can be measured.

iv) Laser in industry :- Lasers are used ~~to~~.

1) To blast holes in diamonds and hard steel

2) To cut, drill, welding and remove metal from surfaces.

3) To measure distance for making maps by servayors

4) For cutting and drilling of metals and non metals such a ceramics, plastics & glass.

Optical fibers

Introduction :- Light wave cannot travel far in open atmosphere. as the energy gets very rapidly dissipated. Hence some kind of guiding channel is needed just like for guiding electric current, a conducting path like a metal wire is needed. optical fiber provides the neccessary waveguide for light. It is a cylindrical wave guide system which can be operate at optical frequencies i.e. optical signals can be transmitted through a fiber over long distance.

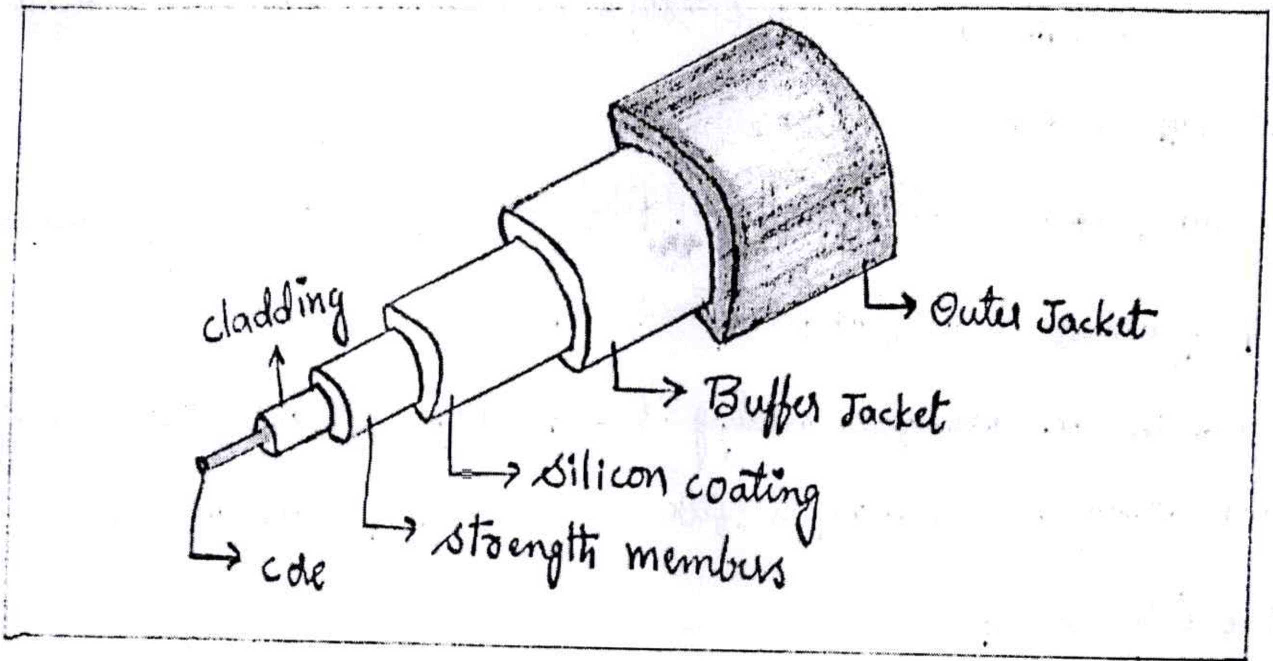
It is playing an important role in the field of communication to transmit voice, television and digital data signals from one place to another place. The transmission of light along the thin cylindrical glass fiber by total-internal reflection was first demonstrated by John Tyndal in 1870.

Definition :-

Optical fiber is a cylindrical wave-guide system which electromagnetic energy in the form of light can be transmitted through it with very little leakage.

→ Light transmitted through the optical fiber by the phenomenon of "Total internal-reflection".

Construction of optical fiber :-



An optical fiber mainly consists the following parts
① core, ② cladding, ③ silicon coating, ④ Buffer jacket
⑤ strength members ⑥ outer jacket

① **core :-** A typical glass fiber consists of a central core of thickness 50um surrounded by cladding. core is made by glass
→ The light will transmits through the core.

② **cladding :-** cladding has slightly lower refractive index than core. The overall diameter of cladding is nearly 125 to 200um
It is also making with either glass or plastic.

③ **silicon coating :** It is provided between buffer jacket and cladding, in order to ~~impure~~ improve the quality of transmission of light.

④ **Buffer jacket :-** Buffer jacket is made with plastic and it is protects the fiber from moisture and abrasion.

⑤ strength members :- To provide neccessary toughness and tensile strength. a layer of strength members arrenged surrounding the buffer jacket.

⑥ Outer jacket :- Finally the fiber cable is covered by black polyurethane outer jacket. Because of this arrengement fiber cable will not be damaged during hard pulling, bending, stretching (or) rolling, even though fiber is made up of brittle glass.

* Total internal reflection :-

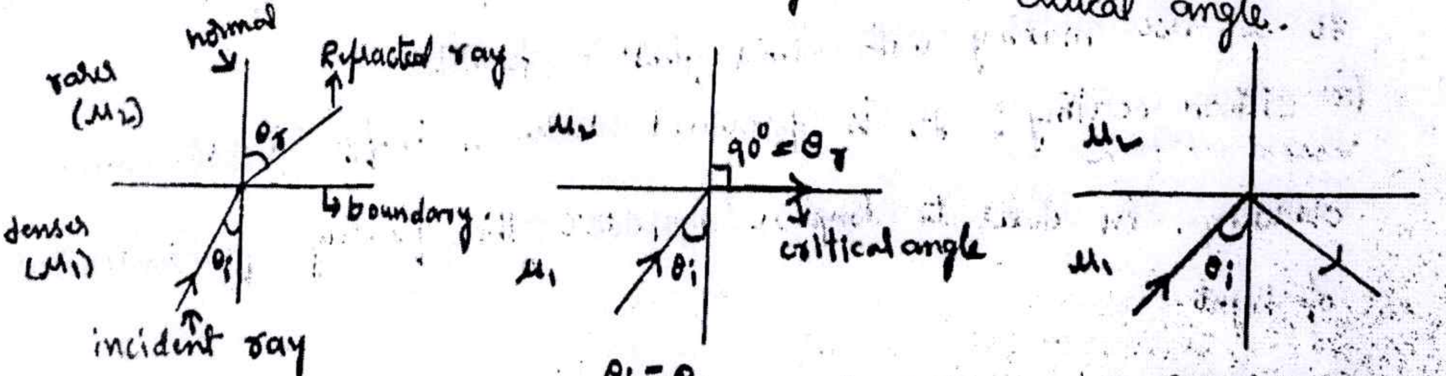
→ Total internal reflection is the 'principle of optical fiber'

" The phenomenon in which a light ray gets totally reflect back when its incidents at an angle greater than the critical angle, is called 'Total internal reflection'.

conditions for total internal reflection :-

① The light rays must travel from denser medium to rarer medium.

② The angle of incidence must be greater than critical angle.



$\theta_i < \theta_c$
Angle of incidence is less than the angle of refraction

$\theta_i = \theta_c$
Angle of incidence is equal to the angle of refraction

$\theta_i > \theta_c$
Angle of incidence greater than the angle of refraction causes TIR

By snell's law.

$\mu_1 \sin\theta_i = \mu_2 \sin\theta_r$

where μ_1 - Refractive index of glass (denser)
μ_2 - Refractive index of air (rarer)

Suppose if $\theta_i = \theta_c$ then $\theta_r = 90°$ hence

$\mu_1 \sin\theta_c = \mu_2 \sin 90°$

$\mu_1 \sin\theta_c = \mu_2$ [since $\sin 90° = 1$)

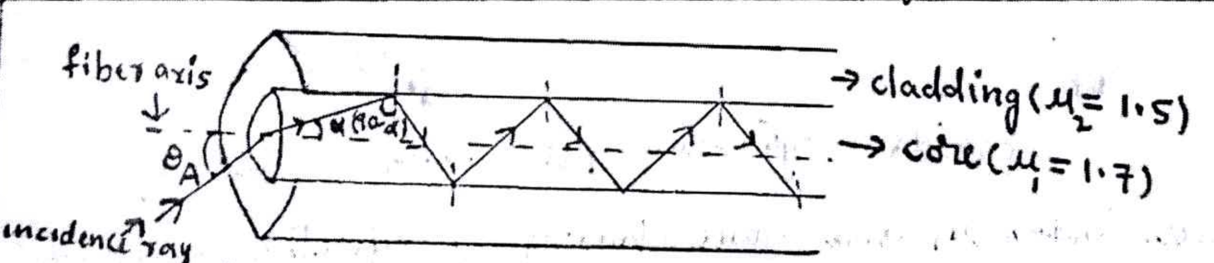
$\sin\theta_c = \frac{\mu_2}{\mu_1}$

$$\boxed{\theta_c = \sin^{-1}\left(\frac{\mu_2}{\mu_1}\right)}$$

* Optical fibes as dielectric waveguide :-

→ The light will travelled through the optical fiber based on the principle of Total internal reflection.

→ Optical fiber itself it is a dielectric waveguide in which entired light in optical fiber will get total internal reflection at the interface of core and cladding.



where θ_A - Acceplance angle
& core RI(μ_1) is greaterthan cladding RI(μ_2).

→ When the light ray entired the optical fiber at small angle known as acceptance angle (θ_A) with the optical fiber axis, this ray refracted thr into the core with an angle of refraction α.

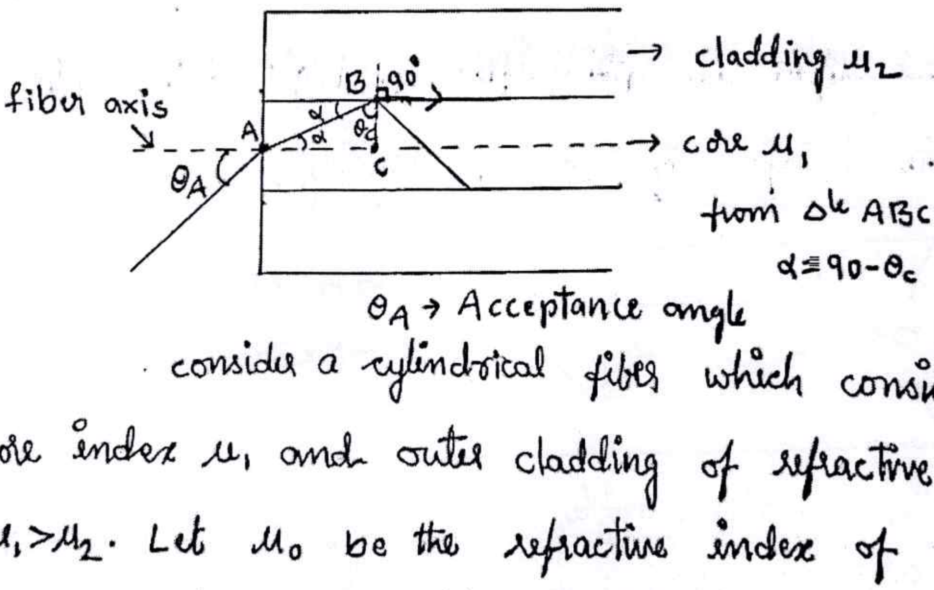
→ This light ray will incidence at the interface between core and cladding at an angle $\theta = (90-\alpha)$ should be greater than critical angle. then the light will get total internal reflection

→ Then this light ray undergoes repeated TIR until it emerges out from the other end of the optical fiber.

→ In this way guided transmission of energy at optical frequencies is possible.

* Acceptance angle :-

Acceptance angle is defined as "the maximum angle of incidence at the first end of the optical fiber for which launched light enters into the core and travels along the interface of core and cladding".



$\theta_A \rightarrow$ Acceptance angle

consider a cylindrical fiber which consists of inner core index μ_1 and outer cladding of refractive index μ_2 where $\mu_1 > \mu_2$. Let μ_0 be the refractive index of the medium from which the light ray enters the fiber. this end of the fiber is known as launched end. Let a ray of light enters the fiber at an angle 'θ_A' to the fiber, as shown in diagram.

Appling snell's law at the point 'A'

$$\mu_0 \sin\theta_A = \mu_1 \sin\alpha \longrightarrow ①$$

~~sin θ~~ from right angle triangle ABC

$$\alpha = (90 - \theta_c)$$

from eq ① ; $\mu_0 \sin\theta_A = \mu_1 \sin(90-\theta_c)$

$$\mu_0 \sin\theta_A = \mu_1 \cos\theta_c \longrightarrow ②$$

Applying snell's law at point B.

$$\mu_1 \sin\theta_c = \mu_2 \sin 90^\circ$$

$$\sin\theta_c = \frac{\mu_2}{\mu_1} \rightarrow ③ \quad (\because \sin 90^\circ = 1)$$

from ② ; $\sin\theta_A = \frac{\mu_1}{\mu_0} (\sqrt{1-\sin^2\theta_c})$

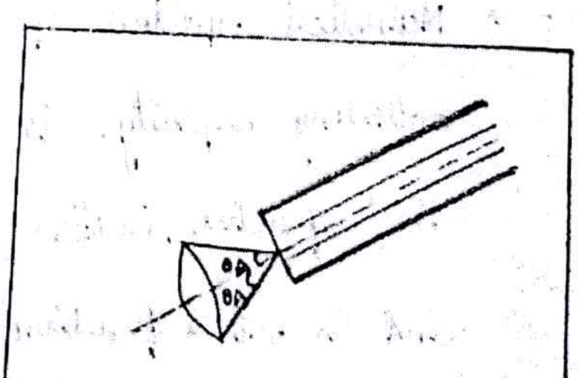
from ③ ; $\sin\theta_A = \frac{\mu_1}{1} (\sqrt{1-(\frac{\mu_2}{\mu_1})^2} \quad (\because \mu_0 = 1)$

$$\sin\theta_A = \mu_1 \frac{\sqrt{\mu_1^2-\mu_2^2}}{\sqrt{\mu_1}^2}$$

$$\sin\theta_A = \sqrt{\mu_1^2-\mu_2^2}$$

$$\boxed{\theta_A = \sin^{-1}(\sqrt{\mu_1^2-\mu_2^2})}$$

* Acceptance cone :-



→ The cone obtained by rotating the light ray along the acceptance angle about the axis of the optical fiber is known as 'acceptance cone'.

→ Here the light rays contained within the cone of angle $2\theta_A$ are accepted and transmitted along the optical fiber.

* Numerical aperture (NA) :-

It is defined as the light gathering capacity of an optical fiber. it is proportional to acceptance angle. Numerically it is equal to sine of acceptance angle.

i.e $\boxed{N \cdot A = \sin\theta_A = \sqrt{\mu_1^2 - \mu_2^2}}$

$$N \cdot A = \sqrt{(\mu_1 + \mu_2)(\mu_1 - \mu_2)} \rightarrow (1)$$

$$\Delta = \frac{\mu_1 - \mu_2}{\mu_1} \Rightarrow \mu_1 - \mu_2 = \Delta \mu_1$$

where 'Δ' is the ratio of differnce of refractive indic of core and cladding.

If $\mu_1 = \mu_2$ and $\mu_1 - \mu_2 = \Delta\mu_1$

from (1); $N \cdot A = \sqrt{\mu_1 + \mu_2 (\Delta\mu_1)}$

$$= \sqrt{2\mu_1^2 \Delta}$$

$$\boxed{N \cdot A = \mu_1 \sqrt{2\Delta}}$$

This is the relation between numerical aperture and relative refractive index change.

→ Numerical Aperture of a optical fiber i.e the light collecting capacity. is effectively dependent only on the refractive indices of the core and cladding materials and is not a function of the fiber dimensions.

* Step index and Graded index optical fibers:-

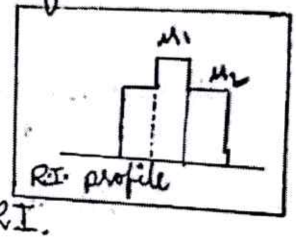
Depending upon the refractive index profile of core & cladding optical fibers are classified into two types.

① Step-index optical fiber

& ② Graded-index optical fiber.

① Step-index optical fiber :-

→ In step-index optical fibers, the refractive index of the core medium is uniform and it is slightly more than the refractive index of cladding



i.e $\mu_1 > \mu_2$ where μ_1 - core RI

μ_2 - cladding RI.

→ The shape of the propagation appears in a zig-zag manner.

→ In step-index optical fiber i) step-index single mode and ii) step index multimode optical fibers are available

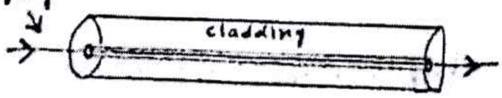
i) step-index single mode fiber :-

→ There is only one path for ray propagation.

→ It is used for short distance ~~propagation~~ communication

→ Distortion does not take place.

→ The diameter of the core is about ~~50 - 200 μm~~ 10 μm.

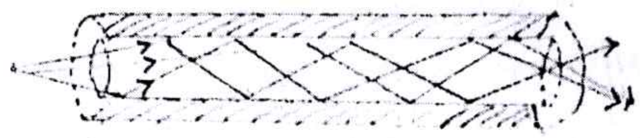


ii) step-index multimode fiber :-

→ There is more than one path for ray propagation

→ Signal distortion is more due to rays are reflected at high angles and travel long distances.

→ The diameter of the core is about 50-200 μm.



→ In step-index optical fibers some delay will be occured at output. It is called intermodal dispersion, due to of this reason, the transmission rate and capacity of the signal in multimode step-index optical fiber reduced.

→ To overcome this difficulty graded index optical fibers are introduced.

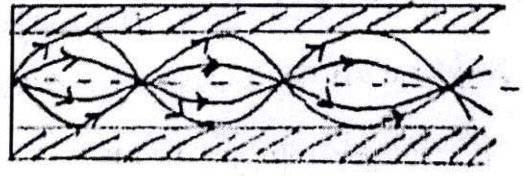
ii) Graded index optical fiber :-

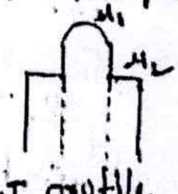
→ In the graded index manner optical fiber, the refractive index of the core medium is made to vary in parabolic manner such that the maximum refractive index is present at the centre of the core and it is slightly decreasing with increasing diameter of the core, At the interface of the core and cladding it is minimum.

→ The diameter of the core is about 50 μm.

→ The transmitted optical signals travels through core medium in the form of skew rays (or) helical (or) spiral manner as shown in diagram.

→ The problem of intermodal dispersion can be removed in this fiber by making variation in refractive index of core, so there is no output delay will be presented in this fibers.





R.I profile

* Attenuation in optical fiber (or) Losses in optical fibers :-

The losses in optical fibers are classified into two types.

(I) Internal losses and (II) External losses

I) Internal losses :-

1. **Absorption losses :-** Absorption of rays is basically a material property and it occurs at all wavelengths.

→ These losses are ~~expected~~ expressed in desibels per kilometer [dB/km]

Mathematically the loss can be expressed as

$$P_{out} = P_{in} e^{-aL/10}$$

where P_{out} – out put power of fiber length 'L'

P_{in} – Input power

a – fiber attenuation in dB/km

$$\boxed{\therefore \ a = \frac{-10}{L} \log\left(\frac{P_{out}}{P_{in}}\right) \ dB/km}$$

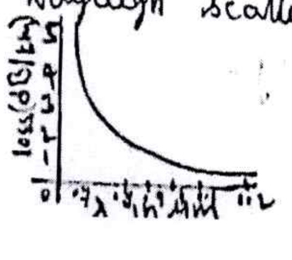
2) **Scattering losses :-** Scattering losses are caused by the interaction of light with density fluctuations with in the fiber.

→ density changes are produced, when optical fibers are manufactured.

→ Rayleigh scattering occurs when the size of the density fluctuations (fiber defect) is lessthan one-tenth of the operating wavelength of the light. it is proportional to 4th power of wavelength.

→ As the wavelength increases Rayleigh scattering decreases.

Rayleigh scattering losses in silica fiber →



3) Leaky loss mode :-

→ Losses due to leaky modes arise due to irregularities in waveguide geometry. so these can be regarded as wavelength scattering.

→ In order to reduce this loss, a cladding is covered by one more layer having greater refractive index than it, but smaller refractive index than the core layer.

II) External Losses :-

① core misalignment :- If the core layers of two optical fibers to be joined are not exactly of the centers, then the data may be lost while connecting the optical fibers.

② Gap losses :- these losses occur if a certain gap is present between two optical fibers to be joined

③ Losses due to difference in diameter :-

some of the light escape into atmosphere due to different diameter of the cables joined together. this loss expressed in terms of dB

$$\text{loss in dB} = -10 \log \frac{D_r}{D_t}$$

where D_r is diameter of receiving optical fiber & D_t is diameter of transmitting optical fiber.

④ Losses due to the bending of optical fiber :-

→ Attenuation in optical fiber due to bending of optical fiber

→ This bending of optical fiber may be micro bending or macrobending.

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Applications of optical fibers :-

① The optical fiber communication has more information carrying capacity.

② small in size and light in weight of the optical fiber system, make fiber optics more suitable in space and ~~aeronatical~~ ~~aero~~ aeronautical applications.

③ Optical fiber temperature sensors are used to measure temperature of objects.

④ Optical fiber is low cost cables per unit length compared to copper cables.

⑤ No possibility of internal noise and cross talk generation

⑥ It is also used in medical field to see internal body parts like lungs in human body.

⑦ In military communications because of data security

Problems :-

① A signal of 100 mW is injected into a fiber. the out coming signal from the other end is 40 mW. What is loss in dB ?

sollution :-

$$\text{Attenuation loss} = -10 \log \left(\frac{P_{out}}{P_{in}}\right) \text{ dB}$$

$$= -10 \cdot \log \left(\frac{40}{100}\right) \text{ dB}$$

$$= 3.98 \text{ dB}.$$

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(2) Calliculate the acceptance angle and numerical aperture of given optical fiber, if the refractive indices of core and cladding are 1.562 and 1.497 respectively?

Sol:- Given data

core refractive index $\mu_1 = 1.562$

cladding refractive index $\mu_2 = 1.497$.

Numerical Aperture (N.A.) $= \sqrt{\mu_1^2 - \mu_2^2}$

$= \sqrt{(1.562)^2 - (1.497)^2}$

$= 0.4459$

acceptance angle $\theta_A = \sin^{-1}(N.A)$

$\theta_A = \sin^{-1}(0.4459)$

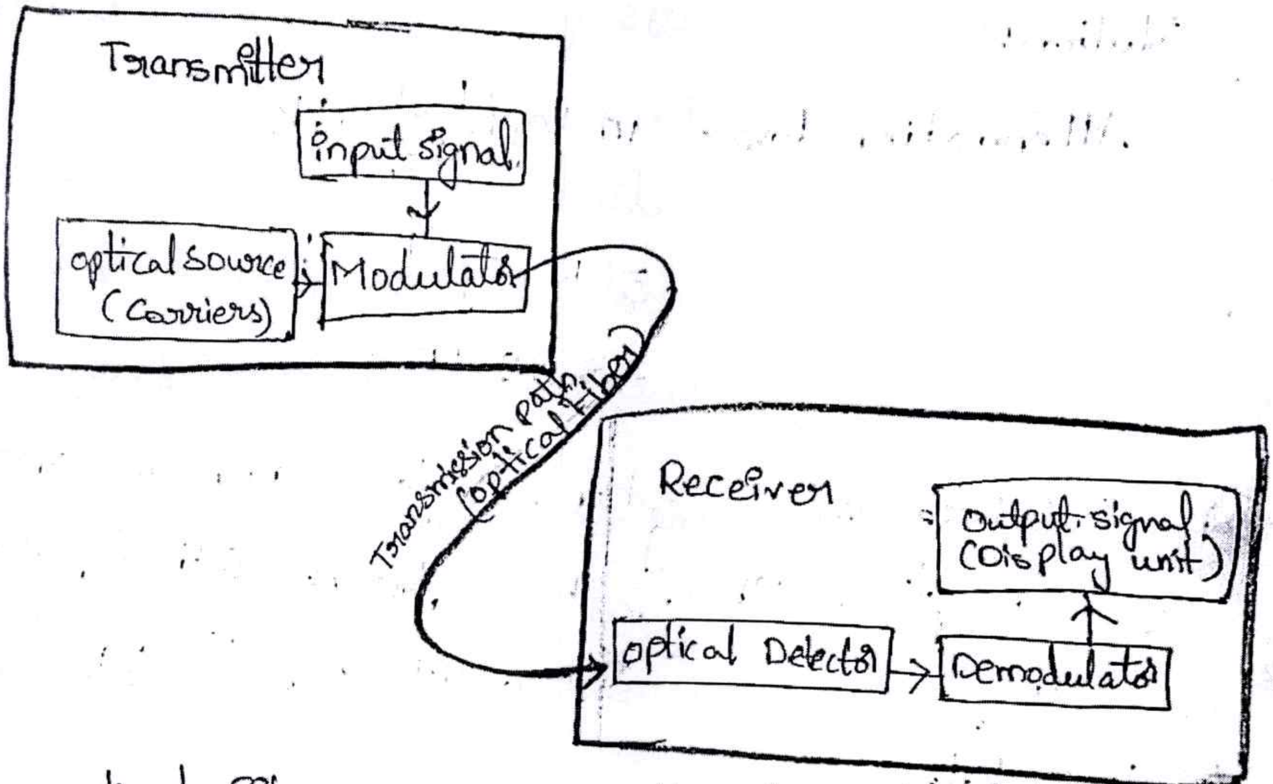
$\theta_A = 26.48^\circ$

→ N.A of material in water having $\sin 60^\circ$ is

$N.A = n_1 \sin 60^\circ$ n_1 - RI of water

$n_1 = 1.33$

Block Diagram of an optical fiber Communication system:-



optical Fibers are very attractive alternative to twisted wire or coaxial cables in communication links. Technological development has led to the manufacturing of fibers with losses less than 1 dB km^{-1} and with high information capacity (band widths of the order of 10^{14} Hz).

Block diagram of an optical fiber communication system is as shown in above figure.

At the transmitting end, the emitter is usually an LED or semiconductor laser. Transmitter includes modulator switches and drive circuits to lasers.

At low information rates the length of a fiber. optical transmission line is limited almost entirely by its losses. At higher rates, the length is limited by the amount of pulse dispersion. Repeaters must be included with fibers. if either the loss limit on the dispersion limit is exceeded. At the repeators an avalanche photo diode (APD) or pin diode receives the attenuated and dispersed train of Pulses from one light, detects and amplifies.

At the receiving end, the optical receiver has three functions namely @ the conversion of optical signal into electrical signal ⓑ amplication and ⓒ demodulation of the signal received to retriever the original message transmitted.

V.IMP. problems

UNIT – I

1) Caliculate the wavelength associated with an electron raised to a potential 1600V. [HINT $\lambda = \frac{12.26}{\sqrt{V}} A^{\circ}$]

2) Caliculate the wavelength associated with an electron with the energy 2000 eV [HINT $\lambda = \frac{h}{\sqrt{2mE}}$]

3) Uncertainty in time of an excited atom is about 10^{-8} s What are the uncertainties in energy and frequency of the radiation? [HINT $\Delta E \cdot \Delta t = \frac{h}{2\pi}$; $\Delta \nu = \frac{\Delta E}{h}$

4) Caliculate the Work function of sodium if its threshold wavelength is 5040A° [HINT $W_0 = \frac{hc}{\lambda_0}$]

5) An electron is confined to a potential well of width 10 nm. caliculate the minimum uncertainty in its velocity. [HINT $\Delta x \cdot \Delta p_x = \frac{h}{2\pi}$: $\Delta p = \Delta v \times m$]

UNIT – II

1) The R_H of a specimen is $3.66 \times 10^{-4}\, m^3 c^{-1}$ its resistivity is $8.93 \times 10^{-3}\, \Omega m$ find μ & n. [HINT. $R_H = \frac{1}{ne}$; $n = \frac{1}{R_H e}$; $\mu_e = \sigma_n R_H$]

UNIT – IV

1 Find the surface area to volume ratio of sphere using surface area and Volume caliculation for the given Radius is 5 meters?

HINT. surface area of the sphere $= 4\pi r^2$
volume of the sphere $= \frac{4}{3}\pi r^3$

) Find surface area to volume ratio of sphere using surface area and volume caliculation for diameter (distance) is 26 m. [HINT $R = \frac{Diameter}{2}$]

UNIT- V

1) Caliculate the acceplance angle of given optical fiber, if the refractive indices of the core and the cladding are 1.563 and 1.498 respectively

HINT. $\sin\theta_n = \sqrt{n_1^2 - n_2^2}$

2) What is the numerical aperture of an optical fiber cable with cladding index of 1.378 and core index of 1.546?

HINT. $NA = \sqrt{n_1^2 - n_2^2}$

3) A fiber cable has an θ_A of $30°$ and core RI of 1.4. calculate RI of cladding

HINT. $\sin^2\theta_A = n_1^2 - n_2^2$

$$n_2^2 = n_1^2 - \sin^2\theta_A$$

4) Find the fractional RI & NA for an optical fiber with RI of core and cladding as 1.5 & 1.49 respectively.

HINT: $\Delta = \frac{n_1 - n_2}{n_1}$; $NA = n_1\sqrt{2\Delta}$

NOTE - HINT'S are not given in question paper

PART-A

1.

a] Define black body Radiation

b] State wien's Law.

c] Define Symmetry in solid's.

d] State Bloch theorem

e) What do you mean by normalized condition

f) Define stefan-Boltzman law

g). What is einstein photo electric equation

h) Define threshold frequency.

i) Write Bloch condition.

j) ~~Define~~ Write any two limitation's of wavefunction.

PART-B

1. a] Explain planck's Radiation law [7m]

b] State Rayleigh-Jean's law [3m]

[OR]

2. a] Explain photoelectric ~~field~~ effect [5m]

b] What are features of photo electric effect [5m]

3. a] Explain devission & Germar experiment with diagram [10]

[OR]

4.

a] Explain Heisenberg's uncertainity principle [5m]

b] An electron has a speed of 600 m/s with an accuracy of 0.005%. calculat the uncertainity with which we can locate the position of the electron. Given $h = 6.6 \times 10^{-34}$ J-s, $m = 9.1 \times 10^{-31}$ kg

[5m]

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5 a]. Explain Schrodinger's time independent wave equation [5m]

b] explain Born's interpretation of the wave function. [5m]

[OR]

6. a] What is classical free electron theory [5m]

b]. Write a note on Fermi - Dirac distribution [5m]

7A]. Explain chronig - penny Model [7m].

b] : What is a origin of energy level [3m]

[OR]

8. A] explain particle in 1d box [5m].

b] Explain effective mass of electron [5m].

9A) Explain Bloch theorem [5m].

B]. classify solids [5m]

[OR]

10. A] Write a note on E-k diagram? [5m]

b] Explain Sommerfield's theory [5m].

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PART - A

1.
a) Define Intrinsic semiconductor with an example
b) Define "Biasing"
c) Write any 4 Advantages of LED.
d) What do you mean by multiplication process
e) Write any Application of BJT
f) Define Zenor breakdown
g) Define Avalanche Breakdown.
h) Give an example for p-type of semiconductor
i) Define Hall Electric field.
j) What are the materials used in LED

PART - B

1. a] Explain Hall effect with a neat diagram
b] Distinguish Extrinsic semiconductors
2. a] Explain the formation of P-N junction diode.
b] Obtain V-I characteristic of junction diode

3a] Explain the working principle of BJT

b] Define LED write a note on working principle of LED

4a] Explain construction and working principle of solar cell.

b] Explain working principle of PIN photo diode.

5a] What are the applications of solar cell.

b] What are the advantages of PIN photo diode.

6a] Explain the construction and working principle of APD

b] mention Applications and disadvantages of APD

7a] Write a note on Zenor diode

b] Explain V-I characteristics of Zenor diode

8a] Explain forward Bias and Reverse Bias of P-N junction Diode

b] Explain Carrier generation in a Semiconductor.

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1a] Explain indirect bandgap of semiconductor.

7b] Explain Direct bandgap of semiconductor.

10 a] Write a note on Intrensic semiconductor.

b] Why we can not use Intrensic semiconductor to fabricate any electronic device.

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PART-A

1. a) Define dielectric constant?
   b) Define Magnetostriction?
   c) What do you mean by energy materials?
   d) Define polarization?
   e) What is mean by Hysterisis loss of ferromagnetic material
   f) Define inverse piezo electricity?
   g) Define Magnetic suscepbility?
   h) Define magnetising force?
   i) Define piezo electric effect?
   j) Define super capacitors?

PART-B

2) a) What are the types of polarization?
   b) Write a note on i) ferro electric ii) piezo electric iii) pyro electric materials

(or)

3 a) What are the applications of dielectric materials?
   b) Write a note on Multiferroics?

4) Explain crystal oscillators?

(or)

5 a) Explain ferro electric Hysteresis?

5)b). Explain liquid crystal display (LCD)

6(a) Explain ferro magnetic Hysterisis ?

6(b) Distinguish soft & Hard magnetic materials

(or)

7)(a) Write a note on Magnetic bubble devices?

8) What are the applications of Magnets!

(or)

9) Explain about Magneto-resistance ?

10) What is mean by rechargeble ion batteries

(or)

11) Explain solid fuel cells!

NANU TECHNOLOGY

PART-A 10M

1. a) Define nano scale?

b) write any two applications of nano materials?

c) What do you mean by quantum confinement?

d) Define quantum size effect?

e) What are the example of nano particles-?

f) What do you mean by Quantum dots, Quantum well?

g) What are the excitons?

h) What do you mean by top down approch? give example?

i) What do you mean by Botton-up approch? give one example?

j) Define Quantum wire?

PART-B

5x10=50M

2) a) Explain working of PVD method with a neat diagram?

b) What are the advantages of PVD?

(or)

3) a) Explain surface to volume ratio?

b) Write a note on quantum confinement?

4) a) Explain SOL-GEL method?

b) What are the advantges and disadvantages of sol-gel method?

(or)

5) a) Explain about TEM technique?

b) what are the advantages of TEM?

6) a) Write a note on XRD technique!

b) write a note on usage of XRD technque?

(or)

Scanned with OKEN S

7) a) Explain precipitation method of fabrication of nana ~~pratil~~ particle?

b) Write a note on ~~combistion~~ combusion method of nano material?

8 a) Explain Ball-Milling method to fabricale nano parlicles?

b) What are the advantages and disadvantages of Ball-Milling?

(or)

9) a) Explain CVD top down approch of nano material?

b) Write CVD advantages?

10) explain characteristic technique 'SEM' with a diagram?

11) What are the advantages of SEM?

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PART-A

1) a) What is the acronym of LASER?

b) Define acceptance angle ?

c) Define Numerical aperture ?

d) Write any two characteristics of LASERS?

e) What is the principle of optical fiber?

f) How laser beam achieve monochromatic beam?

g) Define lasing action?

h) How do you get Total internal reflection?

i) Write any two medicinal applications of LASER?

j) What is the principle of LASER?

PART-B.

2 (a) explain einstein co-efficients & their relation (7M)

b) write a note on pumping mechanism [3M]

(or)

3 a) explain the construction, working principle of Argon ion laser

b) write about Laser beam characteristics?

4) a) Distinguish Graded index and step-index of optical fibers?

b) what is the role of optical fiber in communication system?

(or)

5) ~~a)~~ Write a note on followings

i) Total internal reflection

ii) Numerical aperture

iii) acceptance angle

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6) a) Explain constuction and working principle of CO_2 laser

b) Explain constuction and working principle of He-Ne laser

(or)

7 a) What are the losses in optical fiber?

b) What are the applications of LASER?

8) a) Explain construction and working of Ruby laser?

b) Explain construction and working of semiconductor laser?

(or)

9) a) Explain construction of optical fiber with neat diagram?

b) Explain construction and working of Nd: YAG lasers?

10) How laser differs with normal light sources?

11) Why optical fiber known as wave-guided medium?

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Code No: 181AA

R22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year I Semester Examinations, March/April - 2023
APPLIED PHYSICS
(Common to CE, ME, ECE, EIE, AE, BT, MIE, PCE, CSE(AI&ML), CSE(IOT), AI&DS, AI&ML)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) Part- A for 10 marks, ii) Part - B for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of ten questions (numbered from 2 to 11) carrying 10 marks each. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a) What is blackbody? [1]
b) Define Symmetry in solids [1]
c) State Hall effect. [1]
d) List out applications of BJT. [1]
e) State pyroelectric. [1]
f) What are the applications of Energy Materials? [1]
g) Define Nano. [1]
h) Illustrate applications of nanomaterials. [1]
i) What is acronym LASER? [1]
j) What is total internal reflection? [1]

PART - B

(50 Marks)

2.a) Explain Stefan-Boltzmann's law.
b) Discuss Born interpretation of the wave function. [5+5]

OR

3.a) List out assumptions of Drude & Lorentz free electron theory.
b) Explain Fermi-Dirac distribution of electrons. [5+5]

4.a) Explain working principle of Zener diode.
b) Illustrate working mechanism of PIN diode in forward and reserve bias. [5+5]

OR

5.a) With a neat diagram, describe working principle of Avalanche Photo Diode (APD).
b) Distinguish between intrinsic and extrinsic semiconductors. [5+5]

6.a) What is ferroelectricity? Explain properties of ferroelectric materials.
b) Write a note on bubble memory devices. [5+5]

Do Do Do Do Do Do Do

OR

7.a) Write a note on multiferroics.
b) Explain construction and working principle of rechargeable ion batteries. [5+5]

Do Do Do Do Do Do Do

8.a) Explain quantum confinement phenomenon.
b) Discuss fabrication of nanomaterials using Physical Vapor Deposition (PVD). [5+5]

OR

9.a) Write a note on combustion methods.
b) Discuss surface to volume ratio in nanomaterials. [5+5]

10.a) Describe construction and working mechanism of Nd:YAG laser.
b) Write a note on optical fiber for communication system. [5+5]

OR

11.a) Discuss construction and working principle of Argon ion Laser.
b) Derive an expression for acceptance angle numerical aperture. [5+5]

--ooOoo--

Do Do Do Do Do Do Do

2) symmetry solids means

Do Do Do Do Do Do Do

Do Do Do Do Do Do Do

Do Do Do Do Do Do

Code No: 182AB

R22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech I Year II Semester Examinations, September - 2023

APPLIED PHYSICS

(Common to EEE, CSE, IT, CSIT, CE (SE), CSE (CS), CSE (DS), CSD)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.

i) Part- A for 10 marks, ii) Part - B for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of ten questions (numbered from 2 to 11) carrying 10 marks each. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a) What is photoelectric effect? [1]
b) Draw E-K diagram. [1]
c) What is Hall Effect? [1]
d) List out applications of BJT. [1]
e) Define ferroelectricity. [1]
f) Draw B-H curve. [1]
g) What is Nanotechnology? [1]
h) List out few examples for top-down fabrication techniques. [1]
i) Illustrate application of optical fiber. [1]
j) Explain significance of pumping process. [1]

PART-B

(50 Marks)

2.a) Calculate energy of particle exist in one dimensional potential box.
b) Derive an expression for effective mass of electron. [5+5]

OR

3.a) Discuss Kronig-Penney model.
b) Describe classification of solids on the basis of band theory. [6+4]

4.a) Discuss construction and working mechanism of Solar cell.
b) Explain construction and characteristics of P-N Junction diode. [5+5]

OR

5.a) Describe construction and principle of APD.
b) Explain construction of LED. [6+4]

6.a) Describe construction and principle of Liquid Crystal Displays (LCD).
b) Explain working mechanism of bubble memory devices. [6+4]

OR

7.a) Write a note on multiferroics.
b) Discuss construction and working mechanism of rechargeable ion batteries. [5+5]

8.a) Discuss fabrication of nanomaterial using ball milling method.
b) Distinguish between SEM and TEM. [5+5]

OR

9.a) Describe fabrication of nanomaterial using sol-gel.
b) Write a note on Physical Vapor Deposition (PVD). [5+5]

10.a) Illustrate how optical fiber is used for communication system.
b) With neat diagram, explain construction and principle of Argon ion Laser. [4+6]

OR

11.a) Derive an expression for acceptance angle and numerical aperture.
b) Discuss construction and principle of semiconductor laser. [5+5]

---ooOoo---

Code No: 151AJ

R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, December – 2019/January - 2020

APPLIED PHYSICS

(Common to ECE, EIE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Explain wave particle duality. [2]
b) Define diffusion and drift mechanisms. [2]
c) Illustrate about LED materials. [2]
d) What is coherence? [2]
e) What are piezoelectric materials? [2]
f) Explain about Heisenberg's uncertainty principle. – [3]
g) What is Fermi level? [3]
h) Illustrate working of a PIN diode. [3]
i) Explain losses in optical fibers. [3]
j) Define ampere's and Faraday's law. [3]

PART – B

(50 Marks)

2.a) Discuss about de Broglie's hypothesis.
b) Prove de Broglie's hypothesis using Davission and Germer's experiment. [5+5]

OR

3.a) Derive an expression for time independent Schrodinger's wave equation.
b) Explain the Born interpretation of wave function. [5+5]

4.a) Estimate concentration of electrons in n-type semiconductor.
b) Evaluate I-V characteristics of a pn-junction diode. [5+5]

OR

5.a) Explain the phenomena of carrier generation and recombination.
b) Discuss about working, IV characteristics of Zener diode. [5+5]

6.a) Compare radiative and non-radiative recombination mechanisms.
b) Explain figures of merits of a LED device. [5+5]

OR

7.a) Discuss about construction, principle and working of a semiconductor laser.
b) Evaluate working of a solar cell in terms of characteristics. [5+5]

8.a) Explain interaction of radiation with matter.
b) Discuss working principle and applications of Ruby laser. [5+5]

OR

9.a) Derive an expression for numerical aperture of an optical fiber.
b) Compare working of step index and graded index fibers. [5+5]

10.a) Write a note on Maxwell's equations.
b) Explain classification of magnetic materials. [5+5]

OR

11.a) Derive an expression for internal fields in a solid.
b) Discuss about hysteresis behavior of ferromagnetic material. [5+5]

---ooOoo---

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

I YEAR B.Tech II Semester : I MID EXAMINATION

Subject: Applied physics Marks: $4\times5=20$ M

Branch: CSE-A&B Date: - JUN-2023

Part -B

Time : ___ Duration: 2Hr

Answer any four of the following

1. what is photo electric effect? Define Einstein photo electric equation.
2. Explain construction and working of zener diode.
3. Write and explain Heisenberg uncertainity principle
4. Define Schrodinger wave equation in one dimentional potential box
5. Explain intrinsic and extrinsic semiconductors with suitable examples.
6. Give the assumptions of quantum theory of free electron.

PRINCIPAL

Avanthi Institute of Engg. & Tech

Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Gunthapally (V), Abdullapur met (M), R.R.Dist

I. B.Tech. I Sem., I Mid-Term Examinations, 2023

Applied physics

Part –A

Name:____________________-_______________H.T.NO : | | | | | | | | | | |

Answer All Questions.

All Questions Carry Equal Marks. **Marks: 10M**

i. Multiple choice questions

1. According to the de-broglie, electron exhibit which nature ( )
   (a) Wave nature (b) particle nature (c) Wave &particle nature (d) energy
2. The equation of motion of matter wave was derived by: ( )
   (a) Heisenberg (b) bohr (c) schrodinger (d) de-broglie
3. The equation of matter wave was derived by: ( )
   (a) Heisenberg (b) bohr (c) schorodinger (d) de-broglie
4. According to wave mechanics, a material particle is associated with : ( )
   (a) single wave (b) wave packet (c) progressive wave(d) light
5. The charge of neutron ( )
   (a) 1.6×10^{-34} (b) 1.6×10^{-19} (c) zero (d) infinity
6. Einestein's mass –energy relation is ( )
   (a) $h\vartheta = mc^2$(b) $h^2\vartheta = mc^2$ (c)$\vartheta = hc/\lambda$ (d) $\lambda = mc/h$
7. Which of the following is not a characteristics of wave function ( )
   (a) Continues (b) single valued (c) differentiable (d) Physically significant
8. The uncertainty principle applies to… ( )
   (a) Macroscopic particles (b) microscopic particles (c) gases (d) none of above
9. Davisson and Germer experiment relates to: ( )
   (a) Interference (b) polarisation (c) electron diffraction (d) none of the above
10. Classical free electron theory was develop by ( )
    (a) Lorentz (b)Drude and Lorentz (c) Bloch (d) Newton

ii. Fill in the blanks

1. The waves associated with moving particles is known as _______________waves

2. The experimental proof for existence of matter waves was provided by______________

3. A perfect block body is a good ____________and __________

4. Einstien photo electric equation ___________

5. The__________________ is the minimum frequency of light require to remove an electron

iii. Match the following answeres

1. Bloch theorem	( )	a. $\Delta x.\Delta p \le \frac{h}{4\pi}$
2. Plank's constant value	( )	b. $\Psi = e^{ikx}u_k(x)$
3. Charge of electron	( )	c. $9.1 \times 10^{-31} kg$
4. Mass of electron	( )	d. 6.625×10^{-34}
5. Heisenberg uncertainity principle	( )	e. $>10^{-8}$ sec
		f. 1.6×10^{-19}

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AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Gunthapally (V), Abdullapur met (M), R.R.Dist

I. B.Tech. II Sem., II Mid-Term Examinations, 2023

Applied physics
Part –A

Name:__________________-_____________H.T.NO : | | | | | | | | | | |

Answer All Questions.

All Questions Carry Equal Marks. **Marks: 10M**

i. Multiple choice questions

1. Example of ferromagnetic material ( )
   (a) Iron, steel, cobalt, nickel (b) platinum, aluminium, chromium (c)Bismuth, mercury, silver (d) none
2. Units for magnetic flux density ( )
   (a) Wb/m^2 (b) $Wb/A \cdot m$ (c) A/m (d) $Tesla/m$
3. The material which exhibits hysterias is ( )
   (a) Diamagnetic (b) Paramagnetic (c) Ferromagnetic (d) None
4. Any insulator is a _____________ ( )
   (a) Dielectric (b) conductor (c) insulator (d) none
5. Which one of the following is an example for top-down approach? ( )
   (a) Ball milling (b) Sol-Gel process (c) Both a &b (d) none
6. What is the standard form of SEM ? ( )
   (a) Scanning electrode micron(b) Scanning electron microscope(c)Scanned electron microscope(d) none
7. If an atom jumps from a lower energy level to higher energy level, the process is known as ( )
   (a) Induced emission (b) induced absorption (c) spontaneous emission (d)none
8. Pumping process used in Ruby LASER is ( )
   (a) Electric current (b) electrical discharge (c) optical pumping (d) chemical reactions
9. Active centers in the He-Ne laser ( )
   (a) Neon atoms (b) electrons (c) Helium atoms (d) Both neon and helium atoms
10. In optical fibre, light travels in the ( )
    (a) Core (b) cladding (c) Core –cladding interface (d) Protective material

ii. **Fill in the blanks**

1. **Dielectric is a material that does not have a ____________ for conduction.**

2. **The product of the magnitude of the charges and the distance of their separation is called the ______________ μ of the electric dipole.**

3. **Forbidden energy gap E_g is very_____________ in dielectrics.**

4. **When charges of opposite polarity are induced on the surfaces of a dielectric, the dielectric is said to be_______________**

5. **The process of population inversion is to increase the number of atom in the ______ state**

6. **What is the standard form of TEM __________________**

7. **Life time of ground state atom in excited state ___________**

8. **The main advantage of this Top-down approach is ____________ production rates of nano-powders**

9. **Life time of _______________ state is unlimited.**

10. **Snell's law=_______**

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AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

I YEAR B.Tech II Semester : II MID EXAMINATION

Subject: Applied physics | Marks: 4×5=20 M

Branch: CSE | Date: - AUGUST-2023

Part -B

Time : ___ | Duration: 2Hr

Answer any four of the following

1. **Explain ferroelectric, Piezoelectric and Pyroelectric materials.**
2. **Explain briefly the various types of polarization in dielectrics**
3. **What are soft and hard magnetic materials explain.**
4. **What is the hysteresis loop? What does it represent? what is the significance?**
5. **Write about CVD method.**
6. **Write construction and working of He-Ne laser**

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Avanthi Institute of Engg. & Tech.

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Gunthapally (V), Abdullapurmet (M), R.R. Dist., Near Ramoji Filmcity, Hyderabad - 501 512.

NAAC

INTERNAL DISCRIPTIVE EXAM

NBA NATIONAL BOARD OF ACCREDITATION

DATE: 22/8/23

NAME: K. Navyasree

Subject: Applied physics

ROLL No.: 22Q61A05A8

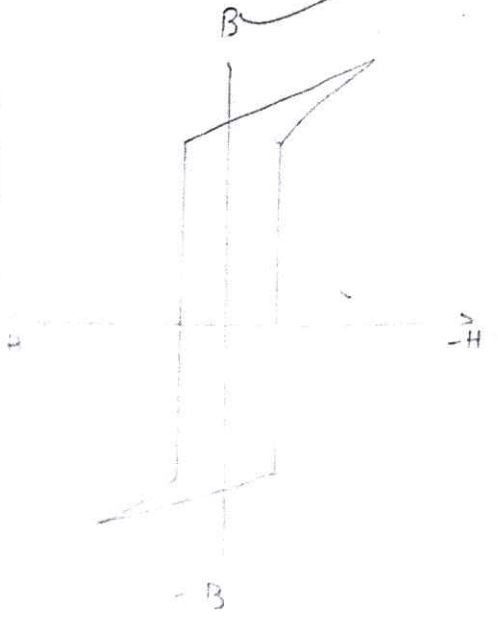
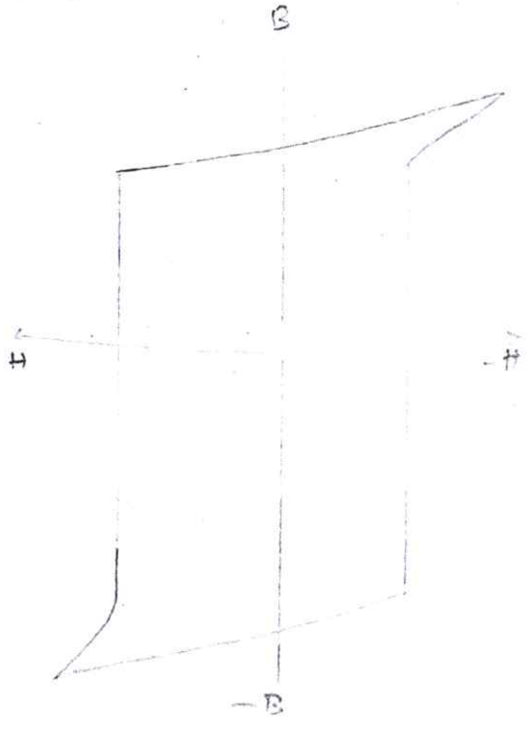
SIGNATURE OF THE INVIGILATOR'S: 22/08

CLASS: CSE-B 1 year SEM. II

SIGNATURE OF THE STUDENT: Navya

TOTAL MARKS: 13

3. Soft and hard magnetic materials.

Soft Magnetic Materials	Hard Magnetic Materials
*Soft Magnetic Materials those that are will be easily mangntize and de-mangntize	Hard magnetic materials those that are difficult in mangntize and de-mangntize.
*Hystersis loop material in the will be tin & long	* Hystersis loop material is wide as shown in figure
	

* Hystersis loss in the form of heat is less	* Hystersis loss in the form of heat is large
* It is used in permibility magentic and suspendility is high	* It is used in permibility magentic and suspenbility is low
* It is used in magnetic core material	* It is used in preparation of permenent magnetic.
Application:- Soft magnetic material are used in Transformers electric motors etc	Application:- hard magnetic material. are used in digital computers Magnetic Tabes etc.
Ex:- pure Iron, Iron cobalt etc.	Ex:- Al, Co, Cu, Ni etc.

2. The Various types of polarization in dielectrics.

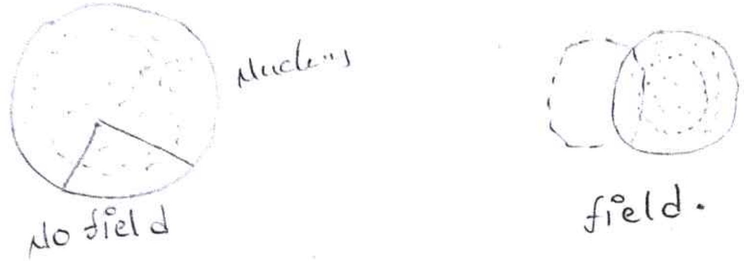
In dielectr palarization There are four types of polarizations are there

1. Electronic polarization
2. Ionic polarization
3. dipolar polarization
4. Space charge polarization.

1. electronic polarization :-

The electronic polarization the Nuclers around the electrons at a Magnetic.

The charge of the electrons and the Nucleus.



$$Radius = \left[\frac{Z\pi \cdot c}{4\pi e}\right]$$

Total charge => $Qe = \left[\frac{Z4\pi}{\rho}\right]$

The charge at the electron of the in No field.

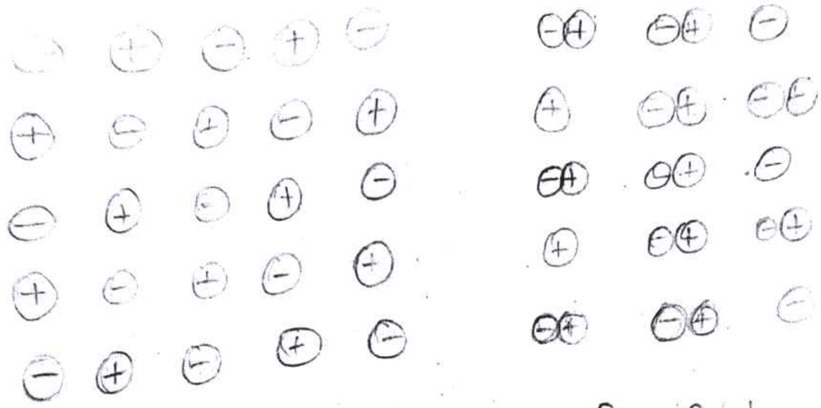
The electrons ~~that~~ the magnetic around the magnetic Nulers

The direct Nuclear are the polarization of the electrons.

2. Ionic polarization:-

the ionic polarization relatible of electrons in +ve charge and -ve

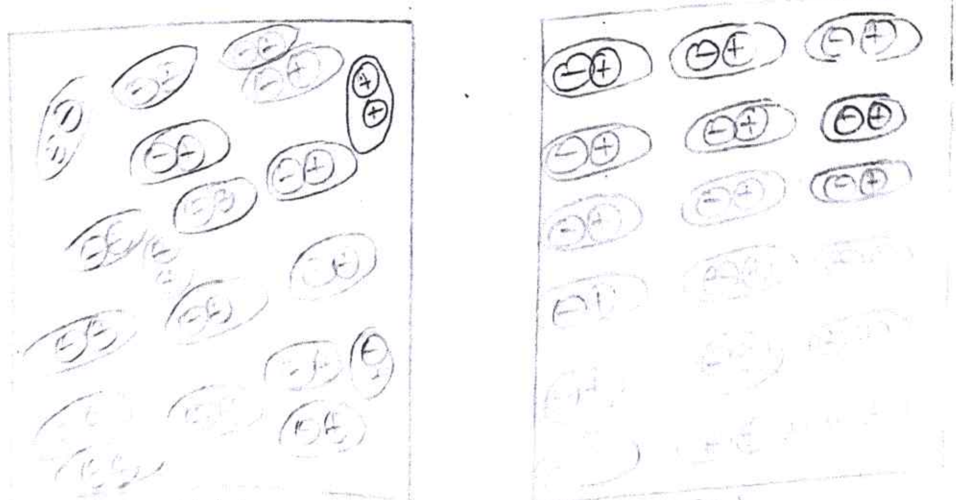
ex: Nacl₃



No field   in field

3. dipolar polarization.

In dipolar polarization in the field are +ve charce and ~~tec~~ -ve charge are in unstabile at the No field. on the field the +ve charge and the -ve charge are stabile



No field   in field.

4. Space charge polarization:-

In the space charge polarization it occurs in

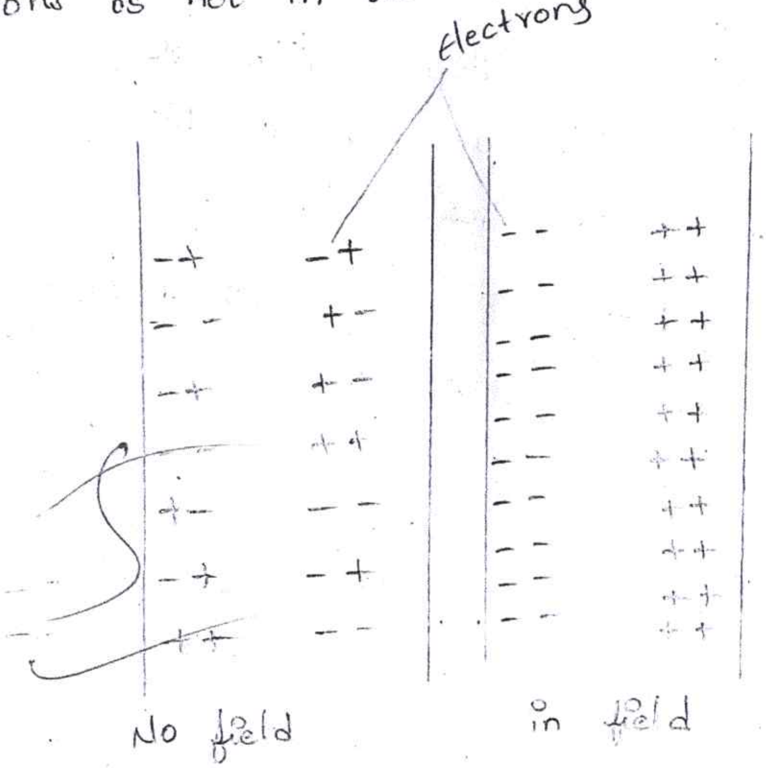
histories.

* In space charge on the field -ve and +ve

electrons at the stabile

* In space charge in the field -ve and +ve

electrons is not in the stabile.



6. Construction and working of He - Ne laser

He - Ne laser is the

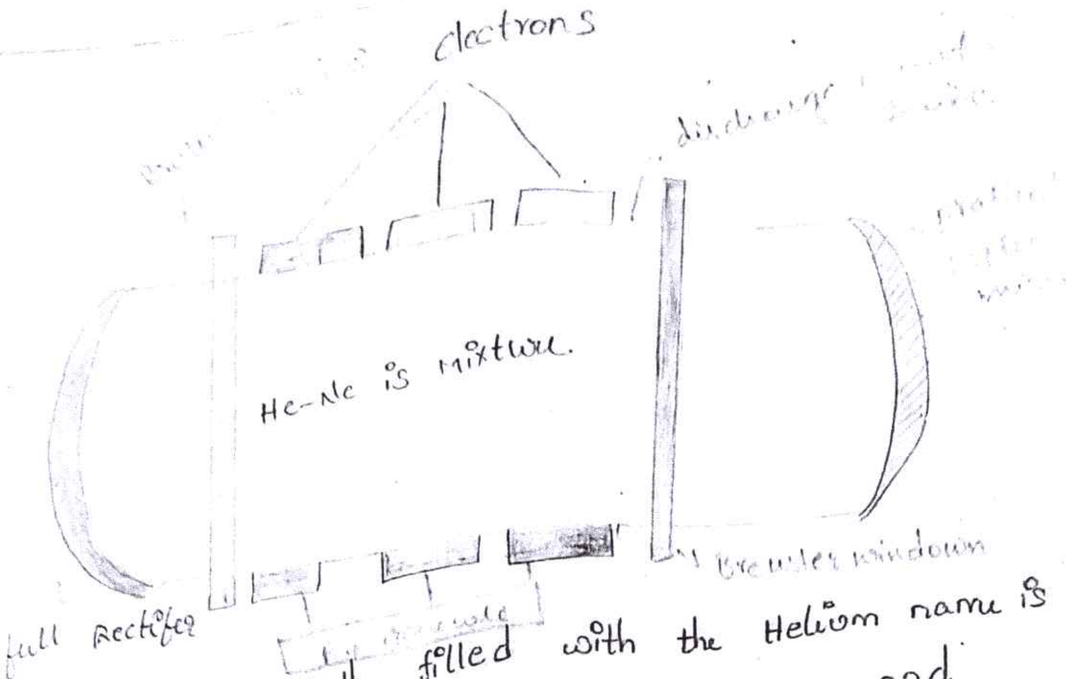
* source of energy

* optical cativity

* pumping maheisim

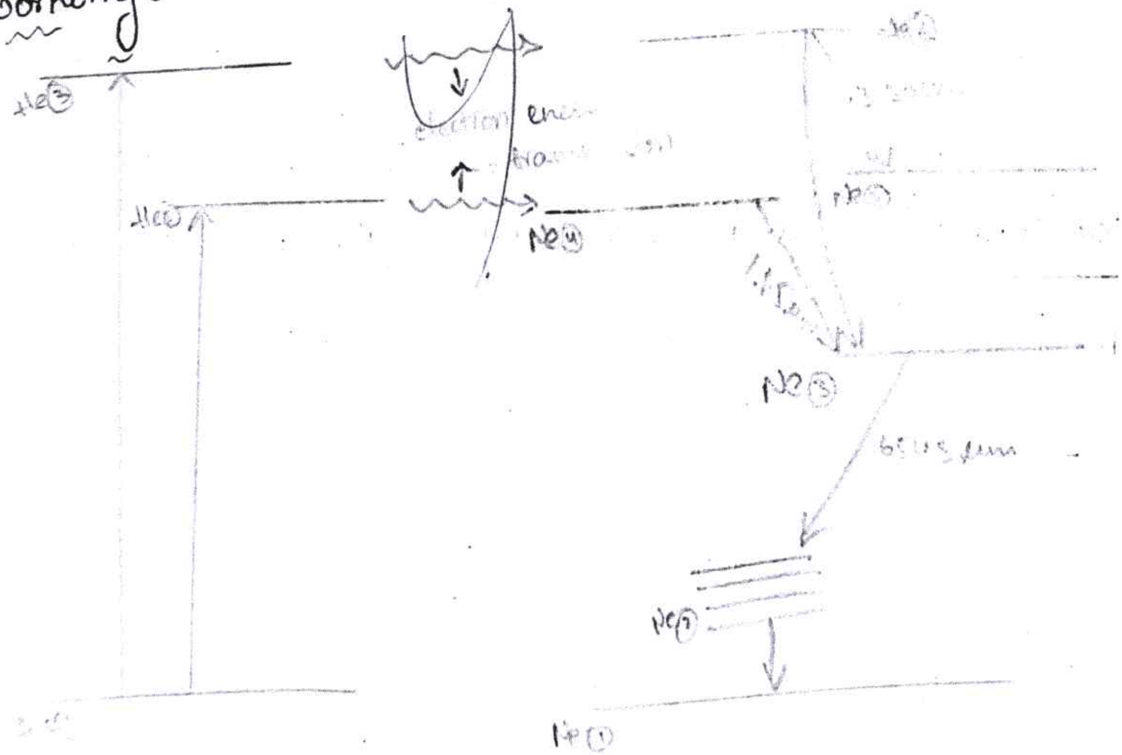
* Active

*



§ Helium name in the filled with the Helium name is mixture. which in the determain the 15cm and 180cm in the length. Helium is the passessed. by 0.1mm and neno is the passessed 0.1mm. one end of quarily ~~file~~ tube is conected to the partical rectifier.

working:—



AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Gunthapally (V), Abdullapur met (M), R.R.Dist

I. B.Tech. II Sem., II Mid-Term Examinations, 2023

Applied physics

Part –A Branch:CSE-A,B,C&DS

Name: K. Navyasree H.T.NO : 22Q61A05A8

Answer All Questions.

All Questions Carry Equal Marks. Marks: 10M

9 / 10

i. Multiple choice questions

1. Example of ferromagnetic material (A)
 (a) Iron, steel, cobalt, nickel (b) platinum, aluminium, chromium (c)Bismuth, mercury, silver (d) none
2. Units for magnetic flux density (A)
 (a) Wb/m^2 (b) $Wb/A.m$ (c) A/m (d) $Tesla/m$
3. The material which exhibits hysterias is (C)
 (a) Diamagnetic (b) Paramagnetic (c) Ferromagnetic (d) None
4. Any insulator is a ___________ (A)
 (a) Dielectric (b) conductor (c) insulator (d) none
5. Which one of the following is an example for top-down approach? (A)
 (a) Ball milling (b) Sol-Gel process (c) Both a &b (d) none
6. What is the standard form of SEM ? (B)
 (a) Scanning electrode micron(b) Scanning electron microscope(c)Scanned electron microscope(d) none
7. If an atom jumps from a lower energy level to higher energy level, the process is known as (B)
 (a) Induced emission (b) induced absorption (c) spontaneous emission (d)none
8. Pumping process used in Ruby LASER is (C)
 (a) Electric current (b) electrical discharge (c) optical pumping (d) chemical reactions
9. Active centers in the He-Ne laser (A)
 (a) Neon atoms (b) electrons (c) Helium atoms (d) Both neon and helium atoms
10. In optical fibre, light travels in the (A)
 (a) Core (b) cladding (c) Core –cladding interface (d) Protective material

ii. Fill in the blanks

1. Dielectric is a material that does not have a free electrons for conduction.
2. The product of the magnitude of the charges and the distance of their separation is called the dipole moment of the electric dipole.
3. Forbidden energy gap E_g is very large in dielectrics.
4. When charges of opposite polarity are induced on the surfaces of a dielectric, the dielectric is said to be polarization.
5. The process of population inversion is to increase the number of atom in the ~~excited~~ state
6. What is the standard form of TEM ~~transistor~~ transmission Electron microscope
7. Life time of ground state atom in excited state 10^{-8} s.
8. The main advantage of this Top-down approach is ~~bulk~~ production rates of nano-powders
9. Life time of ~~Metastabil~~ ground state is unlimited.
10. Snell's law= $\frac{A'}{A2} = \frac{\sin i}{\sin x}$

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NAAC B++ GRADE

INTERNAL DISCRIPTIVE EXAM

NBA NATIONAL BOARD OF ACCREDITATION

DATE: 22/08/23.

NAME : L. Indu

Subject: AP

ROLL No.: 22Q61A05B0

SIGNATURE OF THE INVIGILATOR'S: 22/08

CLASS : CSE-B SEM. II

TOTAL MARKS 20

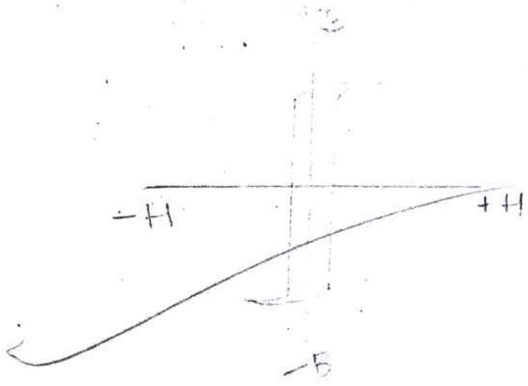
SIGNATURE OF THE STUDENT L.Indu

20

3) Ans: Soft magnetic materials:-

→ Soft magnetic materials are the materials that can be easily magnetize and demagntize are known as soft magnetic materials.

→ Hysteris loop in soft magnetic materials are thin and long.



→ Hysteris loss in the form of heat is less

→ magnetic permeability and magnetic suspectability are high in soft magnetic materials.

→ Soft magnetic materials are used in the preparation of magnetic core material.

→ Applications of soft magnetic materials are transformers, electric motors.

→ Examples of soft magnetic materials are pure Iron-

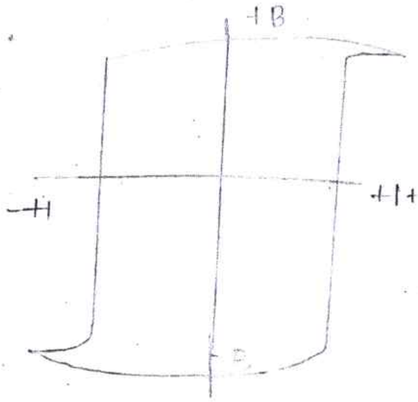
Iron-silicon alloys, Iron-cobalt alloys and Iron-nickel alloys

∴ This is about soft magnetic materials.

Hard magnetic materials:-

→ Hard magnetic materials are difficult to magnetize and demagnetize is known as Hard magnetic materials.

→ Hysteresis loop in Hard magnetic materials are wide.



→ Hysteresis loss in the form of heat is high.

→ Magnetic permeability and magnetic suspectability are low

→ Applications of Hard magnetic materials are used in microphones and magnetic tapes.

→ Hard magnetic materials are used in preparation of permanent magnets.

→ Examples of Hard magnetic materials are Tungsten steel and platinum cobalt etc.

∴ This is about Hard magnetic materials.

2) Types of polarization:-

Ans:- In Dielectrics there are four types of polarization.

They are:

1) electronic polarization

2) Ionic polarization

3) oriented polarization / dipoler polarization

4) space charged polarization.

1) Electronic polarization:-

When an atom is placed in electric field, the positive charge (nucleus) is placed to applied field and negative charge is placed to opposite field. A dipole is created in Electric field.

In dielectrices formation of dipole in electric field is known as Electronic polarization.

not In electric field. In electric field.

→ columb's force of attraction opposes the field direction.

→ $$Qe = \frac{-Ze}{\frac{4}{3}\pi R^3}$$

$$P = \frac{4}{3}\pi x^3 p$$

$$FC = \frac{1}{4\pi\epsilon_0}\frac{QeQp}{x^2}$$

dipole induced

$$\epsilon = \frac{Ze\,x}{\alpha E}$$

$$\boxed{\epsilon = 4\pi\epsilon_0 R}$$

→ In electronic polarisation it depends on volume

Of atom and independent of temperature.

2) Ionic polarisation:-

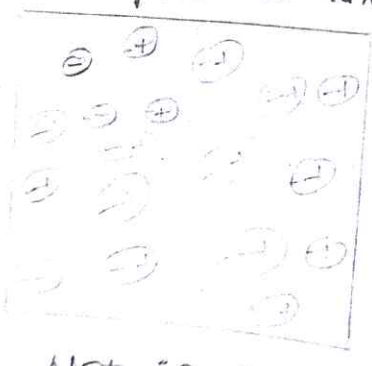
In Ionic polarisation, they are relatively displaced the positive and negative charg-Ions in crystal Ions is known as Ionic polarisation.

→ The build in Ionic polarisation is 10^{-11} to 10^{-14} s

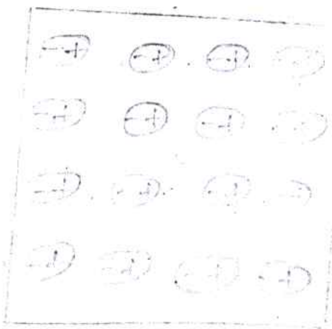
→ In Ionic polarisation, it doesn't depends on temperature

3) Oriented polarisation | dipoler polarisation:-

In Oriented polarisation, the electrons are aligned in an direction whereas presence of Electric field aligned in direction but in absence not aligned is known as oriented polarisation.



Not in field

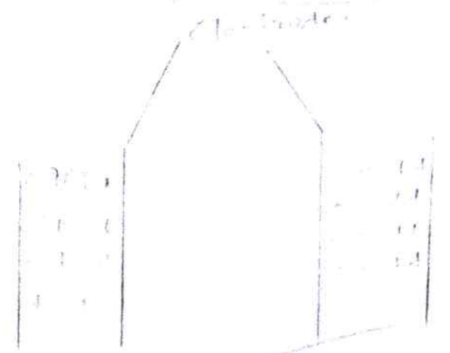


In field

→ It depends of temperature.
→ build up in Oriented polarisation is 10^{-10} s

4) space-charged polarisation:-

In space charged polarisation, the accumulation of electrons charges at electrodes takes place is known as space charged polarisation.



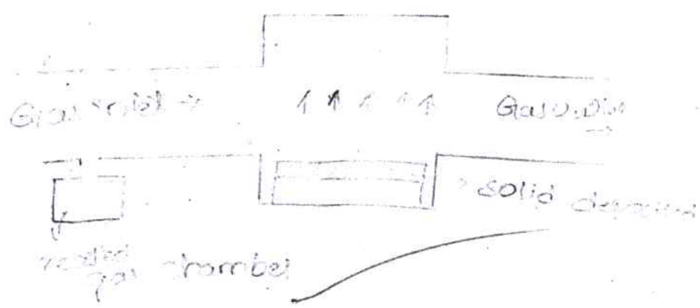
→ space-charged polarisation also known as Influenced polarisation.

∴ This is about different types of polarisations.

5) Chemical vapour deposition (CVD) method:-

Ans: In chemical vapour deposition, the non-volatile (not vapourised) are formed as solid film on the surface by the reaction of vapour phase chemicals by required consistent is known as chemical vapour deposition (CVD).

Construction:-



→ In CVD, ~~through~~ it has reacted gas chamber and Gas in let and Gas outlet on either side as shown in figure.

→ Inert gas are introduced in gas inlet they react with chemical vapour phase

→ Then they go to reacted gas chamber & Gas outlet.

→ Solid film is deposited on surface.

Working:

→ Solid is to deposited on the surface

→ By the reaction of chemicals.

→ CVD's are two types based on:-

CVD Based on temperate:-

1) Hot_wall CVD:- In Hot wall CVD, heats up not only wafer but also the walls of reacter.

2) cold_wall CVD:- In cold wall CVD, heats up only wafer.

CVD Based on pressure:-

1) APCVD:- Atmospheric pressure chemical vapour deposition is operated at Atmospheric pressure.

2) LOW CVD:- Is operated at low pressure.

Advantages:-

→ CVD's give ~~higher quality~~ & improves the hardness of solid.

→ CVD's are used in medical / surgical fields.

Aplications:-

→ CVD's give high Quality films

→ Low Deposition of solids.

→ Fabrication of Carbon nanotubes.

∴ This is about chemical vapour deposition.

1) ans:

Ferroelectectrics:-

In dielectrics, the exhibits of spontaneous polarisation in the absence of electric field. This phenomenon is known as Ferroelectricity and these materials are Ferro Electric materials.

→ properties

→ Ferro electric materials exhibits the piezoelectric due to lack of symmetry.

→ Also Ferro electric materials exhibits the pyro electricity at strong electric field.

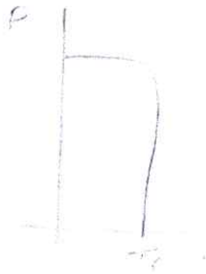
→ Ferro Electric materials are first discovered by Rachalle at the range of temperature $-18^\circ c$ to $22^\circ c$

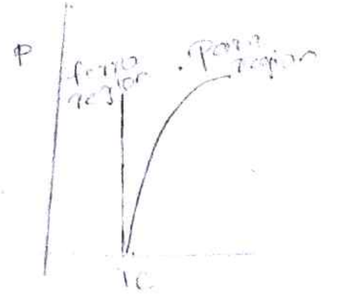
Properties of Ferro electrics:-

→ Ferroelectrics exhibits spotaneous polarisation at certain temperature.

→ If the spotaneous polarisation increases, temperature decreases, this is curie temperature.

→ Dielectric constant change is known as curie-wies law.





Applications of Ferro Electrics:

→ Ferro electrics are used in Digital memory (RAM).

→ By piezoelectric property, ferro electrics such as quartz are used as microphones, ultrasonic transducers.

→ By ~~pyer~~ pyroelectricity property, ferro electrics such as Barium Titanate ($BaTiO_3$) ~~is~~ ~~uses~~ and poly vinyl chloride are used as magnetic detectors.

→ Ferroelectrics are used in making capacitors that stores electric charge.

Piezoelectric materials:

~~piezoelect~~ In dielectrics, the exhibits of spontenous polarisation in presence of electric field is known as piezoelectricity.

→ These materials are known as piezoelectric materials.

Pyroelectric materials:

In dielectrics, the pyroelectric materials are polarisation are in absence of electric field. This phenomenon is known as pyroelectricty and these materials are known as pyroelectric materials.

→ Ferro electric materials also posses pyroelectric property at strong electric field.

AVANTHI INSTITUTE OF ENGINEERING AND TE NOLOGY

Gunthapally (V), Abdullapur met (M), R.R.Di.

I. B.Tech. II Sem., II Mid-Term Examinations, 2023

Applied physics

Part –A Branch:CSE-A,B,C&DS

Name: L.Indu H.T.NO : 22061A05B0

8/10

Answer All Questions.

All Questions Carry Equal Marks. Marks: 10M

i. Multiple choice questions

1. Example of ferromagnetic material (A)
   (a) Iron, steel, cobalt, nickel (b) platinum, aluminium, chromium (c)Bismuth, mercury, silver (d) none
2. Units for magnetic flux density (A)
   (a) Wb/m^2 (b) $Wb/A.m$ (c) A/m (d) $Tesla/m$
3. The material which exhibits hysterias is (C)
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4. Any insulator is a ___________ (A)
   (a) Dielectric (b) conductor (c) insulator (d) none
5. Which one of the following is an example for top-down approach? (A)
   (a) Ball milling (b) Sol-Gel process (c) Both a &b (d) none
6. What is the standard form of SEM ? (B)
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9. Active centers in the He-Ne laser (A)
   (a) Neon atoms (b) electrons (c) Helium atoms (d) Both neon and helium atoms
10. In optical fibre, light travels in the (A)
    (a) Core (b) cladding (c) Core –cladding interface (d) Protective material

ii. Fill in the blanks

1. Dielectric is a material that does not have a free electrons for conduction.
2. The product of the magnitude of the charges and the distance of their separation is called the ___ μ of the electric dipole.
3. Forbidden energy gap E_g is very large in dielectrics.
4. When charges of opposite polarity are induced on the surfaces of a dielectric, the dielectric is said to be polarised
5. The process of population inversion is to increase the number of atom in the ___ state
6. What is the standard form of TEM Transmission electron microscope
7. Life time of ground state atom in excited state 10^{-5}
8. The main advantage of this Top-down approach is ___ production rates of nano-powders
9. Life time of metastable state is unlimited.
10. Snell's law= $\frac{\sin i}{\sin r}$ $\frac{a_1}{a_2} = \frac{\sin i}{\sin r}$

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. -R22-1 Year-II semester

COMPUTER SCIENCE AND ENGINEERING

MID-1 Internal Exam

Subject - Applied Physics

HALL TICKET NUMBER	MARKS
22Q61A0566	33
22Q61A0567	32
22Q61A0568	27
22Q61A0569	29
22Q61A0570	-1
22Q61A0571	23
22Q61A0572	19
22Q61A0573	15
22Q61A0574	27
22Q61A0575	33
22Q61A0576	29
22Q61A0577	25
22Q61A0578	20
22Q61A0579	30
22Q61A0580	25
22Q61A0581	24
22Q61A0582	19
22Q61A0583	27
22Q61A0584	30
22Q61A0585	24
22Q61A0586	35
22Q61A0587	18
22Q61A0588	18
22Q61A0589	20
22Q61A0590	30

FACULTY SIGN. **HOD** **PRINCIPAL**

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Avanthi Institute of Engg. & Tech
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AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. -R22-1 Year-II semester

COMPUTER SCIENCE AND ENGINEERING

MID-II Internal Exam

Subject - Applied Physics

HALL TICKET NUMBER	MARKS
22Q61A0566	33
22Q61A0567	35
22Q61A0568	28
22Q61A0569	27
22Q61A0570	-1
22Q61A0571	31
22Q61A0572	25
22Q61A0573	21
22Q61A0574	32
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22Q61A0588	23
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22Q61A0590	35

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22Q61A05C5	22
22Q61A05C6	21
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22Q61A05C8	28

FACULTY SIGN. **HOD** **PRINCIPAL**

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AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Gunthapally (V), Abdullapur met (M), R.R.Dist

I. B.Tech. I Sem., I Mid-Term Examinations, 2023

Applied physics

Part –A

Name:________________________________ H.T.NO : | | | | | | | | | | |

Answer All Questions.

All Questions Carry Equal Marks. **Marks: 10M**

i. Multiple choice questions

1. According to the de-broglie, electron exhibit which nature (c)
   (a) Wave nature (b) particle nature (c) Wave &particle nature (d) energy
2. The equation of motion of matter wave was derived by: (~~d~~c)
   (a) Heisenberg (b) bohr (c) schrodinger (d) de-broglie
3. The equation of matter wave was derived by: (d)
   (a) Heisenberg (b) bohr (c) schorodinger (d) de-broglie
4. According to wave mechanics, a material particle is associated with : (c)
   (a) single wave (b) wave packet (c) progressive wave (d) light
5. The charge of neutron (b)
   (a) 1.6×10^{-34} (b) 1.6×10^{-19} (c) zero (d) infinity
6. Einestein's mass –energy relation is (a)
   (a) $h\vartheta = mc^2$ (b) $h^2\vartheta = mc^2$ (c) $\vartheta = hc/\lambda$ (d) $\lambda = mc/h$
7. Which of the following is not a characteristics of wave function (d)
   (a) Continues (b) single valued (c) differentiable (d) Physically significant
8. The uncertainty principle applies to... (b)
   (a) Macroscopic particles (b) microscopic particles (c) gases (d) none of above
9. Davisson and Germer experiment relates to: (d)
   (a) Interference (b) polarisation (c) electron diffraction (d) none of the above
10. Classical free electron theory was develop by (b)
    (a) Lorentz (b)Drude and Lorentz (c) Bloch (d) Newton

ii. Fill in the blanks

1. The waves associated with moving particles is known as ___matter___ waves

2. The experimental proof for existence of matter waves was provided by ___Devision & Germi___

3. A perfect block body is a good ___absorber___ and ___emitter___ of heat

4. Einstien photo electric equation ___$h\vartheta = \omega_0 + \frac{1}{2}mv^2$___

5. The ___$E = h\vartheta$.___ is the minimum frequency of light require to remove an electron

iii. Match the following answeres

1. Bloch theorem (b) a. $\Delta x . \Delta p \leq \frac{h}{4\pi}$
2. Plank's constant value (d) b. $\Psi = e^{ikx}u_k(x)$
3. Charge of electron (f) c. $9.1 \times 10^{-31} kg$
4. Mass of electron (c) d. 6.625×10^{-34}
5. Heisenberg uncertainity principle (A) e. $>10^{-8}$ sec

f. 1.6×10^{-19}

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

I YEAR B.Tech II Semester : I MID EXAMINATION

Subject: Applied physics Marks: $4 \times 5 = 20$ M

Branch: CSE-A&B Date: - JUN-2023

Part -B

Time : ___ Duration: 2Hr

Answer any four of the following

1. **what is photo electric effect? Define Einstein photo electric equation.**

2. **Explain construction and working of zener diode.**

3. **Write and explain Heisenberg uncertainity principle**

4. **Define Schrodinger wave equation in one dimentional potential box**

5. **Explain intrinsic and extrinsic semiconductors with suitable examples.**

6. **Give the assumptions of quantum theory of free electron.**

Answer key
For
Mid-I

1. What is photo electric effect? Define Einstein photo electric equation.

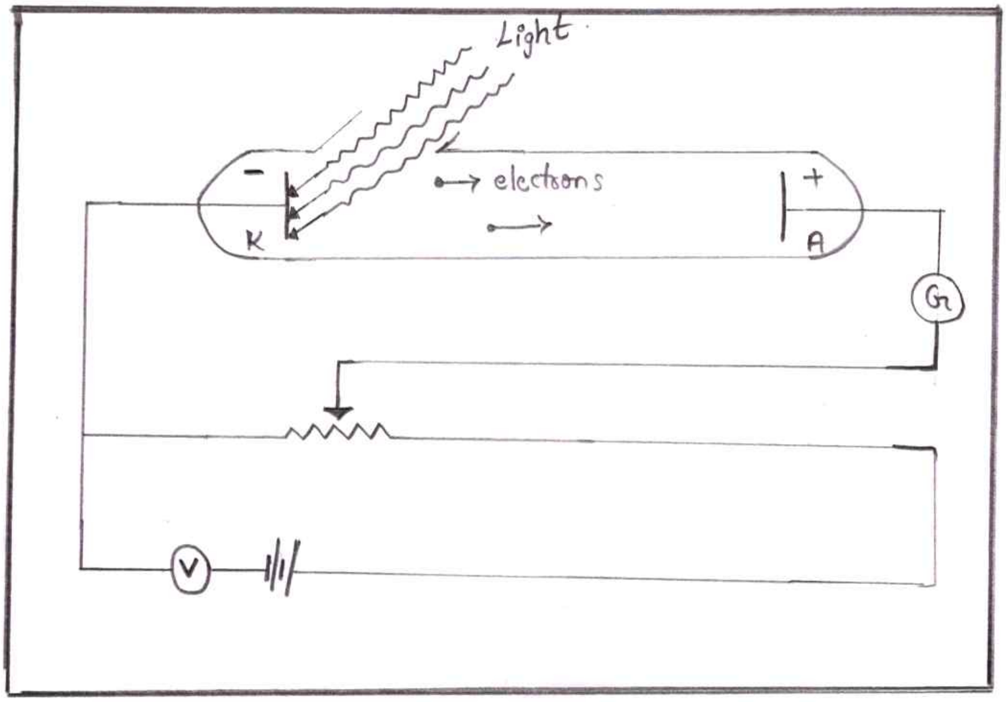
A. Photo - electric effect :-

photo - electric effect is the phenomenon in which the electrons are released from a metal surface, when light of suitable frequency incident on it.

→ The metal is said to be a photo sensitive metal.

→ The emitted are known as photo - electrons.

→ Flow of photo - electrons is called 'photo - electric current'.



→ In 1905 Einstein successfully explained the photo-electric effect

→ According to Einstein when a light beam of photons of energy ($\epsilon \simeq h\nu$) incident on metal surface, the energy of photons is transferred to the electrons to the surface, the of metal

→ one photon (of energy (ϵ) $\simeq h\nu$) is completely absorbed by one electron and gains one quantum of energy

→ Energy of photon is used in two parts.

① one part of photon energy is used to remove the electron from metal surface, this energy is known as 'photo-electric work function (w_0)'.

② The other part of photo energy is used to increase in kinetic energy of the photo-electron

$$\boxed{\therefore\ h\nu = w_0 + \tfrac{1}{2}mv^2}$$

Above equation is known as Einstein photo-electric equation.

→ The thresholed frequency (ν_0) is defined as the minimum frequency of light is required to emit electron from the metal surface.

2. Explain construction and working of zener diode.

A. Zener diode :-

→ A properly doped crystal diode which has a sharp breakdown voltage is known as a zener diode.

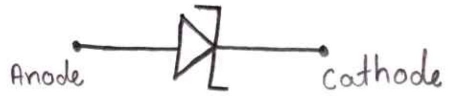
→ The zener diode is normally sperated in reverse break down and the current direction is then from anode to cathode

→ A zener diode has sharp breakdown voltage called zener Voltage (V_Z)

→ A main difference between zener diodes and regular silicon diode is the way they are used in the circuits.

→ Zener diode is a semiconductor diode designed to operate in the breakdown region of reverse bias.

Representation of zener diode.



→ A normal p-n junction diode allows electric current only in forward biased condition. when forward biased Voltage is applied to the p-n junction diode, it allows large amount of electric current. Hence a forward biased p-n junction diode offer only a small resistance to electric current.

→ when reverse biased voltage is applied to p-n junction diode, it blocks large amount of electric current and allows only a small amount of electric current. Hence a reverse biased p-n junction diode offer large resistance to the electric current.

Zener Breakdown:-

If reverse biased voltage is applied to p-n junction diode, it is highly increased a sudden rise in current occurs, at this point a small increase in voltage will rapidly increases the electric current causes a junction breakdown called zener breakdown.

→ The voltage at which zener breakdown occurs is called zener voltage and the sudden increase in current is called zener current

→ A normal p-n junction diode does not operate in breakdown because the excess current permanently damages the diode.

→ Therefore, normal p-n junction diode doesnot operate in reverse breakdown region

→ Zener diodes are the basic building blocks of electronic circuits. They are widely used in all kinds of electronic equipments.

→ They are mainly used to protect electronic circuited from over voltage

→ The zener breakdown occurs in heavily doped p-n junction diode because of their narrow depletion layer.

→ when reverse biased voltage is applied to the diode is increased the narrow depletion region generates strong electric field.

→ when reverse biased voltage is applied to the diode reaches close to zener voltage, the electric field in depletion region is strong enough to pull e^{-}s from them

→ At zener breakdown region a small increase in reaches close to zener voltage, the electric field in depletion region is strong enough, zener breakdown occurs at low reverse voltage where as avalanche breakdown occur at high reverse voltage.

3. Write and explain Heisenberg uncertainity principle.

A. Heisenberg's Uncertainity principle :-

Uncertainity principle of quantum mechanics was discribed by Heisenberg in 1927. The uncertainity principle is a direct consequence of the dual nature of the wave matter

when we regard a moving particle as a wave group, then it may be located any where within the wave group at any given time. we cann't estimate the exact position of the particle inside the wave group. it arises some uncertainity

Hence, According to the Heisenberg Uncertainity principle

"It is imposible to know or to measure both the exact position and momentum of a particle at the same time".

$$\boxed{\Delta x \cdot \Delta P_x \geq \frac{h}{4\pi}}$$

Here $\Delta x \rightarrow$ uncertainity in position

$\Delta P_x \rightarrow$ uncertainity in momentum

& $h \rightarrow$ planck's constant.

→ Therefore simultaneous determination of a pair of physical quantities (position & momentum) of a particle is not possible with required accuracy

→ Another form of uncertainity concerns energy & time

$$\boxed{\Delta E \cdot \Delta t \geq \frac{h}{4\pi}}$$

Here, $\Delta E \rightarrow$ Energy

$\Delta t \rightarrow$ Time.

→ Another two variables

$$\boxed{\Delta J \cdot \Delta \theta \geq \frac{h}{4\pi}}$$

where $\Delta J \rightarrow$ Angular momentum uncertainity

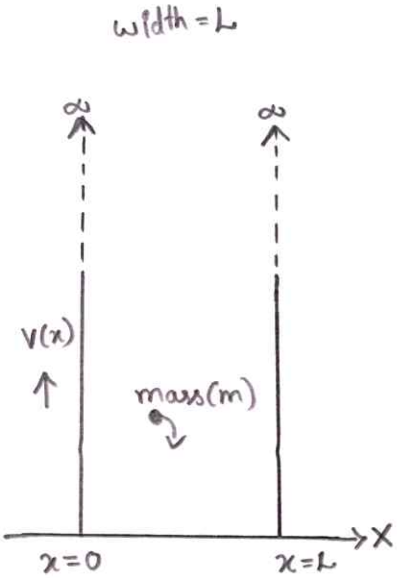
$\Delta \theta \rightarrow$ Angular displacement uncertainity

Thus, the generalized statement of Heisenberg Uncertainity principle is

"It is impossible to specify precisely and simultaneously the values of both no. of particlar pair of physical variable that discribe the behaviour of an atomic system".

4. Define Schrodinger wave equation in one dimentional potential box.

A. particle in one dimensional box:-



→ Consider a particle moving inside a box along the x-direction

→ The particle is bouncing back and forth between the walls of the box having infinite height at $x=0$ & $x=L$ ie) walls of infinite potential wall.

→ The potential energy "V" of the particle can be assumed to be zero b/w $x=0$ to $x=L$ but arises infinite on both sides of the box, the particle can not be escape from the box

ie) $V(x) = 0$ for $0 < x < L$

& $V(x) = \infty$ $x < 0$ and $x > L$

→ Since the particle can not exist outside the box. So its wavefunction (ψ) is zero

→ i.e, the probability of finding the particle outside must be zero. Inside the box wave function (ψ) is finite.

→ The motion of the particle in 1-D box can be discribed by the schrodinger's wave equation

$$\frac{\partial^2\psi(x)}{\partial x^2} + \frac{2m}{\hbar^2}[E-V]\psi(x) = 0 \longrightarrow (1)$$

within the box $V=0$ [potential energy $V=0$]

$$\frac{\partial^2\psi[x]}{\partial x^2} + \frac{2mE}{\hbar^2}\psi(x) = 0$$

$$\frac{\partial^2\psi(x)}{\partial x^2} + k^2\psi(x) = 0 \longrightarrow (2)$$

where $k^2 = \frac{2mE}{\hbar^2} \longrightarrow (A)$

this is the wave equation for a free particle inside a potential wall.

The general solution for this equation is

$$\psi(x) = A\sin kx + B\cos kx \longrightarrow (3)$$

where A & B are the constants

Now applying the boundary conditions

$\rightarrow$ $\psi(x) = 0$ at $x = 0$ [1st]

$$A\sin k(0) + B\cos k(0) = 0$$

$$B = 0$$

sub $B=0$ in eq (3)

$$\psi(x) = A\sin kx \longrightarrow (4)$$

$\rightarrow$ 2nd Boundary condition

$\psi(x) = 0$ at $x = L$ & $B = 0$

from (3) $0 = A\sin kL$

The particle cannot come outside of the box so $A \neq 0$.

therefore KL be an intiger multiple of π.

$$\therefore KL = n\pi$$

$$\boxed{K = \frac{n\pi}{L}} \quad \text{—— (B)}$$

Thus $\psi_n(x) = A\sin\left(\frac{n\pi}{L}\right)x$ —— (5)

eq (5) is known as wavefunction eq

from eq (A) & (B)

$$\frac{n^2\pi^2}{L^2} = \frac{2mE}{\hbar^2}$$

$$\boxed{\therefore E_n = \frac{n^2h^2}{8mL^2}} \quad \text{—— (6)} \qquad \because \hbar = \frac{h}{2\pi}$$

where $n = 1, 2, 3 - - - - -$

→ By this equation we can concluded that the energy of the particle is quantised.

→ It can not vary continuously but can take only certain discrete energy levels

→ Each value of E_n $(n = 1, 2, - - - -)$ is called Eigen value and corresponding ψ_n is called eigen function

→ The value of A can be obtained by normalization condition ie,

$$\int_0^L |\psi(x)|^2 dx = 1$$

Sub $\psi(x)$ in above eq

$$\int_0^L A^2 \sin^2\left(\frac{n\pi x}{L}\right) dx = 1$$

$$\therefore \frac{A^2}{2}\int_0^L \left[1-\cos\left[\frac{2\pi n x}{L}\right]\right] dx = 1 \qquad \because \sin^2\theta = \frac{1-\cos 2\theta}{2}$$

$$\frac{A^2}{2}\left[x - \frac{1}{2\pi n}\sin\frac{2\pi n x}{L}\right]_0^L = 1$$

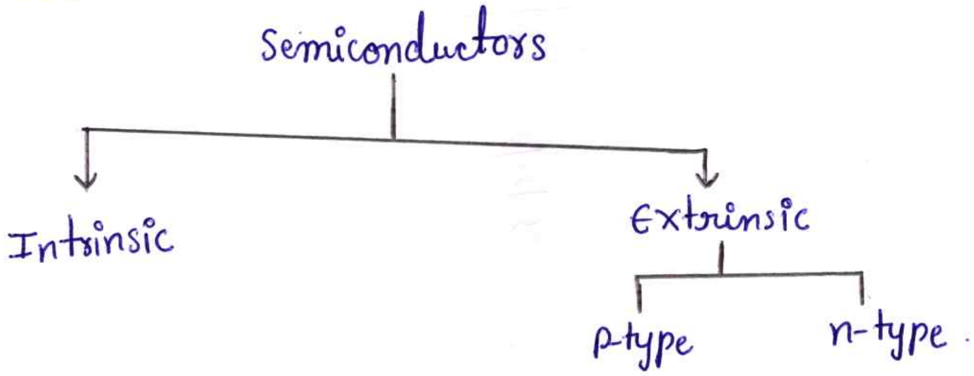
$$\frac{A^2 L}{2} = 1 \Rightarrow A = \sqrt{\frac{2}{L}}$$

$\therefore$ The normalization is $\psi_n(x) = \sqrt{\frac{2}{L}}\sin\frac{n\pi x}{L}$

This is the solution for one dimensional potential box.

5. Explain intrinsic and extrinsic semiconductors with Suitable examples.

A. Semi-conductor:- A semiconductor material is one whose electrical properties lies between insulators and conductors.



Intrinsic Semiconductor:- A Semi-conductor in an extremly pure form is known as Intrinsic Semiconductor

ex:- Silicon, Germanium

Extrinsic Semiconductor:- At room temperature the intrinsic semiconductor has little current conduction cq capability. In order to use the semiconductor in electronic devices, its conduction properties should be increased.

The process of adding impurity to a semi conductor is known as doping such as Semi-conductor is called Impurity or Extrinsic Semiconductor.

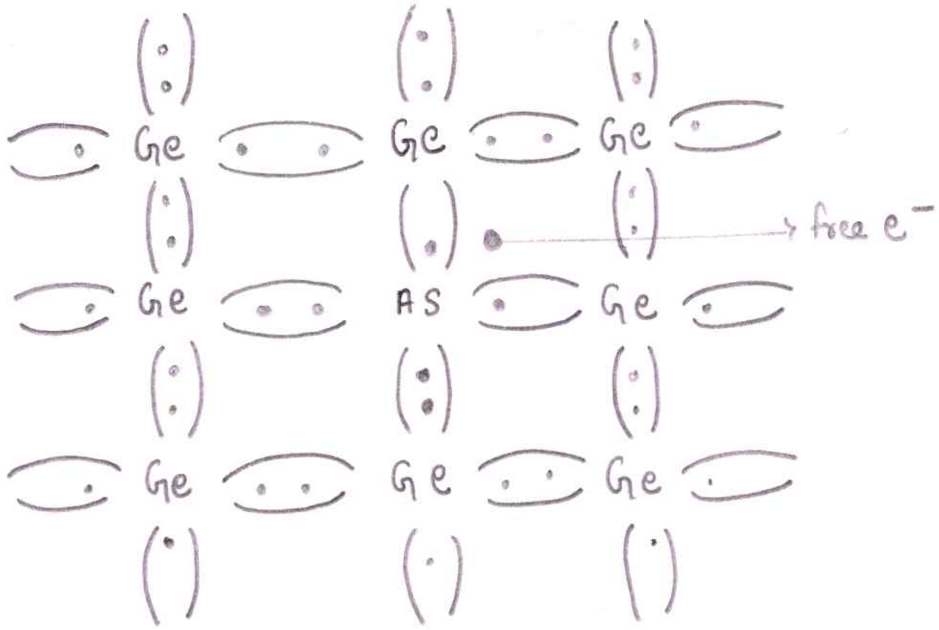
Depending on type of Impurity added, the extrinsic Semiconductor are of 2 types.

① N- type
② P- type.

1. N-type Semiconductors:-

when a small amount of pentavalent impurity is added to a pure Semiconductor crystals. The Resulting crystal is called N-type extrinsic Semiconductor

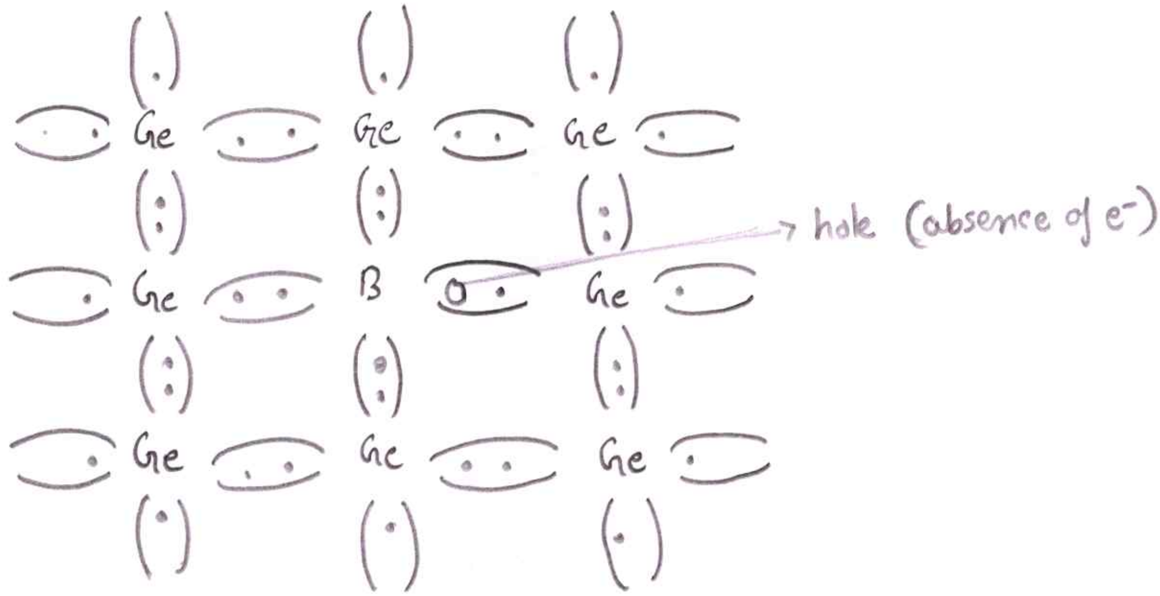
Let us consider the case when pentavalent "Arsenic" is added to pure Semiconductor "Ge".



Such that Arsenic forms 4 covalent Bonds with 4 Ge and fifth e^- of Arsenic is free. This e^- is ready to move in the crystal Lattice.

2. P – type Semiconductor.

when a small amount of trivalent impurity added to a pure semiconductor or 'Ge' the resulting semiconductor is called P-type semiconductor.



In this case Trivalent Boron is added to pure Ge crystal. Each atom of Boron fits into the Ge with 3 covalent bonds with 3 Ge atoms and there is deficiency of $1e^-$ to form 4^{th} Bond with Ge

∴ It is ready to accept e^-

∴ It is known as Acceptor and resulting into P-type Semiconductor.

6. Give the assumptions of quantum theory of free electron.

A. Sommerfield proposed Quantum free electron theory.

→ He treated electron as a quantum particle

→ The free electrons in a metal can have only discrete energy values

→ Thus the energies of electrons are quantized.

→ The electron obey Pauli's exclusion principle

ie) there can not be more then two electrons in any energy level.

→ The distribution of electron in various energy levels obey the Fermi-Dirac quantum statistics.

→ free electrons have the same potential energy within the metal. because of the potential due to ionic cores is uniform throughout the metal.

→ forces of attraction between electron & lattice ions, the force of repulsion between electrons can be neglected.

→ The electrons are treated as wave-like particle.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Gunthapally (V), Abdullapur met (M), R.R.Dist

I. B.Tech. II Sem., II Mid-Term Examinations, 2023

Applied physics

Part –A

Name:________________-___________H.T.NO :

Answer All Questions.

All Questions Carry Equal Marks. Marks: 10M

i. Multiple choice questions

1. Example of ferromagnetic material (A)

   (a) Iron, steel, cobalt, nickel (b) platinum, aluminium, chromium (c)Bismuth, mercury, silver (d) none

2. Units for magnetic flux density (A)

   (a) Wb/m^2 (b) Wb/A·m (c) A/m (d) Tesla/m

3. The material which exhibits hysterias is (C)

   (a) Diamagnetic (b) Paramagnetic (c) Ferromagnetic (d) None

4. Any insulator is a ____________ (A)

   (a) Dielectric (b) conductor (c) insulator (d) none

5. Which one of the following is an example for top-down approach? (A)

   (a) Ball milling (b) Sol-Gel process (c) Both a &b (d) none

6. What is the standard form of SEM ? (B)

   (a) Scanning electrode micron(b) Scanning electron microscope(c)Scanned electron microscope(d) none

7. If an atom jumps from a lower energy level to higher energy level, the process is known as (B)

   (a) Induced emission (b) induced absorption (c) spontaneous emission (d)none

8. Pumping process used in Ruby LASER is (C)

   (a) Electric current (b) electrical discharge (c) optical pumping (d) chemical reactions

9. Active centers in the He-Ne laser (A)

   (a) Neon atoms (b) electrons (c) Helium atoms (d) Both neon and helium atoms

10. In optical fibre, light travels in the (A)

    (a) Core (b) cladding (c) Core –cladding interface (d) Protective material

ii. **Fill in the blanks**

1. **Dielectric is a material that does not have a** free electron **for conduction.**

2. **The product of the magnitude of the charges and the distance of their separation is called the** dipole moment **μ of the electric dipole.**

3. **Forbidden energy gap E_g is very** wide (large) **in dielectrics.**

4. **When charges of opposite polarity are induced on the surfaces of a dielectric, the dielectric is said to be** Electronic polarization.

5. **The process of population inversion is to increase the number of atom in the** Excited **state**

6. **What is the standard form of TEM** Transmission Electron Microscope

7. **Life time of ground state atom in excited state** 10^{-8} s

8. **The main advantage of this Top-down approach is** bulk. **production rates of nano-powders**

9. **Life time of** ground **state is unlimited.**

10. **Snell's law=** $\mu_1 \sin\theta_i = \mu_2 \sin\theta_r$

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

I YEAR B.Tech II Semester : II MID EXAMINATION

Subject: Applied physics Marks: 4×5=20 M

Branch: CSE Date: - AUGUST-2023

Part -B

Time : ___ Duration: 2Hr

Answer any four of the following

1. **Explain ferroelectric, Piezoelectric and Pyroelectric materials.**
2. **Explain briefly the various types of polarization in dielectrics**
3. **What are soft and hard magnetic materials explain.**
4. **What is the hysteresis loop? What does it represent? what is the significance?**
5. **Write about CVD method.**
6. **Write construction and working of He-Ne laser**

Answer key
For
MID-II

1. Explain Ferroelectric, Piezoelectric and Pyroelectric materials.

① Ferroelectric materials:-

→ The dielectric materials which are exhibits spontaneous polarization in the absence of electric field. The phenomenon is called ferroelectric effect. Those material are called Ferroelectric material.

→ All ferroelectric materials exhibits piezoelectric effect.

→ It is also behaves pyroelectricity at strong electric field.

→ Ferroelectricity was first discovered in Rochelle salt at a range of temperature of $-18°c$ to $22°c$

Ex:- Barium Titanate ($BaTiO_3$), lead titanate ($PbTiO_3$)

properties of ferroelectric material:-

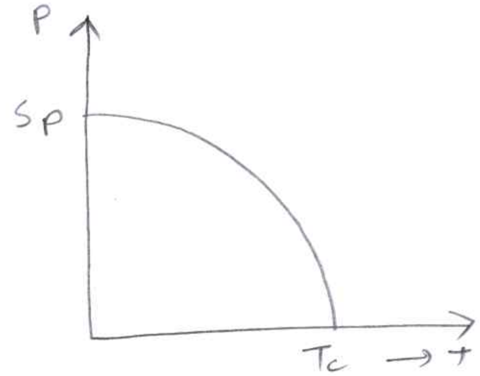
→ All ferroelectric materials posses spontaneous polarization below a certain temperature.

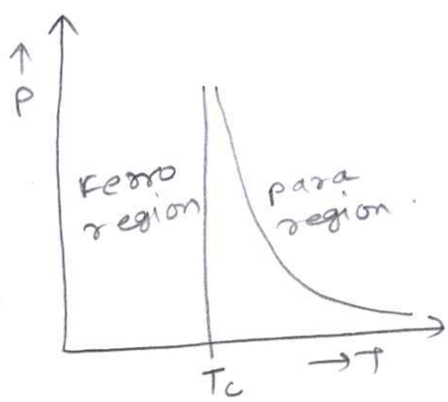
→ As the temperature increases the spontaneous polarization decreases and at a temp. it is vanishes. This temperature is known as curie temperature.

→ dielectric constant changes with temperature known as curie-weiss law

$$\epsilon_r = \frac{C}{T-T_c}$$

c - curie constant
T_c - curie temp.





Applications of Ferroelectric material :-

① Thin film of the ferroelectric materials are used in non-volatile memory (RAM), RFID tags and optical wave guides etc.

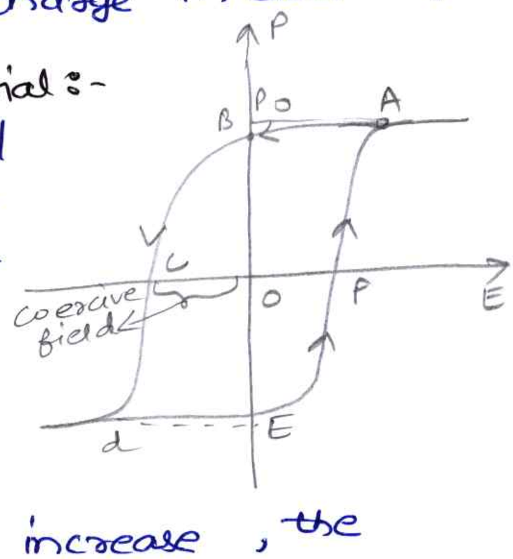
② Making use of piezo-electric property, ferroelectric materials such as quartz, lithium niobate, barium titanate etc are used to make pressure transducer, ultrasonic transducers and microphones.

③ Pyroelectric materials such as barium titanate lithium niobate and polyvinyle fluids are used to make high sensitive IR detectors.

④ Ferroelectric semiconductors such as $BaTiO_3$, $SrTiO_3$, $BaTiO_3 - PbTiO_3$ and $SrTiO_3 - PbTiO_3$ are used to make posistors (which are used to measure and control temperature.

⑤ Ferro-electric ceramics are used in the manufacturing of capacitors to store electric charge in electrical/ electronic circuits.

Hysterisis of a ferroelectric material :-



when an electric field is applied to the ferro-electric material.

" The polarization in the ferro-electric material always lags behind the applied electric field is known as hysterisis of a ferro-electric material."

→ when applied electric field is increase, the polarization of ferroelectric material is also increases rapidly after getting its maximum at point A then remain constant

→ The maximum polarization is called saturation poin (Po)

→ If the electric field is reduced back to zero, polarization will not travel in the initial path, create a new path and reaches to point B at zero electric field, called remanent polarization.

→ To reduced remanent polarization to zero, negative field to be applied, required negative field to remanent polarization becomes zero known as coercive field (-E).

→ If further negative field is increase, negative polarization takes place and reaches to its negative saturation and then remains constant.

→ If same cyclic process completed then DEFA curve will obtained.

→ The space occupied by Hysterisis is called Hysteresis loss that occurs in dielectric material.

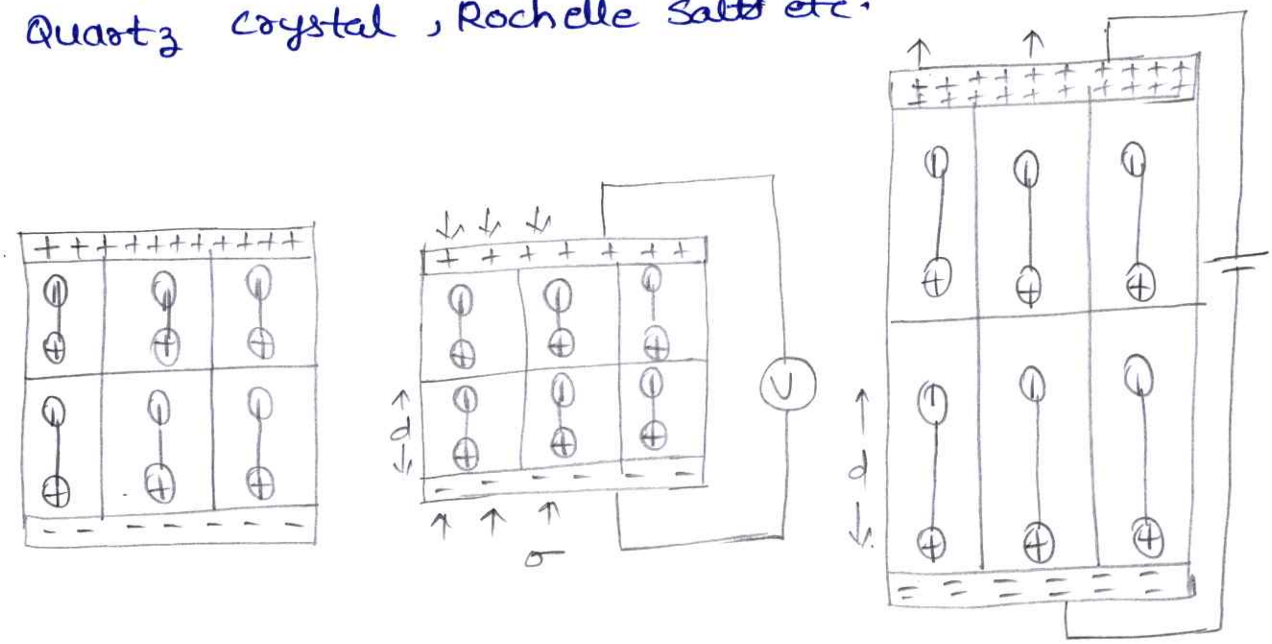
② Piezoelectric materials:-

→ piezo-electric materials are the materials that produce an electric current, when they are placed under Mechanical stress, this property is known as piezo-electricity.

→ If we apply an electric current to these materials, then the materials become strained called inverse piezo-electricity

→ The shape of the material is change slightly (Max 4 0%)

Ex:- Quartz crystal, Rochelle Salt etc.



Applications of piezo-electricity:-

→ single crystal of quartz is very widely used for filter, resonator and delay line application.

→ Rochelle salt is used as transducers in gramphone pick-ups, ear phones, hearing aids, microphones etc.

→ $BaTiO_3$, $PbTiO_3$ are used for high voltage generation, accelerometers transducers etc.

→ piezo electric semiconductors such as Gas, Zno and cds are finding applications as amplifiers of UV waves

→ piezo-electric materials are widely used in scientific and industrial applications.

③ pyroelectricity :-

pyroelectric effect is the change of spontaneous polarization whe the temperature of the speciman is changed.

→ The pyroelectric coefficient (d) is defined as the change in polarization per unit temperature change of the speciman.

$$d = \frac{dP}{dT}$$

→ change in polarization result change in external field and hence charge in surface.

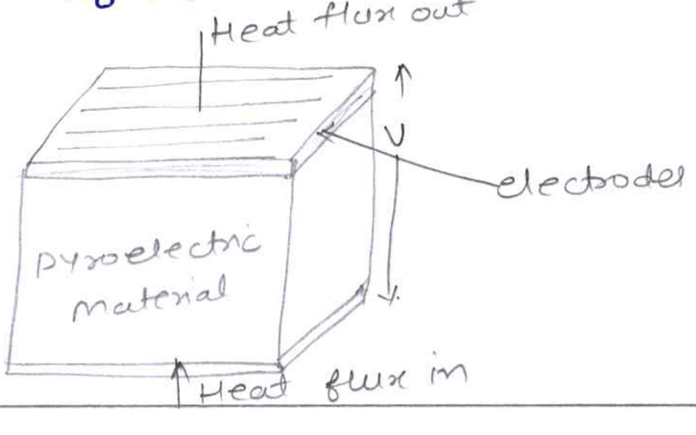
Applications of pyroelectric materials:-

① pyro-electric materials are used to make intruder-alarms.

② fire alarms are works on the principle of pyroelectric effect.

③ pyro-electric detector can be used for radiometry.

④ $NaNO_2$ and PZT ceramics are used in the construction of pyroelectric image tubes.



2. Explain briefly the various types of polarization in dielectrics.

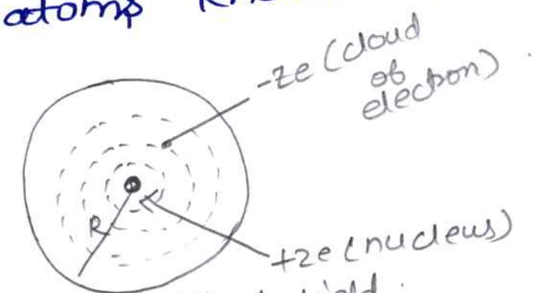
Dielectric polarization is classified into 4 basic types

① Electronic polarization.
② Ionic polarization
③ orientation or dipolar polarization
④ space - charged polarization.

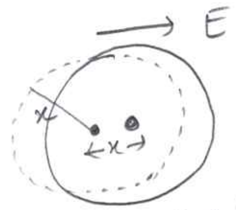
① Electronic polarization :-

→ when an atom placed inside an electric field. The centre of the positive charge (nucleus) is displaced along the applied field direction. while the centre of negative charge is displaced in opposite direction, thus the dipole is created.

→ when a dielectric material is placed inside an electric field such dipoles are created in all the atoms known as electronic polarization.



an atom without field



in field

→ when electric field is applied Lorentz force is acting i.e tend to separate nucleus and electron cloud of atom from their equalibrium position.

→ But coulomb attractive force tend to maintain the original position.

→ Negative charge density of an atom of radius R is

$$\rho = \frac{-Ze}{\frac{4}{3}\pi R^3} \longrightarrow ①$$

Total charge in the sphere is

$$Q_e = \frac{4}{3}\pi x^3 \rho$$

from ①

$$Q_e = \frac{4}{3}\pi x^3 \left[\frac{-Ze}{\frac{4}{3}\pi R^3}\right]$$

$$Q_e = -Ze\left[\frac{x^3}{R^3}\right] \longrightarrow ②$$

Total positive charge of atom of radius x is

$$Q_p = +Ze$$

coulumb's attractive force between nucleus and electron cloud which are separated by 'x'

$$F_c = \frac{1}{4\pi\epsilon_0}\frac{Q_e Q_p}{x^2}$$

$$F_c = \frac{1}{4\pi\epsilon_0}\frac{-Ze\left(\frac{x^3}{R^3}\right)Ze)}{x^2} \Rightarrow \frac{-Z^2e^2x}{4\pi\epsilon_0 R^3}$$

Lorentz force b/w nucleus and electron cloud is

$$F_L = qE = -ZeE$$

At equilibrium

$$F_c = F_L$$

$$-ZeE = \frac{-Z^2e^2x}{4\pi\epsilon_0 R^3}.$$

$$E = \frac{Zex}{4\pi\epsilon_0 R^3} \longrightarrow ③$$

induced dipole moment

$$\mu_{ind} = Zex$$

interm of polarizability

$$\mu_{ind} = \alpha_e E$$

$$E = \frac{Zex}{\alpha_e} \longrightarrow ④$$

from ③ & ④

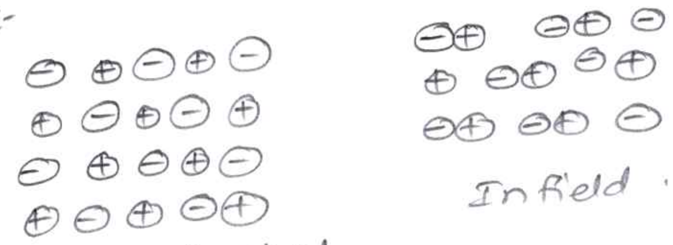
$$\boxed{\alpha_e = 4\pi\epsilon_0 R^3}$$

→ Electronic polarizability is depends on the volume of atom and independent on the temperature.

② Ionic polarization :-

Ionic polarization is caused by relative displacements between positive and negative ions in ionic crystal.

Ex:-



No electric field

In field.

→ Induced dipole moment is proportional to the applied field.

$\mu_i = \alpha_i E$; α_i - Ionic polarizability

→ Ionic polarization is given by $P_i = N\alpha_i E$

$$P_i = \frac{Ne^2}{\omega_0^2}\left[\frac{1}{M} + \frac{1}{m}\right]E$$

m → masses of +ve ions.

M → masses of -ve ions.

ω → angular velocity.

→ Ionic polarization takes 10^{-11} to 10^{-14} s to build up.

→ Ionic polarization is Independent of temperature.

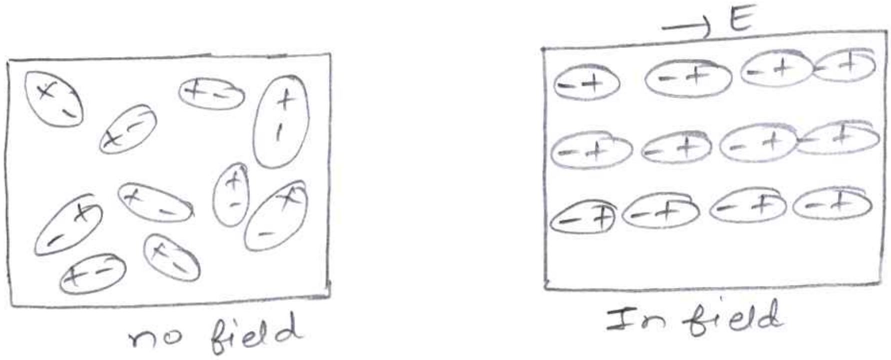
③ Orientation (or) dipolar polarization.

The phenomenon in which the presence of electric field produces, alignment of polar substance in the direction of applied field.

→ In the absence of E the orientation of dipole is random. In the presence of E ~~depe~~ dipoles are align in the field direction.

→ orientation polarization is strongly depend on temperature.

→ The build up time is about $10^{-10}s$ or more.



④ spaced-charged polarization:-

→ space-charged polarization occurs due to the accumulation of charges at the electrodes.

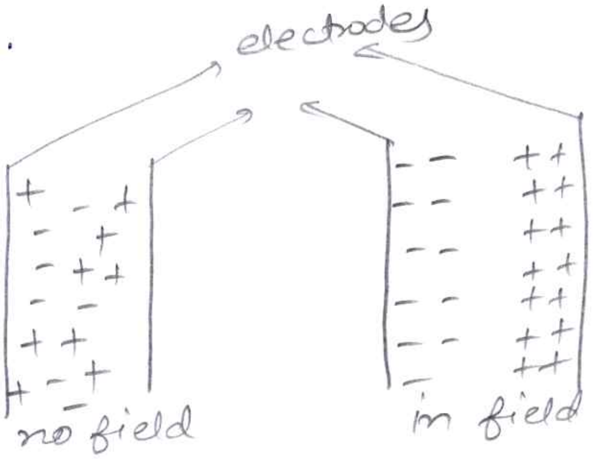
→ this type of polarization occurs in heterogeneous dielectric materials.

→ spaced-charged polarization is also known as interfacial (or) Migrational polarization.

3. what are soft and hard magnetic materials explain.

soft and Hard Magnetic materials:-

Soft Magnetic Material	Hard magnetic Material
1. soft magnetic materials are those that we can be easily magnetize and de-magnetize.	1. Hard magnetic materials are those that are difficult to magnetize and de-magnetize.
2. Hysteresis loop for these materials will be thin and long.	2. Hysteresis loop for these materials is wide as shown in fig.



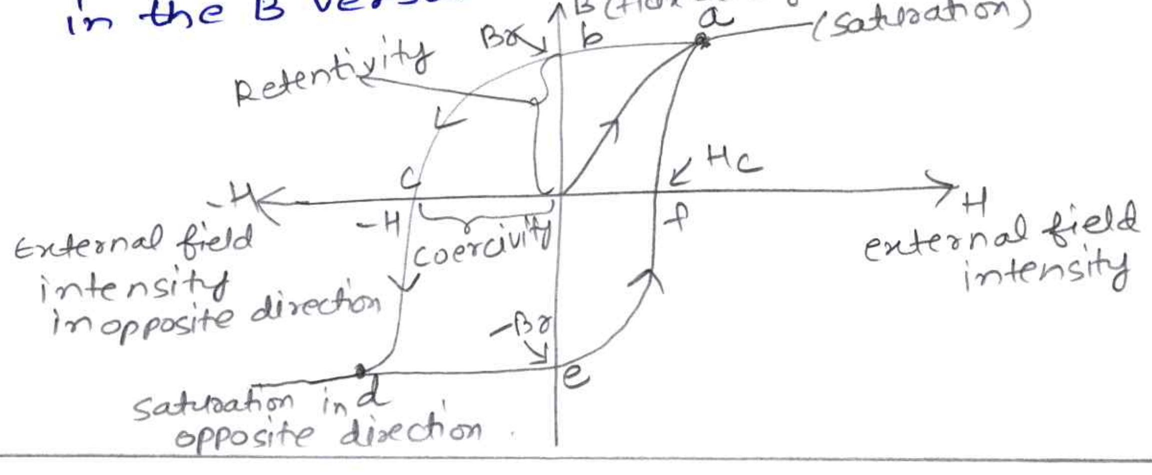
3. Hysteresis loss in the form of heat is less	3. Hysteresis loss in the form of heat is large.
4. Magnetic permeability and Magnetic susceptibility are high.	4. Magnetic permeability and magnetic susceptibility ar low.
5. These are used in preparation of magnetic core material	5. ~~These~~ These are used in preparation for permanent magnets.
6. Applications:- soft magnetic materials used in Transformers, electric moters, magnetic amplifiers, magnetic switching circuits etc.	6. Applications:- Hard materials are used in digital computers, magnetic detectors, magnetic separators, magnetic tapes etc.
7. Ex:- pure iron, Alloys of Iron-silicon, Iron-cobalt, Iron nickel.	7. ex:- Alnico [Alloy of Al, Ni, Co, Cu, Fe] Tungsten steel alloys, platinum cobalt-alloy etc.

4. What is the hysteresis loop? what does it represent? what is the significance?

" The lagging of magnetic intensity (or) magnetising force (H) behind the intensity of magnetic field (B)".

→ These are certain materials like Fe, Co, Ni and certain alloys of these materials which exhibit high degree of magnetization.

→ Below the ferromagnetic curie temperature ferromagnetic materials exhibit the hysteresis in the B versus H curve as shown in diagram.



→ when the field intensity (H) is increased from zero, the flux density (B) is also increases proportionally.

→ Further increasing the value of H, the value of B is saturated at a point a i.e B is constant.

→ Then decreasing the value of H, the B value is also decreased, but at point b, the external field intensity (H) is zero (H=0) but B ≠ 0 and this value of magnetic induction is called residual magnetism (or) retentivity (Br).

→ Retentivity of the material is a measure of remaining magnetic flux in the material when the magnetic field is removed.

→ when sufficient negative field is applied residual magnetisation (Br). become zero. This value of magnetic intensity is coercive field (-Hc) at point c.

→ coercive field (or) coercivity (-Hc) of the material is a measure of required external field intensity (H) to density destroy retantivity.

→ Further if negative magnetic field is applied, B is increases in negative direction and reaches it maximum value then constant this is known as negative saturation at point

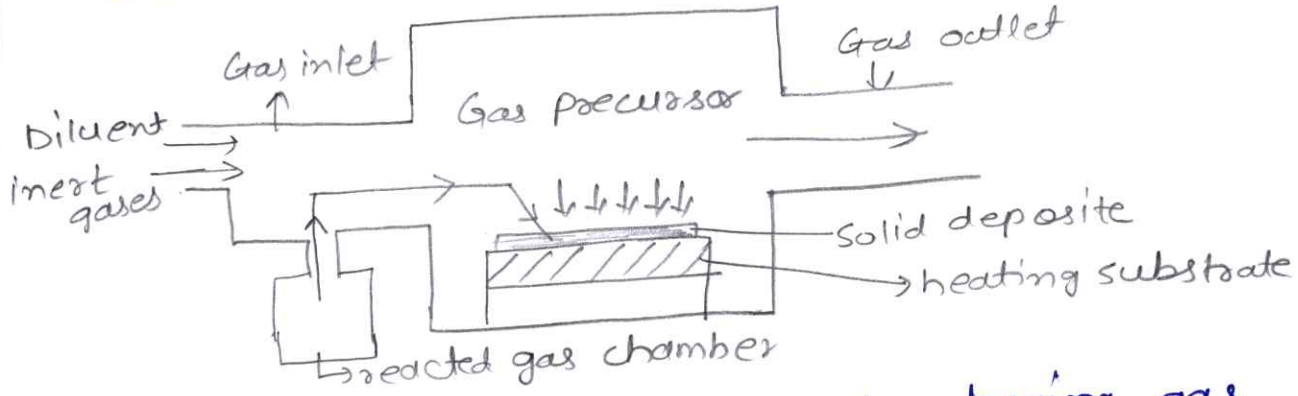
→ Then, if negative field is decreased back to zero and increases from zero as shown in diagram, the curve 'defa' is obtained.

→ The path forced by this B-H plot is called Hysteresis loop.

→ The area covered by loop is known as "Hysteresis ~~loop~~ loss" in the form of Heat.

5. write about CVD method.

CVD is a formation of a non-volatile (not vapourised naturally) solid film on a surface by a reaction of vapour phase chemicals (gaseous precursor) that contain the required constinuent.



It consist of a reacter chamber having gas inlet, gas outlet eitherside as shown in digram and heating substate in which the film of wafer form is deposite on the substrate. the reacted gas chamber is attached at the inlet so as enter gas precursor into the reacter chamber.

working:-

→ To produce nanomaterial wafer form, a required reactant in the gaseous form and diluent inert gas are introduced in the reactant chamber from gas inlet.

→ The reactants are absorbed on the surface of substrate and undergo chemical reactions with the substrate to form of the film.

→ The gaseous by product of the reactions are desorbed and evacuted from the gas outlet.

* Types of CVD based on temperatures :-
1) ~~Hot~~ Hot - wall CVD :- heating system heats up not only wafer but also the walls of the reactor.
2) Cold - wall CVD :- heating system heats up only wafer.

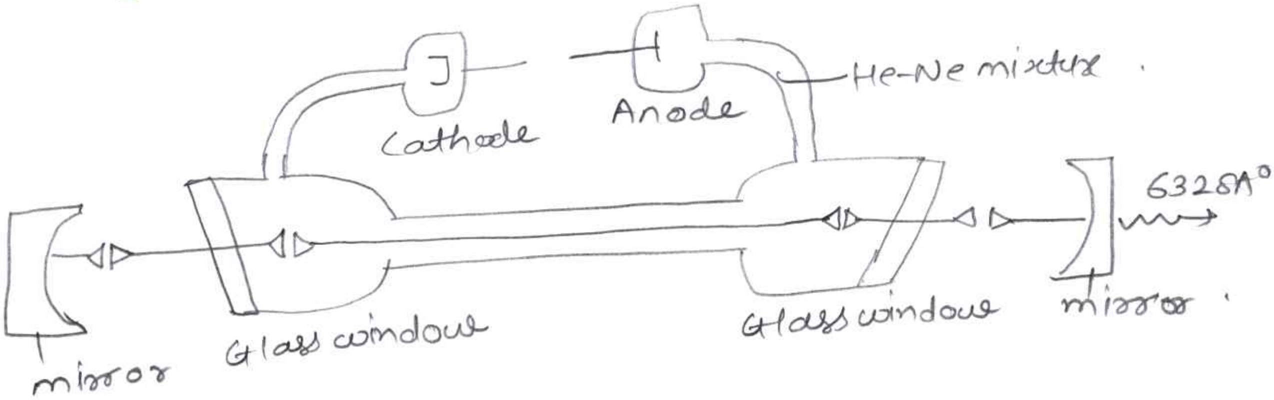
* Types of CVD based on pressure :-
1) APCVD (Atmospheric pressure CVD)
APCVD is operate at Atmospheric pressure.

2) Low - pressure CVD :-
which operate at low pressure than APCVD.

Advantages :-
1) CVD is used to deposite high quality film.
2) It is extreamly useful in the process of atomic layer deposition for depositing extremly thin layer of material.
3) GaAs films are used in some integrated circuits and photo - voltaic devices.
4) Fabrication of carbon nanotubes.

6. Write construction and working of He-Ne Laser.
The first gas laser was He-Ne Laser invented by Ali Javan, william, R. Bennette, Jr and Donald R. Heriott in 1961.
Construction :-
The schematic diagram of He-Ne Laser is as shown in figure.
He-Ne Laser consists of a long discharge tube filled with a mixture of helium and neon gases in the ratio 10:1
Neon atoms are the active centres in He-Ne Laser. The energy levels of Ne are suitable for Laser transitions.

'He' atoms help in exciting Ne atoms. Electrodes are provided in the discharge tube to produce discharge in the gas.



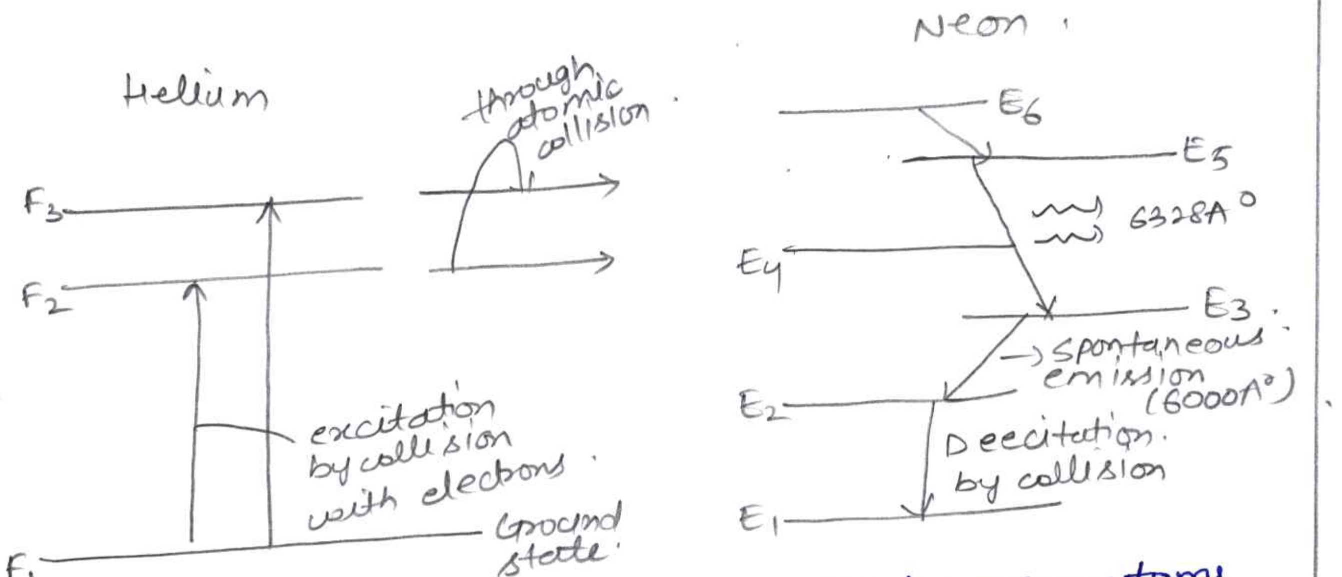
→ The electrodes are connected to a high voltage power supply. The tube is sealed by inclined windows arranged at its two ends.
windows arranged at its two ends.
Two mirrors are arranged at its two ends which act as Resonator.

** The discharge tube is of dimensions.
2-8 mm diameter.
10-100 cm length.

<u>working</u>:-

He-Ne Laser employs a four level pumping scheme. The energy levels of Helium and Neon are as shown in fig. When the power is switched on, a high voltage of about 10kV is applied across the gas. It is sufficient to ionize the gas. The energetic electrons excite He atoms through collisions.

→ one of the excited levels of helium atom (F_3) is at 20.61 eV above the ground level. It is a metastable level.
one of the excited levels of neon (E_6) is at 20.06 eV which is nearly same as F_3 of helium atom.



Helium atoms can transfer energy to neon atoms such an energy transfer
of identical energy levels transfer. so
is called as resonant energy
helium atoms return to the ground levels by
transfering its excess energy to neon atoms.
The k.E of helium atoms provide the additional
0.05 ev required for excitation of neon atoms.
The role of helium atoms is to excite neon
atoms by collisions and to cause population
inversion.
This is the pumping mechanism in He-Ne laser.
The probability of energy transfer from helium
atom to neon atoms is more as there are
10 helium atoms per 1 neon atom in the
gas mixture.
The upper state of neon atoms E_5 is a metastable
state. ∴ Neon atoms accumulate in this state.
A state of population inversion is achieved b/w
E_5 and E_3 levels. The transition $E_5 \rightarrow E_3$ generates
a laser beam of red colour of wavelength 6328A°

From the level E_3 the neon atoms drop to E_2
level spontaneously. E_2 is a metastable state.
so Ne atoms lend to accumulate ate E_2. These
atoms are to be sent to ground state E_1
quickly. otherwise the no. of atoms in the ground
state decreases. The ~~neon atoms~~ rapidly drop
to ground level due to collisions with walls
of the tube. These atoms in ground state will
be available for excitation once again.
He-Ne laser widely used in laser printing,
bar code reading also in laboratories as a
monochromatic source.

ASSIGNMENT QUESTIONS

1. Write the fundamental laws of photo electric effect and Derive the expression for Einstein's photo electric equation
2. Derive the expression for average energy of quantum oscillators and Plank's Formula .Explainits two special cases.
3. Explain construction and working of Davision and Germer experiment to prove that the moving matter particle is associated with a wave.
4. Derive Schrodinger's time independent wave equation and what is the physical significance ofwave function
5. Explain the motion of electron in periodicpotential by using Kronig-penny model?
6. Obtain the expression for Eigen value and Eigen function of a particle in one dimensional potentialbox.
7. Derive the expression for effective mass.
8. Explain Classical and Quantum Free electron theory.
9. Derive a relation between Hall Voltage and Hall Coefficient and Explain experiment of Hall effect.
10. Describe V-I characteristics of Zener diode and pn junction diode in both biasing conditions.
11. Explain the construction and working, figure of merit and Characteristics of LED
12. Explain the Construction, working and characteristic curve of solar cell.
13. Explain construction and working of avalanche diode and PIN diode.
14. Explain various polarisations in dielectric materials.
15. Explain about ferroelectrics and piezoelectrics

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ASSIGNMENT - I

NAME :⇒ K. shivani

Roll No :⇒ 22Q61A0583

class :⇒ CSE -(B)

SUBJECT :⇒ Applied physics (AP)

5/5

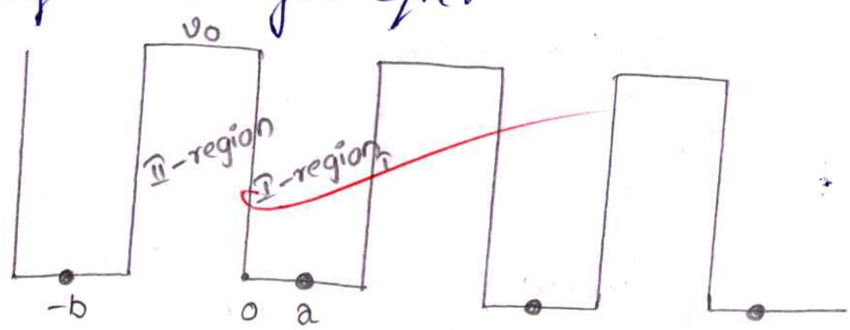
① Kronig penny Model :⇒

Theory :⇒ The potential Energy of electron varies periodica -lly with periodicity of ion core (nucleus).

The potential Energy of the electron near the ion core is zero and Max in b/w adjacent ions in the lattice

Kronig and penny proposed simple method to Explain the behaviour of an electrons in a one dimensions periodic potential.

The possible states that electron can occupy / deter Mined by schrodinger Eqn.



consider an electron moving along x-axis under the periodic potential defined as $V=0$ for $0<x<a$

$V=V_0$ for $b<x<0$

form time independent wave Eqn,

$$\frac{\partial^2 \psi}{\partial x^2}+\frac{2m(E-V)}{\hbar^2}\psi(x)=0$$

for region - I, $V=0$

$$\frac{\partial^2 \psi}{\partial x^2}+\frac{2m(E-V)}{\hbar^2}\psi=0 \quad (\text{or}) \quad \frac{\partial^2 \psi}{\partial x^2}+\frac{2m}{\hbar^2}(E\psi)=0$$

$$\frac{\partial^2 \psi}{\partial x^2} + \alpha^2 \psi = 0 \longrightarrow (1)$$

where $\alpha^2 = \frac{2mE}{\hbar^2}$

for region - II, $V = V_0$

$$\frac{\partial^2 \psi}{\partial x^2} + \frac{2m(E-V_0)}{\hbar^2}\psi = 0$$

$$\frac{\partial^2 \psi}{\partial x^2} + \beta^2 \psi = 0 \longrightarrow (2)$$

where $\beta^2 = \frac{2m}{\hbar^2}(E-V_0)$

Now solution of eqn (1) and (2)

we get

$$\psi = e^{ikx} u_k(x) \longrightarrow (3)$$

differentiate the eqn (3) w.r. to "x"

$$\frac{\partial \psi}{\partial x} = \frac{\partial}{\partial x}\left(e^{ikx} \cdot u_k(x)\right)$$

$$\frac{\partial \psi}{\partial x} = e^{ikx}\frac{\partial}{\partial x}\left(u_k(x) + u_k(x) \cdot \frac{d}{dx} e^{ikx}\right).$$

$$\frac{\partial \psi}{\partial x} = e^{iky}\frac{du_k}{dx} + u_k\, ik e^{ikx}$$

again differentiate wrt "x"

$$\frac{\partial^2 \psi}{\partial x^2} = e^{ikx}\frac{\partial^2 u_k}{\partial x^2} + ike^{ikx}\frac{\partial u_k}{\partial x} + u_k . ik . ik e^{ikx} + ike^{ikx}\frac{du_k}{dx}$$

$$\Rightarrow e^{iky}\frac{d^2 u_k}{dx^2} + \frac{\partial u_k}{\partial x} ike^{itx} - u_k k^2 e^{ikx} + ike^{ikx}\frac{du_k}{dx} \rightarrow (4)$$

Now sub eqn (4) in eqn (1)

$$\Rightarrow e^{ikx}\frac{\partial^2 u_k}{\partial x^2} + \frac{\partial u_k}{\partial x} ike^{ikx} - u_k k^2 e^{ikx} + ike^{ikx}\frac{\partial u_k}{\partial x}\Big) + \alpha^2 e^{ik.x} u_k = 0$$

Divide the above Eqn with ε^{ikx}

$$\Rightarrow \frac{\partial^2 u_K}{\partial x^2} + 2ik\frac{\partial u_K}{\partial x} - u_K K^2 + \alpha^2 u_K = 0$$

$$\Rightarrow \frac{\partial^2 u_K}{\partial x^2} + 2ik\frac{\partial u_K}{\partial x} + u_K(\alpha^2 - K^2)u_K = 0 \longrightarrow (5)$$

Sub eqn (4) in eqn (2)

$$\text{Eqn (2)} \Rightarrow \frac{d^2\psi}{dx^2} - \beta^2\psi = 0$$

$$\Rightarrow \varepsilon^{ikx}\frac{\partial^2 u_K}{\partial x^2} + 2\frac{\partial u_K}{\partial x}\cdot ike^{ikx} - u_K K^2 \cdot e^{ikx} - \beta^2 e^{ikx}\cdot u_K = 0$$

divide the above Eqn with e^{ikx}

$$\Rightarrow \frac{\partial^2 u_K}{\partial x^2} + 2ik\frac{\partial u_K}{\partial x} - (\beta^2 + K^2)u_K = 0 \longrightarrow (6)$$

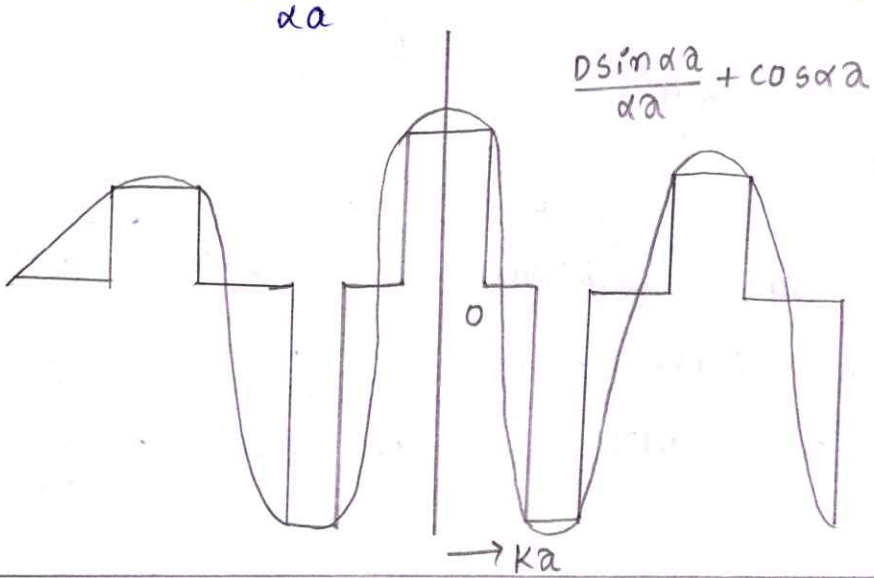
Now the general solution of eqns (5) and (6)

$$P\left(\frac{\sin\alpha a}{\alpha a}\right) + \cos\alpha a = \cos ka \longrightarrow (7)$$

where $P = \dfrac{maV_0 b}{\hbar^2}$

$$\alpha^2 = \frac{2mE}{\hbar^2}$$

A graph $\dfrac{p\sin\alpha a}{\alpha a} + \cos\alpha a$ vs αa is plotted $\dfrac{p\sin\alpha a}{\alpha a} + \cos\alpha a$



Case-I :⇒ $P \to \infty$

$$\sin \alpha a = 0$$

$$\alpha a = n\pi$$

$$\alpha = \frac{n\pi}{a}$$

$$\alpha^2 = \frac{n^2\pi^2}{a^2}$$

$$\alpha^2 = \frac{n^2\pi^2}{a^2}, \quad \alpha^2 = \frac{2mE}{\hbar^2}$$

$$\therefore \frac{n^2\pi^2}{a^2} \Rightarrow \frac{2mE}{\hbar^2} \qquad \because \hbar = \frac{h}{2\pi}$$

$$\Rightarrow \frac{n^2\pi^2\hbar^2}{2ma^2} \Rightarrow \frac{n^2\pi^2h^2}{4\pi^2 2ma^2}$$

$$E \Rightarrow \frac{n^2h^2}{8ma^2}$$

Above Eqn state than nature of insulator

Case-II :⇒ $P \to 0$

$$\cos \alpha a = \cos ka$$

$$\alpha \cancel{a} = k \cancel{a}$$

$$\alpha = k$$

$$\alpha^2 = k^2$$

$$\frac{2mE}{\hbar^2} = k^2$$

$$\therefore \frac{2mE}{\hbar^2} = \frac{4\pi^2}{\lambda^2} \quad \left(\because k = \frac{2\pi}{\lambda}\right)$$

$$E = \frac{4\pi^2\hbar^2}{2m\lambda^2} \Rightarrow \frac{4\pi^2h^2p}{4\pi^2m\lambda^2} \Rightarrow \frac{4\pi^2h^2p^2}{4\pi^2 2mh^2} \Rightarrow \frac{p^2}{2m}$$

This indicates the nature of conductor. In this case the Energy of electrons in the form of kinetic Energy.

② Particle in one dimensional potential Box of infinite height :⇒

consider a particle of mass "m" moving along x-axis b/w the two walls A and B and x = A. The particle moves freely inside the walls potential energy. of particle b/w the two walls constant. The constant potential Energy b/w the walls. It is reflected back.

Immediately now force on the particle change from o to A finite (f) values hence (v). Becomes infinity the particle outside the box, v becomes zero the particle inside the walls (box). We know that time independent schrodinger wave Eqn.

$$\nabla^2 \psi(x) + \frac{2m(E-V)}{\hbar^2}\psi(x) = 0$$

here $\cancel{\text{at } v=0}$ $\nabla^2 = \frac{\partial^2}{\partial x^2}$

$$\frac{\partial^2 \psi(x)}{\partial x^2} + \frac{2m}{\hbar^2}(EV)\psi(x) = 0$$

$$\frac{\partial^2 \psi}{\partial x^2} + \frac{2mE}{\hbar^2}\psi = 0$$

put $K^2 = \frac{2mE}{\hbar^2}$

$$\frac{\partial^2 \psi}{\partial x^2} + K^2\psi = 0 \longrightarrow ①$$

$$\psi(x) = A\sin kx + B\cos kx \longrightarrow ②$$

The solution for Eqn ① is in the form of

$$\psi(x) = A\sin kx + B\cos kx \longrightarrow ②$$

A, B are constants A, B values can be constants.
A, B are values can be obtained from boundary conditions

$\because$ ψ^2 represents the probability of finding the particle at any instants.

Here $\psi=0$ at $x=0$ $\left.\begin{array}{l}\psi(x)=0 \text{ at } (x=0) \\ \psi(x)=0 \text{ at } (x=a)\end{array}\right\} \longrightarrow (3)$

Sub Eqn (3) in 2nd Eqn

$0 = A\sin k(0) + B\cos k(0)$

$\Rightarrow 0+B$

$\Rightarrow B=0$

$\psi(x)=0$ at $x=0$

$0 = A\sin kA$

$A\sin n\pi = A\sin ka$

$ka = n\pi \Rightarrow A=0 / kA=0$

$k = \frac{n\pi}{a}$ Eqn (2) becomes

$\psi(x) = \sin\left(\frac{n\pi}{a}\right)x$

$k = \frac{\sqrt{2mE}}{\hbar} \Rightarrow \frac{2mE\,n\pi^2}{\hbar^2} \Rightarrow \frac{8\pi^2 mE}{h^2}$

$\therefore E = \frac{n\pi}{a}$ & $k^2 = \frac{n^2\pi^2}{a^2}$ $\left[\because k^2 = \frac{2mE}{\hbar^2} \Rightarrow \frac{\sqrt{2mE}}{\hbar}\right]$

$\frac{n^2\pi^2}{a^2} = \frac{8\pi^2 mE}{h^2}$

$E_n = \frac{n^2h^2}{8ma^2} \longrightarrow (5)$

when $n_1 = 1$, $E_1 = \frac{h^2}{8ma^2}$

→ The wave function $\psi = A\sin\left(\frac{n\pi x}{a}\right)$

The complex Conjugate of ψ is $\psi^{*} = A\sin\left(\frac{n\pi x}{a}\right)$

Normalise the wave function. We find

$$\int_0^a \psi\psi^* \, dx$$

$$\int_0^a \psi\psi^* \, dx \Rightarrow \int_0^a A^2 \sin^2\left(\frac{n\pi x}{a}\right) dx$$

$$\Rightarrow A^2 \int_0^a \frac{1-\cos\left(\frac{n\pi x}{a}\right)}{2} dx$$

$$\Rightarrow \frac{A^2}{2}\left[x \frac{\sin\left(\frac{n\pi x}{a}\right)}{(n\pi/a)}\right]_0^a$$

$$\Rightarrow A^2/2\,(a-0)$$

$$\int_0^a \psi\psi^* \, dx = \frac{A^2 a}{2}$$

let $N^2 = \frac{A^2 a}{2}$, $N = A\sqrt{a/2}$

The normalised wave function ψ_n is obtained as

$$\psi_n = \frac{\psi}{N}$$

$$\psi_n = \frac{\cancel{A}\sin\left(\frac{n\pi x}{a}\right)}{\cancel{A}\,(\sqrt{a/2})}$$

$$\psi_n = \sqrt{2/a}\,\sin\left(\frac{n\pi x}{a}\right)$$

These normalised wave function are called Eigen function. $\psi^*_n = \sqrt{2/a}\,\sin\left(\frac{n\pi x}{a}\right)$

⇒ The probability function is $p(x) = |\psi_n|^2$

$$\Rightarrow |\psi_n|^2 = \psi_n\psi_n^*$$

$$\Rightarrow 2/a\,\sin^2\left(\frac{n\pi x}{a}\right)$$

$n_2 = 2,\ E_2 = \frac{4h^2}{8ma^2} \Rightarrow 4E_1$

$n = 3,\ E_3 = \frac{9h^2}{8ma^2} = 9E_1$

$44\ dx = 1 = 1$

$A^2 \int_0^2 \sin^2\left(\frac{\pi x}{2}\right) = 1$

$A^2 \int_0^2 \frac{1 - \cos^2\frac{2\pi}{2}}{2}\ dx = 1$

$A^2 = 1/2$

$A = \frac{\sqrt{3}}{1}$

The normalised wave fonction of particle $\psi_n = \sqrt{2/L}\ \frac{\sin \pi}{L}$

① These Energy values are discreate. They are not continous as expected classed Mechanics.

② Thus according to quantum Mechanics, the particle inside, aliquid has Cannot have all values, of Energy, But only these discreate values. Which are given by $k = \frac{\int a^2 mt}{\hbar^2}$

③ These discreate Energy values are known as Energy Eigen values. These energy levels as shown fig.

$E_3 = 9h^2/8ma^2 \Rightarrow 9E_1$

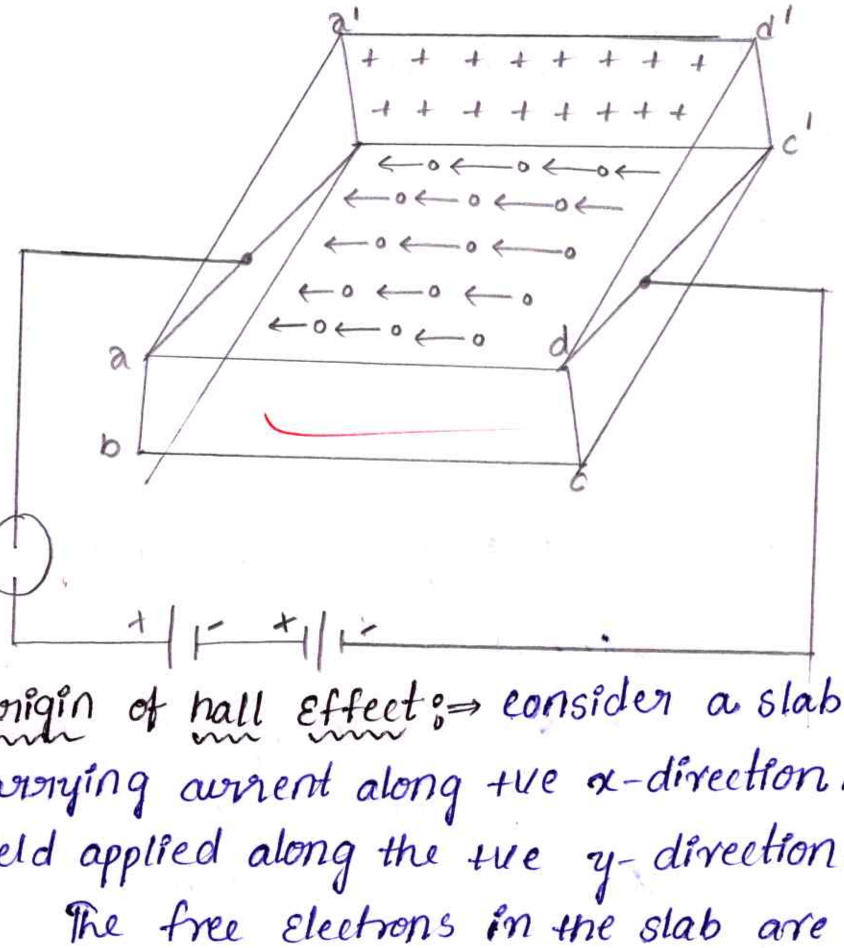
$E_2 = 4h^2/8ma^2 \Rightarrow 4E_1$

$E_1 = h^2/8ma^2$

③ Half Effect:⇒

*→ It was suggested fort. Edward hall in 1987.

*→ When at Rust magnetic field is applied ⊥er to the direction of current in a conductor then a transverse Electric field... is developed this Electric field is ⊥er to both the directions of current and magnetic field. The phenomenon of production of transverse electric field is known as "Half Effect" and this Electric Effield is ⊥er to both the directions of called "Half Effect".



origin of hall effect:⇒ consider a slab of conductor carrying current along +ve x-direction. let $\vec{B}$ iq magnetic field applied along the +ve y-direction.

The free Electrons in the slab are moving along a direction. these two electrons will be Experience force

$$\boxed{F = q(v \times B)}$$

Due to applied magnetic field $\vec{B}$. Electrons are deflected towards face and it will Accumulate. it takes face abcd-

VR of face a'b'c'd' +ve. As a result a potential difference / hall voltage V_x is produced b/w two faces.

The ratio of hall voltage (V_H) to the width of slab (W) along z-direction gives hall field (E_z)

Expression for hall-voltage (V_H):⇒

Magnetic of force due to magnetic field

$q v_d B \sin 90°$ $\quad \because \boxed{q = e}$

$F_B = e v_d B \rightarrow ①$

magnitude of force due to electric field

$F_E = e E_H \rightarrow ②$

In Equilibrium $F_B = F_E$

$\cancel{e} v_d B = \cancel{e} E_H$

$v_d B = E_H$

$v_d = \dfrac{E_H}{B} \rightarrow ③$

The electric current is free slab is given by $I = A n e v_d$

$I = (wt) n e v_d$ $\quad (\because A = wt)$

$v_d = \dfrac{I}{wtne} \rightarrow ④$ $\quad$ $n \rightarrow$ no. of charge carriers per unit volume.

comparing ③ & ④ $\quad$ $A \Rightarrow$ cross sectional Area

$\dfrac{E_H}{B} = \dfrac{I}{wtne} \rightarrow ⑤$

But $E_H = \dfrac{V_H}{w} \rightarrow ⑥$

using ⑥ in ⑤ $= \dfrac{V_H}{Bw} = \dfrac{I}{wtne}$

$$\boxed{V_H = \left[\frac{1}{ne}\right]\frac{BI}{t}}$$

→ hall voltage

from above Eqn

Hall coefficient $= \frac{1}{ne} = \frac{V_H t}{BJ}$

(RH)

$RH = \left[\frac{1}{ne}\right] \Rightarrow \boxed{R_H = 1/nq}$

The hall [Hicket] coeffient is +ve when charge carriers are elections and +ve. when charge currents are holes

hall resistance $= \boxed{\frac{V_H}{I} = \frac{B}{net}}$

Hall effect in p-type and n-type semi conductors :⇒

In p-type material for which the current is passed along x-direction from left to right and magnetic field applied along z-direction as shown in figure

According to flaming left and Rule

$idl \times B = \vec{F}$ — $F =$ lorents force

$\vec{F} = qu_x \times B$ — $E = F/q$

Electric field force $= qE$ — $Fq = F$

For p-type :⇒ $F_y = qV_x * B_z$

$F_y = qE_y$ — $(A \times B = |A||B|\sin\theta)$.

Equate above ② Eqns — $(\sin 90° = 1)$

$qV_xB_z = qE_y$

$V_xB_z = E_y$ — $[\because x = w]$

$E_H = \frac{V_H}{x}, \quad E_H = \frac{V_H}{w}$

$$\boxed{V_x B_z = \frac{V_H}{W}} \longrightarrow (a)$$

drift current :⇒ $J_x = \varepsilon p \mu_p \cdot E_x$

$J_x = \varepsilon p V_x \longrightarrow$ drift velocity

$$\frac{I_x}{A} = J_x = \varepsilon p V_x$$

$$\frac{I_x}{wd} = \varepsilon p V_x$$

$$\boxed{V_x = \frac{I_x}{wd \cdot \varepsilon p}} \longrightarrow (b)$$

from eqn (a)

$$V_x = \frac{V_H}{B_z W}$$

compare (a) and (b)

$$\frac{I_x}{wd \cdot \varepsilon p} = \frac{V_H}{B_z \cancel{w}} \Rightarrow I_x B_z = \varepsilon d p$$

$$\boxed{P = \frac{I_x B_z}{d \varepsilon V_H}}$$

$\varepsilon \longrightarrow$ Election charge

$I_x \longrightarrow$ current

$B_z \longrightarrow$ magnetic field in z-direction

$d \longrightarrow$ depth of semi conductor

$P \longrightarrow$ No. of holes.

similarly, for n-type semi-conductors

$$\boxed{n = \frac{-I_x B_z}{d e V_H}}$$

Modify of charge carriers :⇒

current density $J_x = \frac{I_x}{wd} = \varepsilon p \mu_p E_x$

$E_x = \frac{V}{x} = \frac{V}{L}$

sub E_x value in above Eqn

$$\frac{I_x}{wd} = e p \mu_p \frac{V_x}{L}$$

$$\boxed{\mu_p = \frac{I_x L}{w d e p V_x}}$$ → modify of holes → majority carriers calculation

Similary for electrons

$$\boxed{\mu_n = \frac{I_x L}{w d e n V_x}}$$ → modility of elections

Applications of hall Effect :⇒

① It is used to determine the sign of current carrying charges.

② It is used to design magnetic fluse meters and Multipliers on the basis of hall voltage.

③ It is used to find the power flows in a electro magnetic waves.

④ planck's Radiation Law :⇒

Planck's hypothesis in 1900 max plank introduced the revolutionary Concept of radiation known as quantum theory of radiation.

He made following assumptions

① A black body radiator contains harmonic oscillations of possible frequencies.

② The oscillations cannot emits / absorb energy continously. This is contrary to electro magnetic energy. which allows a continous emission / absorption of energy.

③ The emition / absorption of energy takes place in emits amounts i.e., energy of oscillatory is qualified. The energy of an atomic oscillation of frequency can have only certain values like $0, h\nu, 2h\nu, 4h\nu \ldots$

This is integral Multiple of small unit of energy $h\nu$ called the quantum photon. then $\boxed{\epsilon = nh\nu}$

n = any +ve integer

h = planck's constant.

Average energy of an oscillator :⇒

Let "N" belongs to total numbers of planks oscillator and ϵ_b there total energy then the average energy per plancks oscillator $\bar{\epsilon}$ is given by

$$\boxed{\bar{\epsilon} = \frac{\epsilon}{N}} \longrightarrow ①$$

let $N_0, N_1, N_2, \ldots N_n \ldots$ etc

oscillators having engaies

$0, \varepsilon, 2\varepsilon, 3\varepsilon \ldots n\varepsilon \ldots$ etc

$$N = N_0 + N_1 + N_2 + N_3 \ldots N_n \ldots \longrightarrow ②$$

$$\epsilon = N_0 x_0 + \epsilon N_1 + 2\epsilon N_2 + 3\epsilon N_3 \ldots n\epsilon N_n \longrightarrow ③$$

We know that According to Max wells distribution formulae. The numbes of oscillators having Energy $r\varepsilon$ is given by.

$$N_r = N_0 \, \varepsilon^{-r\varepsilon/KT} \;/\; N_r = N_0 \, \mathrm{Exp}\left(\frac{-r\varepsilon}{KT}\right) \longrightarrow (4)$$

K = Bolzman's constant

sub the values of N_1, N_2, N_3 —— from Eqn (4) in Eqn (2)

$$N = N_0 + N_0 \varepsilon^{-\varepsilon/KT} + N_0 \varepsilon^{-2\varepsilon/KT} + N_0 \varepsilon^{-2\varepsilon/KT} + N_0 \varepsilon^{-2\varepsilon/KT} \text{——} \; N_0 \varepsilon^{(-r\varepsilon/KT)}$$

$$N_0 \{ 1 + \varepsilon^{-\varepsilon/KT} + \varepsilon^{-2\varepsilon/KT} + \text{——} \; \varepsilon^{-r\varepsilon/KT} \quad \left(1 + x + x^2 + x^3 = \frac{1}{(1-x)}\right)$$

$$N = \frac{N_0}{1 - \varepsilon^{-\varepsilon/KT}} \longrightarrow (5)$$

sub (4) Eqn in (5) Eqn

$$E = N_0 \times 0 + \varepsilon N_0 \, \varepsilon^{-\varepsilon/kt} + 2\varepsilon N_0 \, \varepsilon^{-2\varepsilon/KT} +$$

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AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY(Q6)

B.Tech - R22 - I Year - II Semester

COMPUTER SCIENCE AND ENGINEERING

University Mid-1 Internal Marks Report-Date- 2023-08-28 19.03.52

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Note : '-1' Indicates Student is Absent for the exam.

Subject Code	Subject Name
182AB	APPLIED PHYSICS
182AR	ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
182AM	ENGLISH FOR SKILL ENHANCEMENT
182AG	ELECTRONIC DEVICES AND CIRCUITS

Signature Of Principal with Date & Office seal

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

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University Mid-2 Internal Marks Report-Date- 2023-08-28 21.27.38

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22Q61A05A5	5	5	5	5
22Q61A05A6	31	31	31	32
22Q61A05A7	35	34	32	32
22Q61A05A8	27	31	31	30
22Q61A05A9	31	33	32	33
22Q61A05B0	33	31	32	34
22Q61A05B2	30	28	31	31
22Q61A05B4	28	25	25	14
22Q61A05B5	23	23	23	30
22Q61A05B6	28	30	28	35
22Q61A05B7	20	14	14	28
22Q61A05B8	26	20	24	29
22Q61A05B9	24	26	25	30
22Q61A05C0	-1	-1	-1	-1
22Q61A05C2	35	34	34	34
22Q61A05C3	32	29	29	30
22Q61A05C4	28	28	30	30
22Q61A05C5	22	23	23	29
22Q61A05C6	21	21	21	26
22Q61A05C7	32	31	30	29

HTNO	182AB	182AG	182AM	182AR
22Q61A05C8	28	22	26	33
22Q61A05C9	30	32	30	32
22Q61A05D0	28	29	29	32
22Q61A05D1	33	28	29	32
22Q61A05D2	35	32	32	31
22Q61A05D3	35	35	35	32
22Q61A05D4	29	26	26	27
22Q61A05D5	29	31	31	33
22Q61A05D6	32	28	29	32
22Q61A05D7	35	35	35	32
22Q61A05D8	27	26	26	26
22Q61A05D9	33	34	34	32
22Q61A05E0	21	14	14	27
22Q61A05E1	34	31	32	33
22Q61A05E2	35	32	32	33
22Q61A05E3	34	33	33	32
22Q61A05E4	32	32	32	32
22Q61A05E5	29	28	29	26
22Q61A05E6	19	17	20	26
22Q61A05E7	32	31	31	32
22Q61A05E8	35	32	32	33
22Q61A05E9	14	14	14	14
22Q61A05F0	35	35	35	34
22Q61A05F1	35	35	35	33
22Q61A05F2	34	29	30	32
22Q61A05F3	33	34	34	33
22Q61A05F4	26	24	34	27
22Q61A05F5	29	25	25	33
22Q61A05F6	28	24	25	26
22Q61A05F7	34	32	25	27
22Q61A05F8	32	25	26	30
22Q61A05F9	25	20	21	27
22Q61A05G0	35	31	31	33
22Q61A05G1	33	33	34	33
22Q61A05G2	34	32	33	33
22Q61A05G3	5	5	5	5
22Q61A05G4	30	28	28	28
22Q61A05G5	32	27	28	29
22Q61A05G6	33	30	30	33
22Q61A05G7	32	24	25	29
22Q61A05G8	31	26	27	31
22Q61A05G9	32	25	26	31
22Q61A05H0	31	28	29	32
22Q61A05H1	31	28	29	29
22Q61A05H2	32	33	33	33

HTNO	182AB	182AG	182AM	182AR
22Q61A05H3	34	35	34	33
22Q61A05H4	32	30	31	33
22Q61A05H5	33	31	31	32
22Q61A05H6	5	5	5	5
22Q61A05H7	30	30	30	33
22Q61A05H9	34	34	34	29
22Q61A05I0	20	16	19	27
22Q61A05I1	29	27	28	27
22Q61A05I2	21	20	21	27
22Q61A05I3	32	34	33	32
22Q61A05I4	5	5	5	5
22Q61A05I5	22	20	21	27
22Q61A05I6	30	26	27	27
22Q61A05I7	34	27	28	26
22Q61A05I8	25	22	27	32
22Q61A05I9	26	24	27	26
22Q61A05J0	25	27	27	28
22Q61A05J1	31	32	32	32
22Q61A05J2	32	31	31	27

Note : '-1' Indicates Student is Absent for the exam.

Subject Code	Subject Name
182AB	APPLIED PHYSICS
182AR	ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
182AM	ENGLISH FOR SKILL ENHANCEMENT
182AG	ELECTRONIC DEVICES AND CIRCUITS

Signature Of Principal with Date & Office seal

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99637 77979

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EXTERNAL EXAM MARKS LIST

SUBJECT: APPLIED PHYSICS **SECTION CSE-B**

HALL TICKET NUMBER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
22Q61A0566	38	24	62
22Q61A0567	39	28	67
22Q61A0568	33	21	54
22Q61A0569	33	21	54
22Q61A0570	-	-	-
22Q61A0571	32	23	55
22Q61A0572	27	10	37
22Q61A0573	23	3	26
22Q61A0574	35	28	63
22Q61A0575	39	24	63
22Q61A0576	36	22	58
22Q61A0577	35	21	56
22Q61A0578	22	8	30
22Q61A0579	37	21	58
22Q61A0580	33	12	45
22Q61A0581	31	21	52
22Q61A0582	30	21	51
22Q61A0583	36	21	57
22Q61A0584	38	21	59
22Q61A0585	29	21	50
22Q61A0586	40	26	66
22Q61A0587	29	6	35
22Q61A0588	26	3	29
22Q61A0589	29	3	32
22Q61A0590	38	29	67
22Q61A0591	40	21	61
22Q61A0592	21	-1	20
22Q61A0593	36	8	44
22Q61A0594	38	21	59
22Q61A0595	35	21	56
22Q61A0596	38	22	60
22Q61A0597	31	29	60
22Q61A0598	30	21	51
22Q61A0599	31	4	35

22Q61A05A0	33	10	43
22Q61A05A1	28	21	49
22Q61A05A2	29	10	39
22Q61A05A3	-	-	-
22Q61A05A4	25	21	46
22Q61A05A5	15	15	30
22Q61A05A6	35	25	60
22Q61A05A7	37	32	69
22Q61A05A8	32	24	56
22Q61A05A9	37	33	70
22Q61A05B0	35	40	75
22Q61A05B1	-	-	-
22Q61A05B2	29	26	55
22Q61A05B3	-	-	-
22Q61A05B4	30	21	51
22Q61A05B5	25	22	47
22Q61A05B6	28	25	53
22Q61A05B7	26	-1	25
22Q61A05B8	29	21	50
22Q61A05B9	27	21	48
22Q61A05C0	-	-	-
22Q61A05C1	-	-	-
22Q61A05C2	40	31	71
22Q61A05C3	35	21	56
22Q61A05C4	30	10	40
22Q61A05C5	26	9	35
22Q61A05C6	25	12	37
22Q61A05C7	30	21	51
22Q61A05C8	29	24	53

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SUB: AP SEM: I-II Dept. of CSE

Course Outcomes

CO1	Define the basics of properties of matter and its applications.
CO2	Explore the basics of crystals, their structure and different crystal growth techniques.
CO3	Differentiate the concept of thermal properties of materials and their applications.
CO4	Demonstrate the concepts of lasers and advanced physics of quantum theory and its applications in tunneling microscopes.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			1	1					1	1	
CO2	3	2	2									2	1	
CO3	3	3	2	1									1	
CO4	3	3	2										1	
CO avg(M)	3	2.5	1.75	1		1	1					1.5	1	
PO / PSO Attainment Level*	2.92	2.43	1.7	0.97		0.97	0.97					1.46	0.97	

PO/PSO Attainment= COA x M/3

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Cir./Exam Section/0001

Date: 26-10-2022

Attention all the IV B. TECH I SEM students are here by informing you that MID-I examinations will be conducted from 01-11-2022 to 04-11-2022.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

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Cir./Exam Section/0002

Date: 05-11-2022

Attention all the III B. TECH I SEM students are here by informing you that MID-I examinations will be conducted from 11-11-2022 to 14-11-2022.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

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Cir./Exam Section/0003

Date: 24-12-2022

Attention all the I B. TECH I SEM students are here by informing you that MID-I examinations will be conducted from 29-12-2022 to 02-01-2023.

Time: FN: 10.00 AM TO 12.00 AM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH	BS&H
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Cir./Exam Section/0004

Date: 28-12-2022

Attention all the IV B. TECH I SEM students are here by informing you that MID-II examinations will be conducted from 04-01-2023 to 06-01-2023.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH
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Cir./Exam Section/0005

Date: 12-01-2023

Attention all the III B. TECH I SEM students are here by informing you that MID-II examinations will be conducted from 19-01-2023 to 21-01-2023.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH
Signature				T. Rth	

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Cir./Exam Section/0006 Date: 18-01-2023

Attention all the II B. TECH I SEM students are here by informing you that MID-I examinations will be conducted from 23-01-2023 to 25-01-2022.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

HOD	**CSE**	**CSM & CSD**	**ECE**	**EEE**	**MECH**
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Cir./Exam Section/0007 Date: 25-02-2023

Attention all the I B. TECH I SEM students are here by informing you that MID-II examinations will be conducted from 03-03-2023 to 09-03-2023.

Time: FN: 10.00 AM TO 12.00 AM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH	BS&H
Signature		SV		T. Kr		

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Cir./Exam Section/0008

Date: 26-04-2023

Attention all the II B. TECH I SEM students are here by informing you that MID-II examinations will be conducted from 02-05-2023 to 07-05-2023.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH
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Cir./Exam Section/0009 Date: 28-04-2023

Attention all the III, IV B. TECH II SEM students are here by informing you that MID-I examinations will be conducted from 08-05-2023 to 15-05-2023.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH
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Cir./Exam Section/0010

Date: 15-06-2023

Attention all the I B. TECH II SEM students are here by informing you that MID-I examinations will be conducted from 19-06-2023 to 23-06-2023.

Time: FN: 10.00 AM TO 12.00 AM

Note: HOD's are requested to circulate among all concern students.

HOD	**CSE**	**CSM & CSD**	**ECE**	**EEE**	**MECH**	**BS&H**
Signature				T.Kutt		

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Cir./Exam Section/0011 Date: 15-06-2023

Attention all the IV B. TECH II SEM students are here by informing you that MID-II examinations will be conducted from 19-06-2023 to 21-06-2023.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH
Signature				T. Kanth	

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Cir./Exam Section/0012

Date: 16-06-2023

Attention all the III B. TECH II SEM students are here by informing you that MID-II examinations will be conducted from 23-06-2023 to 28-06-2023.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH
Signature				T. K	

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Cir./Exam Section/0013 Date: 06-07-2023

Attention all the II B. TECH II SEM students are here by informing you that MID-I examinations will be conducted from 10-07-2023 to 12-07-2023.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH
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Cir./Exam Section/0014 Date: 16-08-2023

Attention all the I B. TECH II SEM students are here by informing you that MID-II examinations will be conducted from 21-08-2023 to 24-08-2023.

Time: FN: 10.00 AM TO 12.00 AM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH	BS&H
Signature				T. Kutt		

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AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Approved by AICTE, Recg. By Govt. of T.S & Affiliated to JNTUH, Hyderabad)
NAAC "B++" Accredited Institute
Gunthapally (V), Abdullapurmet(M), RR Dist, Near Ramoji Film City, Hyderabad -501512.
www.aietg.ac.in email: principal.avanthi@gmail.com

Cir./Exam Section/0015 Date: 06-09-2023

Attention all the II B. TECH II SEM students are here by informing you that MID-II examinations will be conducted from 12-09-2023 to 14-09-2023.

Time: FN: 09.40 AM TO 11.00 AM

AN: 01.40 PM TO 03.00 PM

Note: HOD's are requested to circulate among all concern students.

HOD	CSE	CSM & CSD	ECE	EEE	MECH
Signature				T. Ku	

OIE

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY - HYDERABAD – 5000 85

EXAMINATION BRANCH

IV YEAR B.TECH – I SEMESTER– R18 REGULATION I - MID TERM EXAMINATIONS NOVEMBER-2022-(IN OFFLINE MODE)

TIMETABLE

TIME→ FN: 11.40 AM TO 1.00 PM (DESCRIPTIVE EXAM: 11.40 AM TO 12.40 PM, OBJECTIVE EXAM:12.40 PM TO 1.00 PM)
AN: 3.40 PM TO 5.00 PM (DESCRIPTIVE EXAM: 3.40 PM TO 04. 40 PM, OBJECTIVE EXAM: 4.40 PM TO 05.00 PM)

BRANCH	01-11-2022 FN TUESDAY	01-11-2022 AN TUESDAY	02-11-2022 FN WEDNESDAY	02-11-2022 AN WEDNESDAY	04-11-2022 FN FRIDAY
			E3	E4	OE2
ELECTRICAL AND ELECTRONICS ENGINEERING (02-EEE)	Fundamentals of Management for Engineers	---			Data Structures
					Artificial Intelligence
			Digital Control systems	HVDC Transmission	Remote Sensing & GIS
			Digital Signal Processing	Power System Reliability	Python Programming
					Java Programming
			Electrical and Hybrid Vehicles	Industrial Electrical Systems	Fundamentals of Biomedical Applications
					Electronic Sensors
					Basic Mechanical Engineering
					Basics of Aeronautical Engineering
					Intellectual Property Rights
					Principles of Entrepreneurship
					Natural Gas Engineering
					Engineering Materials
					Surface Engineering
					Health & Safety in Mines
					Material Handling in Mines

Date: 19-10-2022

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EXAMINATION BRANCH

IV YEAR B.TECH – I SEMESTER– R18 REGULATION I - MID TERM EXAMINATIONS NOVEMBER-2022-(IN OFFLINE MODE)

TIMETABLE

TIME→ FN: 11.40 AM TO 1.00 PM (DESCRIPTIVE EXAM: 11.40 AM TO 12.40 PM, OBJECTIVE EXAM:12.40 PM TO 1.00 PM)
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BRANCH	01-11-2022 FN TUESDAY	01-11-2022 AN TUESDAY	02-11-2022 FN WEDNESDAY	02-11-2022 AN WEDNESDAY	04-11-2022 FN FRIDAY
MECHANICAL ENGINEERING (03-ME)	Refrigeration & Air Conditioning	E2	E3	E4	OE2
		Additive Manufacturing	Power Plant Engineering	Computational Fluid Dynamics	Remote Sensing & GIS
					Data Structures
		Automation in Manufacturing	Automobile Engineering	Turbo Machinery	Artificial Intelligence
					Python Programming
		MEMS	Renewable Energy Sources	Fluid Power Systems	Java Programming
					Fundamentals of Biomedical Applications
					Electronic Sensors
					Utilization of Electrical Energy
					Electric Drives and Control
					Basics of Aeronautical Engineering
					Intellectual Property Rights
					Principles of Entrepreneurship
					Engineering Materials
					Surface Engineering
					Natural Gas Engineering
					Health & Safety in Mines
					Material Handling in Mines

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Date: 19-10-2022 **CONTROLLER OF EXAMINATIONS**

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EXAMINATION BRANCH

IV YEAR B.TECH – I SEMESTER– R18 REGULATION I - MID TERM EXAMINATIONS NOVEMBER-2022-(IN OFFLINE MODE)

TIMETABLE

TIME→ FN: 11.40 AM TO 1.00 PM (DESCRIPTIVE EXAM: 11.40 AM TO 12.40 PM, OBJECTIVE EXAM 12.40 PM TO 1.00 PM)
AN: 3.40 PM TO 5.00 PM (DESCRIPTIVE EXAM: 3.40 PM TO 04. 40 PM, OBJECTIVE EXAM: 4.40 PM TO 05.00 PM)

BRANCH	01-11-2022 FN TUESDAY	01-11-2022 AN TUESDAY	02-11-2022 FN WEDNESDAY	02-11-2022 AN WEDNESDAY	04-11-2022 FN FRIDAY
ELECTRONICS AND COMMUNICATION ENGINEERING (04-ECE)	Microwave and Optical Communications	Professional Practice law & Ethics	E3	E4	**OE2**
					Data Structures
			Artificial Neural Networks	Biomedical Instrumentation	Artificial Intelligence
					Remote Sensing & GIS
					Python Programming
			Scripting Languages	Database Management Systems	Java Programming
			Digital Image Processing		Fundamentals of Biomedical Applications
					Utilization of Electrical Energy
				Network Security and Cryptography	Electric Drives and Control
					Basic Mechanical Engineering
					Basics of Aeronautical Engineering
					Intellectual Property Rights
					Principles of Entrepreneurship
					Basic Mechanical Engineering
					Natural Gas Engineering
					Engineering Materials
					Surface Engineering
					Health & Safety in Mines
					Material Handling in Mines

Date: 19-10-2022

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EXAMINATION BRANCH

IV YEAR B.TECH – I SEMESTER– R18 REGULATION I - MID TERM EXAMINATIONS NOVEMBER-2022-(IN OFFLINE MODE)

TIMETABLE

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BRANCH	01-11-2022 FN TUESDAY	01-11-2022 AN TUESDAY	02-11-2022 FN WEDNESDAY	02-11-2022 AN WEDNESDAY	04-11-2022 FN FRIDAY
COMPUTER SCIENCE AND ENGINEERING (05-CSE)	Cryptography & Network Security	Data Mining	E4	E5	OE2
			Graph Theory	Advanced Algorithms	Remote Sensing & GIS
					Fundamentals of Biomedical Applications
					Electronic Sensors
					Utilization of Electrical Energy
			Introduction to Embedded Systems	Real Time Systems	Electric Drives and Control
					Basic Mechanical Engineering
					Basics of Aeronautical Engineering
				Soft Computing	Intellectual Property Rights
					Principles of Entrepreneurship
			Artificial Intelligence		Natural Gas Engineering
					Engineering Materials
			Cloud Computing	Internet of Things	Surface Engineering
					Health & Safety in Mines
					Material Handling in Mines
			Ad-hoc & Sensor Networks	Software Process & Project Management	

Date: 19-10-2022

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EXAMINATION BRANCH

III YEAR B.TECH –I SEMESTER – R18 REGULATION I - MID TERM EXAMINATIONS NOVEMBER-2022-(IN OFFLINE MODE)

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION AND DAY					
	11-11-2022 FN FRIDAY	11-11-2022 AN FRIDAY	12-11-2022 FN SATURDAY	12-11-2022 AN SATURDAY	14-11-2022 FN MONDAY	14-11-2022 AN MONDAY
CIVIL ENGINEERING (01-C E)	Structural Analysis-II	Geotechnical Engineering	Structural Engineering-I	Transportation Engineering	Concrete Technology Theory of Elasticity Rock Mechanics	Engineering Economics and Accountancy Machinery
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Power Electronics	Power System-II	Measurements and Instrumentation	Business Economics and Financial Analysis	Computer Architecture High Voltage Engineering Electrical Machine Design	---
MECHANICAL ENGINEERING (03- ME)	Dynamics of Machinery	Design of Machine Members-I	Metrology & Machine Tools	Business Economics & Financial Analysis	Thermal Engineering-II	Operations Research

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EXAMINATION BRANCH

III YEAR B.TECH –I SEMESTER – R18 REGULATION I MID TERM EXAMINATIONS NOVEMBER-2022-(IN OFFLINE MODE)

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
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BRANCH	DATE, SESSION AND DAY					
	11-11-2022 FN FRIDAY	11-11-2022 AN FRIDAY	12-11-2022 FN SATURDAY	12-11-2022 AN SATURDAY	14-11-2022 FN MONDAY	14-11-2022 AN MONDAY
ELECTRONICS & COMMUNICATIONS ENGINEERING (04- ECE)	Microprocessor & Microcontrollers	Data Communications and Networks	Control Systems	Business Economics & Financial Analysis	Error Correcting Codes Electronic Measurements and Instrumentation Computer Organization & Operating Systems	-----
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Formal Languages & Automata Theory	Software Engineering	Computer Networks	Web Technologies	Information Theory & Coding Advanced Computer Architecture Common to (CSE, IT) Data Analytics Common to (CSE, IT) Image Processing Common to (CSE, IT) Principles of Programming Languages Common to (CSE, IT)	Computer Graphics Common to (CSE, IT) Advanced Operating Systems Common to (CSE, IT) Informational Retrieval Systems Distributed Databases Natural Language Processing
ELECTRONICS AND INSTRUMSNTTATION ENGINEERING (10-EIE)	Microprocessor & Microcontrollers	Process Dynamics and Control	Control Systems	Business Economics & Financial Analysis	Instrumentation Practices in Industries Operating Systems Robotics and Automation	---

DATE: 07-11-2022

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EXAMINATION BRANCH

III YEAR B.TECH –I SEMESTER – R18 REGULATION I MID TERM EXAMINATIONS NOVEMBER-2022 -(IN OFFLINE MODE)

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BRANCH	DATE, SESSION AND DAY					
	11-11-2022 FN FRIDAY	11-11-2022 AN FRIDAY	12-11-2022 FN SATURDAY	12-11-2022 AN SATURDAY	14-11-2022 FN MONDAY	14-11-2022 AN MONDAY
COMPUTER SCIENCE AND ENGINEERING) (CYBER SECURITY) (62-CSE(CS)	Design and Analysis of Algorithms	Database Management Systems	Cryptography and Network Security	Formal Languages and Automata Theory	Compiler Design	Ethical Hacking
					Artificial Intelligence	Data Science
					Data warehousing and Data Mining	Distributed Systems
					Ad-hoc & Sensor Networks	Cyber Laws
					Cloud computing	IOT Security
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML)	Design and Analysis of Algorithms	Machine Learning	Computer Networks	Compiler Design	Graph Theory	Software Testing Methodoiogies
					Introduction to Data Science	Information Retrieval Systems
					Web Programming	Pattern Recognition
					Image Processing	Computer Vision and Robotics
					Computer Graphics	Data Warehousing and Business Intelligence

DATE: 07-11-2022

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EXAMINATION BRANCH

III YEAR B.TECH –I SEMESTER – R18 REGULATION I MID TERM EXAMINATIONS NOVEMBER-2022 -(IN OFFLINE MODE)

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BRANCH	DATE, SESSION AND DAY					
	11-11-2022 FN FRIDAY	11-11-2022 AN FRIDAY	12-11-2022 FN SATURDAY	12-11-2022 AN SATURDAY	14-11-2022 FN MONDAY	14-11-2022 AN MONDAY
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS))	Design and Analysis of Algorithms	Introduction to Data Science	Computer Networks	Data Mining	Data Warehousing and Business Intelligence	Spatial and Multimedia Databases
					Artificial Intelligence	Information Retrieval Systems
					Web Programming	Software Project Management
					Image Processing	DevOps
					Computer Graphics	Computer Vision and Robotics
COMPUTER SCIENCE AND ENGINEERING (IOT) (69-CSE(IOT))	Microprocessors & Microcontrollers	Database Management Systems	Computer Networks	Finite Automata and Compiler Design	Architecting Smart IoT Devices	Machine Learning
					Data Analytics for IoT	Real Time Systems
					IoT System Architectures	Embedded Hardware Design
					Operating Systems for IoT	Energy Sources and Power Management
					Design and Analysis of Algorithms	Software Engineering

DATE: 07-11-2022

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I YEAR B.TECH I SEMESTER – R22 REGULATIONS I - MID TERM EXAMINATIONS DECEMBER-2022 /JANUARY-2023

REVISED T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY			
	29-12-2022 THURSDAY	30-12-2022 FRIDAY	31-12-2022 SATURDAY	02-01-2023 MONDAY
CIVIL ENGINEERING (01-C E)	Matrices and Calculus	Applied Physics	C Programming and Data Structures	English for Skill Enhancement
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Matrices and Calculus	Engineering Chemistry	C Programming and Data Structures	Electrical Circuit Analysis – I
MECHANICAL ENGINEERING (03-ME)	Matrices and Calculus	Applied Physics	C Programming and Data Structures	English for Skill Enhancement
ELECTRONICS & COMMUNICATIONS ENGINEERING (04- ECE)	Matrices and Calculus	Applied Physics	C Programming for Engineers	English for Skill Enhancement

DATE: 23-12-2022

Sd/-

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E X A M I N A T I O N   B R A N C H ECM

I YEAR B.TECH I SEMESTER – R22 REGULATIONS I - MID TERM EXAMINATIONS DECEMBER-2022 /JANUARY-2023

REVISED T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY			
	29-12-2022 THURSDAY	30-12-2022 FRIDAY	31-12-2022 SATURDAY	02-01-2023 MONDAY
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Matrices and Calculus.	Engineering Chemistry	Programming for Problem Solving	Basic Electrical Engineering
ELECTRONICS AND INSTRUMENTATION ENGINEERING (10-EIE)	Matrices and Calculus	Applied Physics	C Programming for Engineers	English for Skill Enhancement
INFORMATION TECHNOLOGY (12- IT)	Matrices and Calculus	Engineering Chemistry	Programming for Problem Solving	Basic Electrical Engineering

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DATE: 23-12-2022

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E X A M I N A T I O N   B R A N C H ECM

I YEAR B.TECH I SEMESTER – R22 REGULATIONS I - MID TERM EXAMINATIONS DECEMBER-2022 /JANUARY-2023

REVISED T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY			
	29-12-2022 THURSDAY	**30-12-2022 FRIDAY**	**31-12-2022 SATURDAY**	**02-01-2023 MONDAY**
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML))	Matrices and Calculus	Applied Physics	Programming for Problem Solving	English for Skill Enhancement
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS))	Matrices and Calculus	Engineering Chemistry	Programming for Problem Solving	Basic Electrical Engineering
COMPUTER SCIENCE AND ENGINEERING (IOT) (69-CSE(IOT))	Matrices and Calculus	Applied Physics	Programming for Problem Solving	English for Skill Enhancement
COMPUTER SCIENCE AND ENGINEERING (NETWORKS) (70-CSE(NETWORKS)	Matrices and Calculus	Engineering Chemistry	Programming for Problem Solving	Basic Electrical Engineering
TEXTILE ENGINEERING (71-TTE)	Matrices and Calculus	Applied Physics	C Programming and Data Structures	English for Skill Enhancement

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DATE: 23-12-2022

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E X A M I N A T I O N B R A N C H

II YEAR B.TECH I SEMESTER R18 REGULATION I -MID TERM EXAMINATIONS JANUARY-2023

TI M E T A B L E

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION AND DAY					
	23-01-2023 FN MONDAY	23-01-2023 AN MONDAY	24-01-2023 FN TUESDAY	24-01-2023 AN TUESDAY	25-01-2023 FN WEDNESDAY	25-01-2023 AN WEDNESDAY
CIVIL ENGINEERING (01-C E)	Surveying and Geomatics	Engineering Geology	Strength of Materials - I	Probability and Statistics	Fluid Mechanics	--
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Engineering Mechanics	Electrical Circuit Analysis	Analog Electronics	Electrical Machines - I	Electromagnetic Fields	--
MECHANICAL ENGINEERING (03- ME)	Probability and Statistics & Complex	Mechanics of Solids	Material Science and Metallurgy	Production Technology	Thermodynamics	---

DATE: 17-01-2023

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EXAMINATION BRANCH

II YEAR B.TECH I SEMESTER R18 REGULATION I -MID TERM EXAMINATIONS JANUARY-2023

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION AND DAY					
	23-01-2023 FN MONDAY	**23-01-2023 AN MONDAY**	**24-01-2023 FN TUESDAY**	**24-01-2023 AN TUESDAY**	25-01-2023 FN WEDNESDAY	25-01-2023 AN WEDNESDAY
ELECTRONICS & COMMUNICATIONS ENGINEERING (04- ECE)	Probability Theory and Stochastic Processes	Network Analysis and Transmission Lines	Digital System Design	Signals and Systems	Electronic Devices and Circuits	--
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Analog and Digital Electronics	Data Structures	Computer Oriented Statistical Methods	Object Oriented Programming using C++	Computer Organization and Architecture	--
ELECTRONICS AND INSTRUMSNTTATION ENGINEERING (10EIE)	Electronic Measurements	Network Theory	Transducers Engineering	Signals and Systems	Electronic Devices and Circuits	--

DATE: 17-01-2023

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EXAMINATION BRANCH

II YEAR B.TECH I SEMESTER R18 REGULATION I -MID TERM EXAMINATIONS JANUARY-2023

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
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BRANCH	DATE, SESSION DAY					
	23-01-2023 FN MONDAY	23-01-2023 AN MONDAY	24-01-2023 FN TUESDAY	24-01-2023 AN TUESDAY	25-01-2023 FN WEDNESDAY	25-01-2023 AN WEDNESDAY
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML)	Discrete Mathematics	Data Structures	Mathematical and Statistical Foundations	Python Programming	Computer Organization and Architecture	Business Economics & Financial Analysis
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS)	Discrete Mathematics	Data Structures	Mathematical and Statistical Foundations	Python Programming	Computer Organization and Architecture	Business Economics & Financial Analysis
COMPUTER SCIENCE AND ENGINEERING (IOT) (69-CSE(IOT)	Analog and Digital Electronics	Data Structures	Computer Oriented Statistical Methods	Python Programming	Discrete Mathematics	--
COMPUTER SCIENCE AND ENGINEERING (NETWORKS) (70-CSE(NETWORKS)	Analog and Digital Electronics	Data Structures	Computer Oriented Statistical Methods	Python Programming	Computer Organization and Architecture	----

17-01-2023

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EXAMINATION BRANCH

IV YEAR B.TECH – I SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JANUARY-2023

TIMETABLE

TIME→ FN: 11.40 AM TO 1.00 PM (DESCRIPTIVE EXAM: 11.40 AM TO 12.40 PM, OBJECTIVE EXAM:12.40 PM TO 1.00 PM)
AN: 3.40 PM TO 5.00 PM (DESCRIPTIVE EXAM: 3.40 PM TO 04. 40 PM, OBJECTIVE EXAM: 4.40 PM TO 05.00 PM)

BRANCH	04-01-2023 FN WEDNESDAY	04-01-2023 AN WEDNESDAY	05-01-2023 FN THURSDAY	05-01-2023 AN THURSDAY	06-01-2023 FN FRIDAY
			E3	E4	OE2
ELECTRICAL AND ELECTRONICS ENGINEERING (02-EEE)	Fundamentals of Management for Engineers	---	Digital Control systems	HVDC Transmission	Data Structures
			Digital Signal Processing	Power System Reliability	Artificial Intelligence
			Electrical and Hybrid Vehicles	Industrial Electrical Systems	Remote Sensing & GIS
					Python Programming
					Java Programming
					Fundamentals of Biomedical Applications
					Electronic Sensors
					Basic Mechanical Engineering
					Basics of Aeronautical Engineering
					Intellectual Property Rights
					Principles of Entrepreneurship
					Natural Gas Engineering
					Engineering Materials
					Surface Engineering
					Health & Safety in Mines
					Material Handling in Mines

Date: 24-12-2022

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY - HYDERABAD – 5000 85

EXAMINATION BRANCH

IV YEAR B.TECH – I SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JANUARY-2023

TIMETABLE

TIME→ FN: 11.40 AM TO 1.00 PM (DESCRIPTIVE EXAM: 11.40 AM TO 12.40 PM, OBJECTIVE EXAM:12.40 PM TO 1.00 PM)
AN: 3.40 PM TO 5.00 PM (DESCRIPTIVE EXAM: 3.40 PM TO 04. 40 PM, OBJECTIVE EXAM: 4.40 PM TO 05.00 PM)

BRANCH	04-01-2023 FN WEDNESDAY	04-01-2023 AN WEDNESDAY	05-01-2023 FN THURSDAY	05-01-2023 AN THURSDAY	06-01-2023 FN FRIDAY
MECHANICAL ENGINEERING (03-ME)	Refrigeration & Air Conditioning	E2	E3	E4	OE2
		Additive Manufacturing	Power Plant Engineering	Computational Fluid Dynamics	Remote Sensing & GIS
					Data Structures
		Automation in Manufacturing	Automobile Engineering	Turbo Machinery	Artificial Intelligence
					Python Programming
		MEMS	Renewable Energy Sources	Fluid Power Systems	Java Programming
					Fundamentals of Biomedical Applications
					Electronic Sensors
					Utilization of Electrical Energy
					Electric Drives and Control
					Basics of Aeronautical Engineering
					Intellectual Property Rights
					Principles of Entrepreneurship
					Engineering Materials
					Surface Engineering
					Natural Gas Engineering
					Health & Safety in Mines
					Material Handling in Mines

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Date: 24-12-2022

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CONTROLLER OF EXAMINATIONS

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY - HYDERABAD – 5000 85

EXAMINATION BRANCH

IV YEAR B.TECH – I SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JANUARY-2023

TIMETABLE

TIME→ FN: 11.40 AM TO 1.00 PM (DESCRIPTIVE EXAM: 11.40 AM TO 12.40 PM, OBJECTIVE EXAM:12.40 PM TO 1.00 PM)
AN: 3.40 PM TO 5.00 PM (DESCRIPTIVE EXAM: 3.40 PM TO 04. 40 PM, OBJECTIVE EXAM: 4.40 PM TO 05.00 PM)

BRANCH	04-01-2023 FN WEDNESDAY	04-01-2023 AN WEDNESDAY	05-01-2023 FN THURSDAY	05-01-2023 AN THURSDAY	06-01-2023 FN FRIDAY
ELECTRONICS AND COMMUNICATION ENGINEERING (04-ECE)	Microwave and Optical Communications	Professional Practice law & Ethics	E3	E4	**OE2**
					Data Structures
			Artificial Neural Networks	Biomedical Instrumentation	Artificial Intelligence
					Remote Sensing & GIS
					Python Programming
			Scripting Languages	Database Management Systems	Java Programming
			Digital Image Processing		Fundamentals of Biomedical Applications
					Utilization of Electrical Energy
				Network Security and Cryptography	Electric Drives and Control
					Basic Mechanical Engineering
					Basics of Aeronautical Engineering
					Intellectual Property Rights
					Principles of Entrepreneurship
					Basic Mechanical Engineering
					Natural Gas Engineering
					Engineering Materials
					Surface Engineering
					Health & Safety in Mines
					Material Handling in Mines

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Date: 24-11-2022

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EXAMINATION BRANCH

IV YEAR B.TECH – I SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JANUARY-2023

TIMETABLE

TIME→ FN: 11.40 AM TO 1.00 PM (DESCRIPTIVE EXAM: 11.40 AM TO 12.40 PM, OBJECTIVE EXAM:12.40 PM TO 1.00 PM)
AN: 3.40 PM TO 5.00 PM (DESCRIPTIVE EXAM: 3.40 PM TO 04. 40 PM, OBJECTIVE EXAM: 4.40 PM TO 05.00 PM)

BRANCH	04-01-2023 FN WEDNESDAY	04-01-2023 AN WEDNESDAY	05-01-2023 FN THURSDAY	05-01-2023 AN THURSDAY	06-01-2023 FN FRIDAY
COMPUTER SCIENCE AND ENGINEERING (05-CSE)	Cryptography & Network Security	Data Mining	E4	E5	OE2
			Graph Theory	Advanced Algorithms	Remote Sensing & GIS
					Fundamentals of Biomedical Applications
					Electronic Sensors
					Utilization of Electrical Energy
			Introduction to Embedded Systems	Real Time Systems	Electric Drives and Control
					Basic Mechanical Engineering
					Basics of Aeronautical Engineering
				Soft Computing	Intellectual Property Rights
					Principles of Entrepreneurship
			Artificial Intelligence		Natural Gas Engineering
					Engineering Materials
			Cloud Computing	Internet of Things	Surface Engineering
					Health & Safety in Mines
					Material Handling in Mines
			Ad-hoc & Sensor Networks	Software Process & Project Management	

Date: 24-12-2022

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY - HYDERABAD – 500085

EXAMINATION BRANCH

III YEAR B.TECH –I SEMESTER – R18 REGULATION II - MID TERM EXAMINATIONS JANUARY-2023

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION AND DAY					
	19-01-2023 FN THURSDAY	19-01-2023 AN THURSDAY	20-01-2023 FN FRIDAY	20-01-2023 AN FRIDAY	21-01-2023 FN SATURDAY	21-01-2023 AN SATURDAY
CIVIL ENGINEERING (01-C E)	Structural Analysis-II	Geotechnical Engineering	Structural Engineering-I	Transportation Engineering	Concrete Technology Theory of Elasticity Rock Mechanics	Engineering Economics and Accountancy Machinery
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Power Electronics	Power System-II	Measurements and Instrumentation	Business Economics and Financial Analysis	Computer Architecture High Voltage Engineering Electrical Machine Design	---
MECHANICAL ENGINEERING (03- ME)	Dynamics of Machinery	Design of Machine Members-I	Metrology & Machine Tools	Business Economics & Financial Analysis	Thermal Engineering-II	Operations Research

DATE: 09-01-2023

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EXAMINATION BRANCH

III YEAR B.TECH –I SEMESTER – R18 REGULATION II MID TERM EXAMINATIONS JANUARY-2023

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION AND DAY					
	19-01-2023 FN THURSDAY	19-01-2023 AN THURSDAY	20-01-2023 FN FRIDAY	20-01-2023 AN FRIDAY	21-01-2023 FN SATURDAY	21-01-2023 AN SATURDAY
ELECTRONICS & COMMUNICATIONS ENGINEERING (04- ECE)	Microprocessor & Microcontrollers	Data Communications and Networks	Control Systems	Business Economics & Financial Analysis	Error Correcting Codes Electronic Measurements and Instrumentation Computer Organization & Operating Systems	-----
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Formal Languages & Automata Theory	Software Engineering	Computer Networks	Web Technologies	Information Theory & Coding Advanced Computer Architecture Common to (CSE, IT) Data Analytics Common to (CSE, IT) Image Processing Common to (CSE, IT) Principles of Programming Languages Common to (CSE, IT)	Computer Graphics Common to (CSE, IT) Advanced Operating Systems Common to (CSE, IT) Informational Retrieval Systems Distributed Databases Natural Language Processing
ELECTRONICS AND INSTRUMSNTTATION ENGINEERING (10-EIE)	Microprocessor & Microcontrollers	Process Dynamics and Control	Control Systems	Business Economics & Financial Analysis	Instrumentation Practices in Industries Operating Systems Robotics and Automation	---

PRINCIPAL
Avanthi Institute of Engg. & Tech
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DATE: 09-01-2023

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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E X A M I N A T I O N B R A N C H

III YEAR B.TECH –I SEMESTER – R18 REGULATION II MID TERM EXAMINATIONS JANUARY-2023

TI M E T A B L E

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION AND DAY					
	19-01-2023 FN THURSDAY	19-01-2023 AN THURSDAY	20-01-2023 FN FRIDAY	20-01-2023 AN FRIDAY	21-01-2023 FN SATURDAY	21-01-2023 AN SATURDAY
COMPUTER SCIENCE AND ENGINEERING) (CYBER SECURITY) (62-CSE(CS)	Design and Analysis of Algorithms	Database Management Systems	Cryptography and Network Security	Formal Languages and Automata Theory	Compiler Design	Ethical Hacking
					Artificial Intelligence	Data Science
					Data warehousing and Data Mining	Distributed Systems
					Ad-hoc & Sensor Networks	Cyber Laws
					Cloud computing	IOT Security
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML)	Design and Analysis of Algorithms	Machine Learning	Computer Networks	Compiler Design	Graph Theory	Software Testing Methodologies
					Introduction to Data Science	Information Retrieval Systems
					Web Programming	Pattern Recognition
					Image Processing	Computer Vision and Robotics
					Computer Graphics	Data Warehousing and Business Intelligence

DATE: 09-01-2023

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E X A M I N A T I O N B R A N C H

III YEAR B.TECH –I SEMESTER – R18 REGULATION II MID TERM EXAMINATIONS JANUARY-2023

T I M E T A B L E

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
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BRANCH	DATE, SESSION AND DAY					
	19-01-2023 FN THURSDAY	19-01-2023 AN THURSDAY	20-01-2023 FN FRIDAY	20-01-2023 AN FRIDAY	21-01-2023 FN SATURDAY	21-01-2023 AN SATURDAY
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS)	Design and Analysis of Algorithms	Introduction to Data Science	Computer Networks	Data Mining	Data Warehousing and Business Intelligence	Spatial and Multimedia Databases
					Artificial Intelligence	Information Retrieval Systems
					Web Programming	Software Project Management
					Image Processing	DevOps
					Computer Graphics	Computer Vision and Robotics
COMPUTER SCIENCE AND ENGINEERING (IOT) (69-CSE(IOT)	Microprocessors & Microcontrollers	Database Management Systems	Computer Networks	Finite Automata and Compiler Design	Architecting Smart IoT Devices	Machine Learning
					Data Analytics for IoT	Real Time Systems
					IoT System Architectures	Embedded Hardware Design
					Operating Systems for IoT	Energy Sources and Power Management
					Design and Analysis of Algorithms	Software Engineering

DATE: 09-01-2023

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500085

E X A M I N A T I O N B R A N C H ECM

I YEAR B.TECH I SEMESTER – R22 REGULATIONS II - MID TERM EXAMINATIONS MARCH-2023

T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY				
	03-03-2023 FRIDAY	**04-03-2023 SATURDAY**	**06-03-2023 MONDAY**	**08-03-2023 WEDNESDAY**	**09-03-2023 THURSDAY**
CIVIL ENGINEERING (01-C E)	Matrices and Calculus	Applied Physics	C Programming and Data Structures	English for Skill Enhancement	--
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Matrices and Calculus	Engineering Chemistry	C Programming and Data Structures	Electrical Circuit Analysis – I	--
MECHANICAL ENGINEERING (03-ME)	Matrices and Calculus	Applied Physics	C Programming and Data Structures	English for Skill Enhancement	--
ELECTRONICS & COMMUNICATION S ENGINEERING (04- ECE)	Matrices and Calculus	Applied Physics	C Programming for Engineers	English for Skill Enhancement	---

DATE: **21-02-2023**

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

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CONTROLLER OF EXAMINATIONS

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500085

E X A M I N A T I O N B R A N C H ECM

I YEAR B.TECH I SEMESTER – R22 REGULATIONS II - MID TERM EXAMINATIONS MARCH-2023

T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY				
	03-03-2023 FRIDAY	04-03-2023 SATURDAY	06-03-2023 MONDAY	08-03-2023 WEDNESDAY	09-03-2023 THURSDAY
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Matrices and Calculus.	Engineering Chemistry	Programming for Problem Solving	Basic Electrical Engineering	--
ELECTRONICS AND INSTRUMENTATION ENGINEERING (10-EIE)	Matrices and Calculus	Applied Physics	C Programming for Engineers	English for Skill Enhancement	--
INFORMATION TECHNOLOGY (12- IT)	Matrices and Calculus	Engineering Chemistry	Programming for Problem Solving	Basic Electrical Engineering	--

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

DATE: **21-02-2023**

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500085

E X A M I N A T I O N B R A N C H ECM

I YEAR B.TECH I SEMESTER – R22 REGULATIONS II - MID TERM EXAMINATIONS MARCH-2023

T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY				
	03-03-2023 FRIDAY	04-03-2023 SATURDAY	06-03-2023 MONDAY	08-03-2023 WEDNESDAY	09-03-2023 THURSDAY
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML))	Matrices and Calculus	Applied Physics	Programming for Problem Solving	English for Skill Enhancement	--
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS))	Matrices and Calculus	Engineering Chemistry	Programming for Problem Solving	Basic Electrical Engineering	--
COMPUTER SCIENCE AND ENGINEERING (IOT) (69-CSE(IOT))	Matrices and Calculus	Applied Physics	Programming for Problem Solving	English for Skill Enhancement	--
COMPUTER SCIENCE AND ENGINEERING (NETWORKS) (70-CSE(NETWORKS)	Matrices and Calculus	Engineering Chemistry	Programming for Problem Solving	Basic Electrical Engineering	--
TEXTILE ENGINEERING (71-TTE)	Matrices and Calculus	Applied Physics	C Programming and Data Structures	English for Skill Enhancement	--

DATE: **21-02-2023**

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Sd/-
CONTROLLER OF EXAMINATIONS

Web : www.jntuh.ac.in
E Mail : dejntuh@jntuh.ac.in
Phone : Off: +91–40–23156113
Fax : +91–40–23158668

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by JNTU Act No. 30 of 2008)
Kukatpally, Hyderabad – 500 085 Telangana (India)
ACCREDITED BY NAAC WITH 'A' GRADE

Dr. K. VENKATESWARA RAO
M.Sc.,M.Tech.,PhD.,PDF(USA).
Professor of Nano Technology &
DIRECTOR OF EVALUATION

Letter No EB /OLE/1197 **Date: 28-04-2023**

To
The Principals,
Constituent and Affiliated colleges offering B.Tech. Courses, JNTUH

Dear Sir/Madam,

Sub: JNTUH - Exam Branch – Conducting of B.Tech. II year I sem second midterms exams and external Lab examinations, and for the B.Tech IV year II and III year II sem first midterm exams May-2023 University Exams -Intimation-Reg.

Ref: Note file orders of the Vice-Chancellor dated 28.03.2023

The Principals are informed to note that the dates for lab external examinations and second mid term exams of B.Tech II year I sem, B.Tech III & IV years II sem of first midterm exam are to be scheduled as mentioned in the table below.

S.No	Event	Starting Date	Ending Date
1.	Conducting of second mid term exams of B.Tech II year I semester	02-05-2023	07-05-2023
2.	Conducting of Lab Externals for both B.Tech II year I semester reg/supply II year II sem supply.		
3.	Uploading of mid marks and External Lab marks	On or before 15-05-2023	
4.	Conducting of first mid term exams of B.Tech III & IV year II semester	08-05-2023	15-05-2023

The cooperation of the Principals is highly solicited.

Thanking you

Yours Sincerely

PRINCIPAL
...nthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Sd/-
DIRECTOR OF EVALUATION

Web : www.jntuh.ac.in
E Mail : dejntuh@jntuh.ac.in
Phone : Off: +91–40–23156113
Fax : +91–40–23158668

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by JNTU Act No. 30 of 2008)
Kukatpally, Hyderabad – 500 085 Telangana (India)
ACCREDITED BY NAAC WITH 'A' GRADE

Dr. K. VENKATESWARA RAO
M.Sc.,M.Tech.,PhD.,PDF(USA).
Professor of Nano Technology &
DIRECTOR OF EVALUATION

Letter No EB /OLE/1197 **Date: 28-04-2023**

To
The Principals,
Constituent and Affiliated colleges offering B.Tech. Courses, JNTUH

Dear Sir/Madam,

Sub: JNTUH - Exam Branch – Conducting of B.Tech. II year I sem second midterms exams and external Lab examinations, and for the B.Tech IV year II and III year II sem first midterm exams May-2023 University Exams -Intimation-Reg.

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S.No	Event	Starting Date	Ending Date
1.	Conducting of second mid term exams of B.Tech II year I semester	02-05-2023	07-05-2023
2.	Conducting of Lab Externals for both B.Tech II year I semester reg/supply II year II sem supply.		
3.	Uploading of mid marks and External Lab marks	On or before 15-05-2023	
4.	Conducting of first mid term exams of B.Tech III & IV year II semester	08-05-2023	15-05-2023

The cooperation of the Principals is highly solicited.

Thanking you

Yours Sincerely

Sd/-
DIRECTOR OF EVALUATION

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500085

E X A M I N A T I O N B R A N C H ECM

I YEAR B.TECH II SEMESTER – R22 REGULATIONS I - MID TERM EXAMINATIONS JUNE-2023

T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY			
	19-06-2023 MONDAY	21-06-2023 WEDNESDAY	22-06-2023 THURSDAY	23-06-2023 FRIDAY
CIVIL ENGINEERING (01-C E)	Ordinary Differential Equations and Vector Calculus	Applied Mechanics	Engineering Chemistry	Surveying
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Ordinary Differential Equations and Vector Calculus	Electrical Circuit Analysis - II	Applied Physics	English for Skill Enhancement
MECHANICAL ENGINEERING (03-ME)	Ordinary Differential Equations and Vector Calculus	Engineering Mechanics	Engineering Chemistry	Engineering Materials
ELECTRONICS & COMMUNICATION S ENGINEERING (04- ECE)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Engineering Chemistry	Basic Electrical Engineering

DATE: **15-06-2023**

Sd/-

CONTROLLER OF EXAMINATIONS

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Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500085

E X A M I N A T I O N   B R A N C H ECM

I YEAR B.TECH II SEMESTER – R22 REGULATIONS I - MID TERM EXAMINATIONS JUNE-2023

T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY			
	19-06-2023 MONDAY	21-06-2023 WEDNESDAY	22-06-2023 THURSDAY	23-06-2023 FRIDAY
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Applied Physics	English for Skill Enhancement
ELECTRONICS AND INSTRUMENTATION ENGINEERING (10-EIE)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Engineering Chemistry	Basic Electrical Engineering
INFORMATION TECHNOLOGY (12- IT)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Applied Physics	English for Skill Enhancement

DATE: **15-06-2023**

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500085

EXAMINATION BRANCH ECM

I YEAR B.TECH II SEMESTER – R22 REGULATIONS I - MID TERM EXAMINATIONS JUNE-2023

TIMETABLE

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY			
	19-06-2023 MONDAY	21-06-2023 WEDNESDAY	22-06-2023 THURSDAY	23-06-2023 FRIDAY
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML))	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Engineering Chemistry	Basic Electrical Engineering
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS))	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Applied Physics	English for Skill Enhancement
COMPUTER SCIENCE AND ENGINEERING (IOT) (69-CSE(IOT))	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Engineering Chemistry	Basic Electrical Engineering
COMPUTER SCIENCE AND ENGINEERING (NETWORKS) (70-CSE(NETWORKS)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Applied Physics	English for Skill Enhancement
TEXTILE ENGINEERING (71-TTE)	Ordinary Differential Equations and Vector Calculus	Engineering Mechanics	Engineering Chemistry	Engineering Materials

DATE: **15-06-2023**

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY - HYDERABAD – 5000 85

EXAMINATION BRANCH

IV YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM

BRANCH	19-06-2023 FN MONDAY	19-06-2023 AN MONDAY	21-06-2023 FN WEDNESDAY
ELECTRICAL AND ELECTRONICS ENGINEERING (02-EEE)	E5 Power Quality & FACTS	E6 Smart Grid Technologies	OE3
	Control Systems Design	Electrical Distribution Systems	Database Management Systems
			Elements of Rocket Propulsion
	AI Techniques in Electrical Engineering		Basics of Virtual Instrumentation
			Environmental Impact Assessment
			Fundamentals of Robotics
		Advanced Control of Electric Drives	Green Fuel Technologies
			High Temperature Materials
			Light Metals and Alloys
			Linear and Non-Linear Optimization Techniques
			Mobile Application Development
			Machine Learning
			Measuring Instruments
			Non-Conventional Sources of energy
			Remote Sensing and GIS in Mining
			Total Quality Management
			Solid Fuel Technology
			Scripting Languages

Date: 12-06-2023

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY - HYDERABAD – 5000 85

EXAMINATION BRANCH

IV YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	19-06-2023 FN MONDAY	19-06-2023 AN MONDAY	21-06-2023 FN WEDNESDAY
	E5	E6	OE3
MECHANICAL ENGINEERING (03-ME)	Industrial Robotics	Industrial Management	Basics of Power Plant Engineering
			Basics of Virtual Instrumentation
	Composite Materials		Environmental Impact Assessment
			Database Management Systems
	Mechanical Vibrations	Tribology	Elements of Rocket Propulsion
			Energy Sources and Applications
		Production and Operations Management	Fundamentals of Robotics
			Green Fuel Technologies
			High Temperature Materials
			Light Metals and Alloys
			Linear and Non-Linear Optimization Techniques
			Mobile Application Development
			Machine Learning
			Measuring Instruments
			Remote Sensing and GIS in Mining
			Total Quality Management
			Solid Fuel Technology
			Scripting Languages

Date: 12-06-2023

PRINCIPAL
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KUKATPALLY - HYDERABAD – 5000 85

EXAMINATION BRANCH

IV YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	19-06-2023 FN MONDAY	19-06-2023 AN MONDAY	21-06-2023 FN WEDNESDAY
ELECTRONICS AND COMMUNICATION ENGINEERING (04-ECE)	E5	E6	**OE3**
			Basics of Power Plant Engineering
			Database Management Systems
	Satellite Communications	System on Chip Architecture	Elements of Rocket Propulsion
			Energy Sources and Applications
	Radar Systems	Test and Testability	Environmental Impact Assessment
			Fundamentals of Robotics
			Green Fuel Technologies
			High Temperature Materials
	Wireless Sensor Networks	Low Power VLSI Design	Light Metals and Alloys
			Linear and Non-Linear Optimization Techniques
			Mobile Application Development
			Machine Learning
			Non-Conventional Sources of energy
			Basics of Virtual Instrumentation
			Remote Sensing and GIS in Mining
			Total Quality Management
			Solid Fuel Technology
			Scripting Languages

Date: 12-06-2023

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EXAMINATION BRANCH

IV YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	19-06-2023 FN MONDAY	19-06-2023 AN MONDAY	21-06-2023 FN WEDNESDAY
COMPUTER SCIENCE AND ENGINEERING (05-CSE)	Organizational Behaviour	E6	OE3
		Computational Complexity	Basics of Power Plant Engineering
		Distributed Systems	Elements of Rocket Propulsion
			Energy Sources and Applications
		Neural Networks & Deep Learning	Environmental Impact Assessment
			Fundamentals of Robotics
		Cyber Forensics	Green Fuel Technologies
			High Temperature Materials
		Human Computer Interaction	Light Metals and Alloys
			Measuring Instruments
			Non-Conventional Sources of energy
			Remote Sensing and GIS in Mining
			Total Quality Management
			Solid Fuel Technology
			Basics of Virtual Instrumentation
			Linear and Non-Linear Optimization Techniques

Date: 12-06-2023

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EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

TIME TABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	26-06-2023 FN MONDAY	26-06-2023 AN MONDAY	27-06-2023 FN TUESDAY	27-06-2023 AN TUESDAY	28-06-2023 FN WEDNESDAY	28-06-2023 AN WEDNESDAY
ELECTRICAL AND ELECTRONICS ENGINEERING (02-EEE)	Signals and Systems	Microprocessors & Microcontrollers	Power System Protection	E2 Optimization Techniques Wind and Solar Energy systems Power Semiconductor Drives	Power System Operation and Control	**(OE1)** Alloy Steels Basics of Sensors Technology Cloud Computing Coal Gasification, Cbm & Shale Gas Cyber Laws Cyber Laws & Ethics Disaster Preparedness And Planning Management Entrepreneurship Ethical Hacking Fundamentals of Ai Fundamentals of Data Science Fundamentals of Internet of Things Fundamentals of Management For Engineers Game Theory General Geology Industrial Management Introduction To Iot Introduction To Mining Technology Iot Sensors Machine Learning Basics Network Administration Non Conventional Energy Sources Machine Learning Basics Operations Research Quantitative Analysis For Business Decisions R Programming Testing of Materials

Date: 20-06-2023

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EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

TI M E T A B L E

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	26-06-2023 FN MONDAY	26-06-2023 AN MONDAY	27-06-2023 FN TUESDAY	27-06-2023 AN TUESDAY	28-06-2023 FN WEDNESDAY	28-06-2023 AN WEDNESDAY
MECHANICAL ENGINEERING (03-ME)	Design of Machine Members-II	CAD & CAM	Heat Transfer	**EI** Unconventional Machining Processes Machine Tool Design Production Planning & Control	Finite Element Methods	**(OE1)** **Alloy Steels** Basics Of Sensors Technology Cloud Computing Coal Gasification, Cbm & Shale Gas Cyber Laws Cyber Laws & Ethics Disaster Preparedness And Planning Management Entrepreneurship Ethical Hacking Fundamentals of Ai Fundamentals of Data Science Fundamentals of Internet of Things Fundamentals of Management For Engineers Game Theory General Geology Industrial Management Introduction To Iot Introduction To Mining Technology Iot Sensors Machine Learning Basics Network Administration Non Conventional Energy Sources Operations Research R Programming Reliability Engineering Renewable Energy Sources Testing of Materials

Date: 20-06-2023

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EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

TIME TABLE

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BRANCH	26-06-2023 FN MONDAY	26-06-2023 AN MONDAY	27-06-2023 FN TUESDAY	27-06-2023 AN TUESDAY	28-06-2023 FN WEDNESDAY	28-06-2023 AN WEDNESDAY
ELECTRONICS AND COMMUNICATION ENGINEERING (04-ECE)	Antennas and Propagation	Digital Signal Processing	E2: Object Oriented Programming Through Java	E2: Embedded System Design; Mobile Communications And Networks	VLSI Design	(OE1): Alloy Steels; Basics Of Sensors Technology; Cloud Computing; Coal Gasification, Cbm & Shale Gas; Cyber Laws; Cyber Laws & Ethics; Disaster Preparedness And Planning Management; Entrepreneurship; Ethical Hacking; Fundamentals of Ai; Fundamentals of Data Science; Fundamentals of Management For Engineers; Game Theory; General Geology; Industrial Management; Introduction To Iot; Introduction To Mining Technology; Iot Sensors; Machine Learning Basics; Network Administration; Non Conventional Energy Sources; Operations Research; Quantitative Analysis For Business Decisions; R Programming; Reliability Engineering; Renewable Energy Sources; Testing of Materials

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EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

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BRANCH	26-06-2023 FN MONDAY	26-06-2023 AN MONDAY	27-06-2023 FN TUESDAY	27-06-2023 AN TUESDAY	28-06-2023 FN WEDNESDAY	28-06-2023 AN WEDNESDAY
COMPUTER SCIENCE AND ENGINEERING (05-CSE)	Compiler Design	Machine Learning	Design and Analysis of Algorithms	E3 Concurrent Programming Network Programming Scripting Languages Mobile Application Development Software Testing Methodologies	–	(OE1) Alloy Steels Basics Of Sensors Technology Cloud Computing Coal Gasification, Cbm & Shale Gas Cyber Laws Disaster Preparedness And Planning Management Ethical Hacking Fundamentals of Ai Fundamentals of Data Science Fundamentals of Internet Of Things Game Theory General Geology Industrial Management Introduction To Iot Introduction To Mining Technology Iot Sensors Machine Learning Basics Network Administration Non Conventional Energy Sources Operations Research Quantitative Analysis For Business Decisions R Programming Reliability Engineering Renewable Energy Sources Testing of Materials

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Date: 20-06-2023

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EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

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BRANCH	26-06-2023 FN MONDAY	26-06-2023 AN MONDAY	27-06-2023 FN TUESDAY	27-06-2023 AN TUESDAY	28-06-2023 FN WEDNESDAY	28-06-2023 AN WEDNESDAY
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML	Artificial Intelligence	Devops	Natural Language Processing	E3	E3	(OE1)
						Alloy Steels
						Basics Of Sensors Technology
					Internet of Things	Cloud Computing
						Coal Gasification, CBM & Shale Gas
						Cyber Laws
				Data Mining		Cyber Laws & Ethics
						Disaster Preparedness And Planning Management
				Scripting Languages		Entrepreneurship
						Ethical Hacking
				Mobile Application Development		Fundamentals of Data Science
						Fundamentals of Internet of Things
				Cryptography And Network Security		Fundamentals of Management For Engineers
						Game Theory
						General Geology
						Industrial Management
						Introduction To Iot
						Introduction To Mining Technology
						Iot Sensors
						Network Administration
						Non Conventional Energy Sources
						Operations Research
						Quantitative Analysis For Business Decisions
						R Programming
						Reliability Engineering
						Renewable Energy Sources
						Testing of Materials

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EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION II - MID TERM EXAMINATIONS JUNE-2023

TIME TABLE

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BRANCH	26-06-2023 FN MONDAY	26-06-2023 AN MONDAY	27-06-2023 FN TUESDAY	27-06-2023 AN TUESDAY	28-06-2023 FN WEDNESDAY	28-06-2023 AN WEDNESDAY
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS)	Compiler Design	Machine Learning	Big Data Analytics	E3 Software Testing Methodologies Data Visualization Techniques Scripting Languages Mobile Application Development Cryptography and Network Security	—	(OE1) Alloy Steels Basics Of Sensors Technology Cloud Computing Coal Gasification, Cbm & Shale Gas Cyber Laws Cyber Laws & Ethics Disaster Preparedness And Planning Management Entrepreneurship Ethical Hacking Fundamentals Of Ai Fundamentals Of Internet Of Things Fundamentals Of Management For Engineers Game Theory General Geology Industrial Management Introduction To Iot Introduction To Mining Technology Iot Sensors Machine Learning Basics Network Administration Non Conventional Energy Sources Operations Research Quantitative Analysis For Business Decisions Reliability Engineering Renewable Energy Sources Testing Of Materials

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EXAMINATION BRANCH

II YEAR B.TECH –I1 SEMESTER – R18 REGULATION - I MID TERM EXAMINATIONS JULY-2023

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION AND DAY					
	10-07-2023 FN MONDAY	10-07-2023 AN MONDAY	11-07-2023 FN TUESDAY	11-07-2023 AN TUESDAY	12-07-2023 FN WEDNESDAY	12-07-2023 AN WEDNESDAY
CIVIL ENGINEERING (01-C E)	Basic Electrical and Electronics Engineering	Basic Mechanical Engineering for Civil Engineers	Strength of Materials - II	Structural Analysis - I	Hydraulics and Hydraulic Machinery	Building Materials, Construction and Planning
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Laplace Transforms, Numerical Methods & Complex variables	Electrical Machines – II	Control Systems	Power System - I	Digital Electronics	---
MECHANICAL ENGINEERING (03- ME)	Basic Electrical and Electronics Engineering	Kinematics of Machinery	Thermal Engineering - I	Fluid Mechanics and Hydraulic Machines	Instrumentation and Control Systems	---

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DATE: **30-06-2023**

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EXAMINATION BRANCH

II YEAR B.TECH –I1 SEMESTER – R18 REGULATION - I MID TERM EXAMINATIONS JULY-2023

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
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BRANCH	DATE, SESSION AND DAY					
	10-07-2023 FN MONDAY	10-07-2023 AN MONDAY	11-07-2023 FN TUESDAY	11-07-2023 AN TUESDAY	12-07-2023 FN WEDNESDAY	12-07-2023 AN WEDNESDAY
ELECTRONICS & COMMUNICATIONS ENGINEERING (04- ECE)	Laplace Transforms, Numerical Methods & Complex Variables	Electromagnetic Fields and Waves	Analog and Digital Communications	Linear IC Applications	Electronic Circuit Analysis	---
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Discrete Mathematics	Business Economics & Financial Analysis	Operating Systems	Database Management Systems	Java Programming	---
ELECTRONICS AND INSTRUMSNTTATIO N ENGINEERING (10-EIE)	Laplace Transforms, Numerical Methods & Complex Variables	Industrial Instrumentation	Digital System Design	Linear IC Applications	Electronic Circuit Analysis	----

DATE: 30-06-2023

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EXAMINATION BRANCH

II YEAR B.TECH –I1 SEMESTER – R18 REGULATION - I MID TERM EXAMINATIONS JULY-2023

TIMETABLE

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
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BRANCH	DATE, SESSION AND DAY					
	10-07-2023 FN MONDAY	10-07-2023 AN MONDAY	11-07-2023 FN TUESDAY	11-07-2023 AN TUESDAY	12-07-2023 FN WEDNESDAY	12-07-2023 AN WEDNESDAY
COMPUTER SCIENCE INFORMATION TECHNOLOGY CSIT(33)	Automata Theory & Compiler Design	Software Engineering	Operating Systems	Database Management Systems	Object Oriented Programming using Java	--
INFORMATION TECHNOLOGY AND ENGINEERING (34- ITE)	Discrete Mathematics	Business Economics & Financial Analysis	Operating Systems	Database Management	Object Oriented Programming using J	---
COMPUTER ENGINEERING (SOFTWARE ENGINEERING) (56-CE(SE)	Discrete Mathematics	Business Economics & Financial Analysis	Operating Systems	Principles of Software Engineering	Object Oriented Programming using Java	--
COMPUTER SCIENCE AND ENGINEERING) (CYBER SECURITY) (62-CSE(CS)	Discrete Mathematics	Business Economics & Financial Analysis	Operating Systems	Computer Networks	Object Oriented Programming using Java	--

DATE: 30-06-2023

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EXAMINATION BRANCH ECM

I YEAR B.TECH II SEMESTER – R22 REGULATIONS II - MID TERM EXAMINATIONS AUGUST-2023

TIMETABLE

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY			
	21-08-2023 MONDAY	22-08-2023 TUESDAY	23-08-2023 WEDNESDAY	24-08-2023 THURSDAY
CIVIL ENGINEERING (01-C E)	Ordinary Differential Equations and Vector Calculus	Applied Mechanics	Engineering Chemistry	Surveying
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Ordinary Differential Equations and Vector Calculus	Electrical Circuit Analysis - II	Applied Physics	English for Skill Enhancement
MECHANICAL ENGINEERING (03-ME)	Ordinary Differential Equations and Vector Calculus	Engineering Mechanics	Engineering Chemistry	Engineering Materials
ELECTRONICS & COMMUNICATIONS ENGINEERING (04- ECE)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Engineering Chemistry	Basic Electrical Engineering

DATE: **11-08-2023**

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E X A M I N A T I O N   B R A N C H ECM

I YEAR B.TECH II SEMESTER – R22 REGULATIONS II - MID TERM EXAMINATIONS AUGUST-2023

T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY			
	21-08-2023 MONDAY	**22-08-2023 TUESDAY**	**23-08-2023 WEDNESDAY**	**24-08-2023 THURSDAY**
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Applied Physics	English for Skill Enhancement
ELECTRONICS AND INSTRUMENTATION ENGINEERING (10-EIE)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Engineering Chemistry	Basic Electrical Engineering
INFORMATION TECHNOLOGY (12- IT)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Applied Physics	English for Skill Enhancement

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DATE: **11-08-2023**

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I YEAR B.TECH II SEMESTER – R22 REGULATIONS II - MID TERM EXAMINATIONS AUGUST-2023

T I M E T A B L E

TIME→ FN: 10.00 AM TO 12.00 Noon

BRANCH	DATE AND DAY			
	21-08-2023 MONDAY	22-08-2023 TUESDAY	23-08-2023 WEDNESDAY	24-08-2023 THURSDAY
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Engineering Chemistry	Basic Electrical Engineering
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Applied Physics	English for Skill Enhancement
COMPUTER SCIENCE AND ENGINEERING (IOT) (69-CSE(IOT)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Engineering Chemistry	Basic Electrical Engineering
COMPUTER SCIENCE AND ENGINEERING (NETWORKS) (70-CSE(NETWORKS)	Ordinary Differential Equations and Vector Calculus	Electronic Devices and Circuits	Applied Physics	English for Skill Enhancement
TEXTILE ENGINEERING (71-TTE)	Ordinary Differential Equations and Vector Calculus	Engineering Mechanics	Engineering Chemistry	Engineering Materials

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DATE: **11-08-2023**

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EXAMINATION BRANCH

II YEAR B.TECH –I1 SEMESTER – R18 REGULATION - II MID TERM EXAMINATIONS SEPTEMBER-2023

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION AND DAY					
	12-09-2023 FN TUESDAY	12-09-2023 AN TUESDAY	13-09-2023 FN WEDNESDAY	13-09-2023 AN WEDNESDAY	14-09-2023 FN THURSDAY	14-09-2023 AN THURSDAY
CIVIL ENGINEERING (01-C E)	Basic Electrical and Electronics Engineering	Basic Mechanical Engineering for Civil Engineers	Strength of Materials - II	Structural Analysis - I	Hydraulics and Hydraulic Machinery	Building Materials, Construction and Planning
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Laplace Transforms, Numerical Methods & Complex variables	Electrical Machines – II	Control Systems	Power System - I	Digital Electronics	---
MECHANICAL ENGINEERING (03- ME)	Basic Electrical and Electronics Engineering	Kinematics of Machinery	Thermal Engineering - I	Fluid Mechanics and Hydraulic Machines	Instrumentation and Control Systems	---

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DATE: 06-09-2023

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E X A M I N A T I O N B R A N C H

II YEAR B.TECH –I1 SEMESTER – R18 REGULATION - II MID TERM EXAMINATIONS SEPTEMBER-2023

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION AND DAY					
	12-09-2023 FN TUESDAY	12-09-2023 AN TUESDAY	13-09-2023 FN WEDNESDAY	13-09-2023 AN WEDNESDAY	14-09-2023 FN THURSDAY	14-09-2023 AN THURSDAY
ELECTRONICS & COMMUNICATIONS ENGINEERING (04- ECE)	Laplace Transforms, Numerical Methods & Complex Variables	Electromagnetic Fields and Waves	Analog and Digital Communications	Linear IC Applications	Electronic Circuit Analysis	---
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Discrete Mathematics	Business Economics & Financial Analysis	Operating Systems	Database Management Systems	Java Programming	---
ELECTRONICS AND INSTRUMSNTTATIO N ENGINEERING (10-EIE)	Laplace Transforms, Numerical Methods & Complex Variables	Industrial Instrumentation	Digital System Design	Linear IC Applications	Electronic Circuit Analysis	----

DATE: 06-09-2023

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Sd/-
CONTROLLER OF EXAMINATIONS

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY - HYDERABAD – 500085

EXAMINATION BRANCH

II YEAR B.TECH –I1 SEMESTER – R18 REGULATION - II MID TERM EXAMINATIONS SEPTEMBER-2023

TIME→ FN: 9.40 AM TO 11.00 AM (DESCRIPTIVE EXAM: 9.40 AM TO 10.40 AM, OBJECTIVE EXAM: 10.40 AM TO 11.00 AM)
AN: 1.40 PM TO 03.00 PM (DESCRIPTIVE EXAM: 1.40 PM TO 2.40 PM, OBJECTIVE EXAM: 2.40 PM TO 03.00 PM)

BRANCH	DATE, SESSION DAY					
	12-09-2023 FN TUESDAY	12-09-2023 AN TUESDAY	13-09-2023 FN WEDNESDAY	13-09-2023 AN WEDNESDAY	14-09-2023 FN THURSDAY	14-09-2023 AN THURSDAY
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML)	Formal Language and Automata Theory	Software Engineering	Operating Systems	Database Management Systems	Object Oriented Programming using Java	--
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS)	Formal Language and Automata Theory	Software Engineering	Operating Systems	Database Management Systems	Object Oriented Programming using Java	---
COMPUTER SCIENCE AND ENGINEERING (IOT) (69-CSE(IOT)	Computer Organization and Architecture	Business Economics & Financial Analysis	Operating Systems	Sensors and Devices	Object Oriented Programming using Java	---
COMPUTER SCIENCE AND ENGINEERING (NETWORKS) (70-CSE(NETWORKS)	Discrete Mathematics	Business Economics & Financial Analysis	Operating Systems	Computer Networks	Object Oriented Programming using Java	---

DATE: 06-09-2023

Sd/-
CONTROLLER OF EXAMINATIONS

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500 085

EXAMINATION BRANCH

III YEAR B.TECH -I SEMESTER – R18 REGULATION SUPPLEMENTARY EXAMINATIONS JULY/AUGUST-2023

TIME TABLE

TIME→AN: 2:00 PM TO 5:00 PM

BRANCH	DATE, DAY AND SESSION						
	20-07-2023 THURSDAY	22-07-2023 SATURDAY	25-07-2023 TUESDAY	27-07-2023 THURSDAY	31-07-2023 MONDAY	02-08-2023 WEDNESDAY	04-08-2023 FRIDAY
CIVIL ENGINEERING (01-C E)	Concrete Technology Theory of Elasticity Rock Mechanics	Geotechnical Engineering	Structural Engineering-I(RCC)	Transportation Engineering	Structural Analysis-II	Engineering Economics and Accountancy	----
ELECTRICAL AND ELECTRONICS ENGINEERING (02- EEE)	Power Electronics	Power System-II	Measurements and Instrumentation	Business Economics and Financial Analysis	Computer Architecture High Voltage Engineering Electrical Machine Design	--	---
MECHANICAL ENGINEERING (03- ME)	Design of Machine Members-I	Operations Research	Dynamics of Machinery	Business Economics & Financial Analysis	Thermal Engineering-II	Metrology & Machine Tools	----
ELECTRONICS & COMMUNICATIONS ENGINEERING (04- ECE)	Control Systems	Data Communications and Networks	Microprocessor & Microcontrollers	Business Economics & Financial Analysis	Error Correcting Codes Electronic Measurements and Instrumentation Computer Organization & Operating Systems	---	----

DATE: **21-06-2023**

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Sd/-
CONTROLLER OF EXAMINATIONS

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500 085

E X A M I N A T I O N B R A N C H

III YEAR B.TECH -I SEMESTER – R18 REGULATION SUPPLEMENTARY EXAMINATIONS JULY/AUGUST-2023

TI M E T A B L E

TIME→AN: 2:00 PM TO 5:00 PM

BRANCH	DATE, DAY AND SESSION						
	20-07-2023 THURSDAY	22-07-2023 SATURDAY	25-07-2023 TUESDAY	27-07-2023 THURSDAY	31-07-2023 MONDAY	02-08-2023 WEDNESDAY	04-08-2023 FRIDAY
COMPUTER SCIENCE & ENGINEERING (05- CSE)	Formal Languages & Automata Theory	Software Engineering	Computer Networks	Web Technologies	Information Theory & Coding Advanced Computer Architecture Data Analytics Image Processing Principles of Programming Languages	Advanced Operating Systems Informational Retrieval Systems Natural Language Processing	Computer Graphics Distributed Databases
ELECTRONICS AND INSTRUMSNTTATION ENGINEERING (10-EIE)	Control Systems	Process Dynamics and Control	Microprocessor & Microcontrollers	Business Economics & Financial Analysis	Instrumentation Practices in Industries Operating Systems Robotics and Automation	--------	----
INFORMATION TECHNOLOGY (12-IT)	Formal Languages & Automata Theory	Software Engineering	Web Programming	Data Communications and Computer Networks	Biometrics Advanced Computer Architecture Data Analytics Image Processing Principles of Programming Languages	Machine Learning Pattern Recognition Database Security Advanced Operating Systems	Computer Graphics

DATE: 21-06-2023

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Sd/-
CONTROLLER OF EXAMINATIONS

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500 085

EXAMINATION BRANCH

III YEAR B.TECH -I SEMESTER – R18 REGULATION SUPPLEMENTARY EXAMINATIONS JULY/AUGUST-2023

TIME TABLE

TIME→AN: 2:00 PM TO 5:00 PM

BRANCH	DATE, DAY AND SESSION						
	20-07-2023 THURSDAY	22-07-2023 SATURDAY	25-07-2023 TUESDAY	27-07-2023 THURSDAY	31-07-2023 MONDAY	02-08-2023 WEDNESDAY	04-08-2023 FRIDAY
COMPUTER SCIENCE AND ENGINEERING) (CYBER SECURITY) (62-CSE(CS)	Formal Languages and Automata Theory	Database Management Systems	Cryptography and Network Security	Design and Analysis of Algorithms	Compiler Design Artificial Intelligence Data warehousing and Data Mining Ad-hoc & Sensor Networks	Ethical Hacking Data Science Distributed Systems Cyber Laws IOT Security	Cloud computing
COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) (66-CSE(AI&ML)	Compiler Design	Machine Learning	Computer Networks	Design and Analysis of Algorithms	Graph Theory Introduction to Data Science Web Programming Image Processing	Software Testing Methodologies Information Retrieval Systems Pattern Recognition Computer Vision and Robotics Data Warehousing and Business Intelligence	Computer Graphics

DATE: **21-06-2023**

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

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CONTROLLER OF EXAMINATION

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500 085

EXAMINATION BRANCH

III YEAR B.TECH -I SEMESTER – R18 REGULATION SUPPLEMENTARY EXAMINATIONS JULY/AUGUST-2023

TIME→AN: 2:00 PM TO 5:00 PM

BRANCH	DATE, DAY AND SESSION						
	20-07-2023 THURSDAY	22-07-2023 SATURDAY	25-07-2023 TUESDAY	27-07-2023 THURSDAY	31-07-2023 MONDAY	02-08-2023 WEDNESDAY	04-08-2023 FRIDAY
COMPUTER SCIENCE AND ENGINEERING (DATASCIENCE) (67-CSE(DS)	Data Mining	Introduction to Data Science	Computer Networks	Design and Analysis of Algorithms	Data Warehousing and Business Intelligence Artificial Intelligence Web Programming Image Processing	Spatial and Multimedia Databases Information Retrieval Systems Software Project Management Dev Ops Computer Vision and Robotics	Computer Graphics
COMPUTER SCIENCE AND ENGINEERING (IOT) (69-CSE(IOT)	Finite Automata and Compiler Design	Database Management Systems	Computer Networks		Architecting Smart IoT Devices Data Analytics for IoT IoT System Architectures Operating Systems for IoT Design and Analysis of Algorithms	Machine Learning Real Time Systems Embedded Hardware Design Energy Sources and Power Management Software Engineering	Microprocessors & Microcontrollers

DATE: **21-06-2023**

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

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CONTROLLER OF EXAMINATION

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500 085

EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION REGULAR /SUPPLEMENTARY EXAMINATIONS JULY -2023

TI ME T A B L E

T I M E→ FN: 10:00 AM TO1:00 PM

BRANCH	10-07-2023 MONDAY	12-07-2023 WEDNESDAY	14-07-2023 FRIDAY	19-07-2023 WEDNESDAY	21-07-2023 FRIDAY	24-07-2023 MONDAY
CIVIL ENGINEERING (01-CE)	Hydrology & Water Resources Engineering	Environmental Engineering	Foundation Engineering	**E2** Prestressed Concrete Elements of Earth Quake Engineering Advanced Structural Analysis	Structural Engineering II(Steel)	**(OE1)** Alloy Steels Basics of Sensors Technology Cloud Computing Coal Gasification, Cbm & Shale Gas Cyber Laws Cyber Laws & Ethics Entrepreneurship Ethical Hacking Fundamentals of Ai Fundamentals of Data Science Fundamentals of Internet of Things Fundamentals of Management For Engineers Game Theory General Geology Industrial Management Introduction To Iot Introduction To Mining Technology Iot Sensors Machine Learning Basics Network Administration Non Conventional Energy Sources Operations Research Quantitative Analysis For Business Decisions R Programming Reliability Engineering Renewable Energy Sources Testing of Materials

Date: 21-06-2023

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Sd/-

CONTROLLER OF EXAMINATIONS

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500 085

EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION REGULAR /SUPPLEMENTARY EXAMINATIONS JULY -2023

TI ME TABL E

T I M E→ FN: 10:00 AM TO1:00 PM

BRANCH	10-07-2023 MONDAY	12-07-2023 WEDNESDAY	14-07-2023 FRIDAY	19-07-2023 WEDNESDAY	21-07-2023 FRIDAY	24-07-2023 MONDAY
				E2		(OE1)
ELECTRICAL AND ELECTRONICS ENGINEERING (02-EEE)	Signals and Systems	Microprocessors & Microcontrollers	Power System Protection	Optimization Techniques Wind and Solar Energy systems Power Semiconductor Drives	Power System Operation and Control	Alloy Steels Basics of Sensors Technology Cloud Computing Coal Gasification, Cbm & Shale Gas Cyber Laws Cyber Laws & Ethics Disaster Preparedness And Planning Management Entrepreneurship Ethical Hacking Fundamentals of Ai Fundamentals of Data Science Fundamentals of Internet of Things Fundamentals of Management For Engineers Game Theory General Geology Industrial Management Introduction To Iot Introduction To Mining Technology Iot Sensors Machine Learning Basics Network Administration Non Conventional Energy Sources Operations Research Quantitative Analysis For Business Decisions R Programming Testing of Materials

Date: 21-06-2023

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KUKATPALLY, HYDERABAD – 500 085

EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION REGULAR /SUPPLEMENTARY EXAMINATIONS JULY -2023

TIME TABLE

TIME→ FN:10:00 AM TO 1:00 PM

BRANCH	10-07-2023 MONDAY	12-07-2023 WEDNESDAY	14-07-2023 FRIDAY	19-07-2023 WEDNESDAY	21-07-2023 FRIDAY	24-07-2023 MONDAY
MECHANICAL ENGINEERING **(03-ME)**	Design of Machine Members-II	CAD & CAM	Heat Transfer	**EI** Unconventional Machining Processes Machine Tool Design Production Planning & Control	Finite Element Methods	**(OE1)** **Alloy Steels** Basics Of Sensors Technology Cloud Computing Coal Gasification, Cbm & Shale Gas Cyber Laws Cyber Laws & Ethics Disaster Preparedness And Planning Management Entrepreneurship Ethical Hacking Fundamentals of Ai Fundamentals of Data Science Fundamentals of Internet of Things Fundamentals of Management For Engineers Game Theory General Geology Industrial Management Introduction To Iot Introduction To Mining Technology Iot Sensors Machine Learning Basics Network Administration Non Conventional Energy Sources Operations Research R Programming Reliability Engineering Renewable Energy Sources Testing of Materials

Date: 21-06-2023

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

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CONTROLLER OF EXAMINATIONS

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

KUKATPALLY, HYDERABAD – 500 085

EXAMINATION BRANCH

III YEAR B.TECH – II SEMESTER– R18 REGULATION REGULAR /SUPPLEMENTARY EXAMINATIONS JULY -2023

TIME TABLE

TIME→ FN:10:00 AM TO 1:00 PM

BRANCH	10-07-2023 MONDAY	12-07-2023 WEDNESDAY	14-07-2023 FRIDAY	19-07-2023 WEDNESDAY	21-07-2023 FRIDAY	24-07-2023 MONDAY
ELECTRONICS AND COMMUNICATION ENGINEERING (04-ECE)	Antennas and Propagation	Digital Signal Processing	E2: Object Oriented Programming Through Java	E2: Embedded System Design; Mobile Communications And Networks	VLSI Design	(OE1): Alloy Steels; Basics Of Sensors Technology; Cloud Computing; Coal Gasification, Cbm & Shale Gas; Cyber Laws; Cyber Laws & Ethics; Disaster Preparedness And Planning Management; Entrepreneurship; Ethical Hacking; Fundamentals of Ai; Fundamentals of Data Science; Fundamentals of Management For Engineers; Game Theory; General Geology; Industrial Management; Introduction To Iot; Introduction To Mining Technology; Iot Sensors; Machine Learning Basics; Network Administration; Non Conventional Energy Sources; Operations Research; Quantitative Analysis For Business Decisions; R Programming; Reliability Engineering; Renewable Energy Sources; Testing of Materials

Date: 21-06-2023

Sd/-

CONTROLLER OF EXAMINATIONS

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Approved by AICTE, Recg. By Govt. of T.S & Affiliated to JNTUH, Hyderabad)
NAAC "B++" Accredited Institute
Gunthapally (V), Abdullapurmet(M), RR Dist, Near Ramoji Film City, Hyderabad -501512.
www.aietg.ac.in email: principal.avanthi@gmail.com

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Ref: AVIH/EEE/PROJECT/Cir/2022-23/01 **DATE: 29.08.2022**

PROJECT SCHEDULE

For the academic year 2022-23, all the IV B.Tech I Semester (2019 Admitted Batch) are hereby informed that the students should undergo the course PROJECT WORK as per the JNTUH R18 Regulations. The following is the detailed schedule.

S.NO.	Review & Assessment	Topic	Tentative Schedule
		Semester-I	
1	Project Initialization	a. Problem identification b. Domain and Technology c. Objective of Project d. Submission of Abstract e. Weekly plan of work	19.09.2022 to 24.09.2022
2	First Review Assessment	a. Literature Survey b. Identification of problem c. Disadvantage of Existing System	10.10.2022 to 15.10.2022
3	Second Review Assessment	a. Proposed Systems b. Advantages c. Design	07.11.2022 to 12.11.2022
4	Third Review Assessment	a. Methodology and Expected Results b. Implementation and Results	05.12.2022 to 10.12.2022
		Semester-II	
5	Fourth Review Assessment	a. Analysis b. Progress of work observation	13.02.2023 To 20.02.2023
6	Fifth Review Assessment	a. Testing and validation b. Project documentation status	10.04.2023 To 17.04.2023
7	Sixth and final Review Assessment	a. Conclusion and future study b. Submission of Project document	01.05.2023 To 08.05.2023

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Guidelines to students:

1. UG project work shall be carried out in two stages: Project Stage – I during IV Year I Semester, Project Stage – II during IV Year II Semester.

2. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester.

3. First report includes project work carried out in IV Year I semester and second report includes project work carried out in IV Year I & II Semesters.

4. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.

5. For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall evaluate the project 10 work for 75 marks and project supervisor shall evaluate for 25 marks.

6. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

7. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8. For Project Stage – II, the external examiner shall evaluate the project work for 75 marks and the project supervisor shall evaluate it for 25 marks.

9. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

10. For conducting viva-voce of project stage – II, University selects an external examiner from the list of experts in the relevant branch submitted by the Principal of the College.

11. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

Project Co-Ordinator

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

HOD-EEE
Head of the Department
Electrical & Electronics Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
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www.aietg.ac.in email: principal.avanthi@gmail.com

DEPARTMENT OF MECHANICAL ENGINEERING

Ref: AVIH/MECH/PROJECT/Cir/2022-23/01 **DATE: 29.08.2022**

PROJECT SCHEDULE

For the academic year 2022-23, all the IV B.Tech I Semester (2019 Admitted Batch) are hereby informed that the students should undergo the course PROJECT WORK as per the JNTUH R18 Regulations. The following is the detailed schedule.

S.NO.	Review & Assessment	Topic	Tentative Schedule
		Semester-I	
1	Project Initialization	a. Problem identification b. Domain and Technology c. Objective of Project d. Submission of Abstract e. Weekly plan of work	19.09.2022 to 24.09.2022
2	First Review Assessment	a. Literature Survey b. Identification of problem c. Disadvantage of Existing System	10.10.2022 to 15.10.2022
3	Second Review Assessment	a. Proposed Systems b. Advantages c. Design	07.11.2022 to 12.11.2022
4	Third Review Assessment	a. Methodology and Expected Results b. Implementation and Results	05.12.2022 to 10.12.2022
		Semester-II	
5	Fourth Review Assessment	a. Analysis b. Progress of work observation	13.02.2023 To 20.02.2023
6	Fifth Review Assessment	a. Testing and validation b. Project documentation status	10.04.2023 To 17.04.2023
7	Sixth and final Review Assessment	a. Conclusion and future study b. Submission of Project document	01.05.2023 To 08.05.2023

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Guidelines to students:

1. UG project work shall be carried out in two stages: Project Stage – I during IV Year I Semester, Project Stage – II during IV Year II Semester.

2. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester.

3. First report includes project work carried out in IV Year I semester and second report includes project work carried out in IV Year I & II Semesters.

4. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.

5. For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall evaluate the project 10 work for 75 marks and project supervisor shall evaluate for 25 marks.

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Project Co-Ordinator | PRINCIPAL | HOD-MECH

PRINCIPAL
Avanthi Institute of Engg. & Tech.
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Head of the Department
Mechanical Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
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www.aietg.ac.in email: principal.avanthi@gmail.com

DEPARTMENT OF ELECTRONOCIS AND COMMUNICATION ENGINEERING

Ref: AVIH/ECE/PROJECT/Cir/2022-23/01 **DATE: 29.08.2022**

PROJECT SCHEDULE

For the academic year 2022-23, all the IV B.Tech I Semester (2019 Admitted Batch) are hereby informed that the students should undergo the course PROJECT WORK as per the JNTUH R18 Regulations. The following is the detailed schedule.

S.NO.	Review & Assessment	Topic	Tentative Schedule
		Semester-I	
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		Semester-II	
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6	Fifth Review Assessment	a. Testing and validation b. Project documentation status	10.04.2023 To 17.04.2023
7	Sixth and final Review Assessment	a. Conclusion and future study b. Submission of Project document	01.05.2023 To 08.05.2023

PRINCIPAL
Avanthi Institute of Engg. & Tech
Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist.

Guidelines to students:

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9. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

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11. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

Project Co-Ordinator | PRINCIPAL, Avanthi Institute of Engg. & Tech, Gunthapally (V), Abdullapurmet (Mdl), R.R. Dist. | **HOD-ECE**, Head of the Department, Electronics & Communication Engineering, Avanthi Institute of Engineering & Technology, Gunthapally (Vill), Abdullapur Met (Mdl), Ranga Reddy District.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
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www.aietg.ac.in email: principal.avanthi@gmail.com

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Ref: AVIH/CSE/PROJECT/Cir/2022-23/01 **DATE: 29.08.2022**

PROJECT SCHEDULE

For the academic year 2022-23, all the IV B.Tech I Semester (2019 Admitted Batch) are hereby informed that the students should undergo the course PROJECT WORK as per the JNTUH R18 Regulations. The following is the detailed schedule.

S.NO.	Review & Assessment	Topic	Tentative Schedule
		Semester-I	
1	Project Initialization	a. Problem identification b. Domain and Technology c. Objective of Project d. Submission of Abstract e. Weekly plan of work	19.09.2022 to 24.09.2022
2	First Review Assessment	a. Literature Survey b. Identification of problem c. Disadvantage of Existing System	10.10.2022 to 15.10.2022
3	Second Review Assessment	a. Proposed Systems b. Advantages c. Design	07.11.2022 to 12.11.2022
4	Third Review Assessment	a. Methodology and Expected Results b. Implementation and Results	05.12.2022 to 10.12.2022
		Semester-II	
5	Fourth Review Assessment	a. Analysis b. Progress of work observation	13.02.2023 To 20.02.2023
6	Fifth Review Assessment	a. Testing and validation b. Project documentation status	10.04.2023 To 17.04.2023
7	Sixth and final Review Assessment	a. Conclusion and future study b. Submission of Project document	01.05.2023 To 08.05.2023

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AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Approved by AICTE, Recg. By Govt. of T.S & Affiliated to JNTUH, Hyderabad)
NAAC "B++" Accredited Institute
Gunthapally (V), Abdullapurmet(M), RR Dist, Near Ramoji Film City, Hyderabad -501512.
www.aietg.ac.in email: principal.avanthi@gmail.com

Guidelines to students:

1. UG project work shall be carried out in two stages: Project Stage – I during IV Year I Semester, Project Stage – II during IV Year II Semester.

2. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester.

3. First report includes project work carried out in IV Year I semester and second report includes project work carried out in IV Year I & II Semesters.

4. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.

5. For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall evaluate the project 10 work for 75 marks and project supervisor shall evaluate for 25 marks.

6. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

7. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8. For Project Stage – II, the external examiner shall evaluate the project work for 75 marks and the project supervisor shall evaluate it for 25 marks.

9. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

10. For conducting viva-voce of project stage – II, University selects an external examiner from the list of experts in the relevant branch submitted by the Principal of the College.

11. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

Project Co-Ordinator **HOD-CSE**

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Head of the Department
Computer Science & Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
Ranga Reddy District.

DEPARMENT OF ELECTRONICS AND COMMINUCATION ENGINEERING													
ELECTRONIC DEVICES AND CIRCUITS													
ACEDAMIC YEAR 2022-23													
CO-PO Mapping													
COURSE OUTCOMES													
CO1	Know the characteristics of various components their applications												
CO2	Understand the utilization of components.												
CO3	Analyze the Field Effect Transistor characteristics and its applications												
CO4	Design and analyze small signal amplifier circuits.												
CO-PO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2	2	2							2	2	
CO2	3	3		2	2							2	2	2
CO3	3	3	2	2	2							2	2	
CO4	3											2		2
CO avg(M)	3	3	2	2	2							2	2	2

HOD

Head of the Department
Electronics & Communication Engineering
Avanthi Institute of Engineering & Technology
Gunthapally (Vill), Abdullapur Met (Mdl),
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AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
GUNTHAPALLY (V)
ABDULLAPURMET (M)
R.R. DISTRICT.

DEPARMENT OF COMPUTER SCIENCE AND ENGINEERING														
HUMAN COMPUTER INTERACTION														
ACEDAMIC YEAR 2022-23														
CO-PO Mapping														
COURSE OUTCOMES														
CO1	Enumerate the basic concepts of human ,computer interaction.													
CO2	Create the processes of human computer interaction life cycle													
CO3	Analyse and design the various interaction design models.													
CO4	Apply the interface design standards/guidelines for evaluating the developed interactions.													
CO5	Establish the different levels of communication across the application stakeholder.													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	2					2		1	2	2
CO2	3	3	2	2	2					1		2	2	
CO3	3	3	3	2	2					2		2		2
CO4	2	2	2	2	2					2	2	2	2	
CO5	2	2	2	2	2					2	2	2		
CO avg(M)	2.4	2.4	2	2	2					1	2	2	2	2

HOD

Head of the Department
Computer Science & Engineering
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Ranga Reddy District. Telangana.

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AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
GUNTHAPALLY (V)
ABDULLAPURMET (M)
R.R. DISTRICT.

DEPARMENT OF COMPUTER SCIENCEAND ENGINEERING	
DESIGN AND ANALYSIS OF ALGORITHMS	
ACEDAMIC YEAR 2022-23	
CO-PO MAPPING	
COURSE OUTCOMES	
CO1	Ability to analyze the performance of algorithms.
CO2	Ability to choose appropriate data structures and algorithm design methods for a specified application.
CO3	Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2									2	1	
CO2	2	3	2									2	2	
CO3	2	2	3									2	2	
CO avg(M)	2.33	2.66	2.33									2	2	

HOD

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R.R. DISTRICT.

DEPARMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING	
HIGH VOLTAGE ENGINEERING	
ACEDAMIC YEAR 2022-23	
CO-PO Mapping	
COURSE OUTCOMES	
CO1	Describe the principles behind generating high DC – AC and impulse voltages
CO2	Develop equivalent circuit models of the different high voltage generators
CO3	Perform a dynamic response analysis of high voltage measurement systems

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			2					2	3	2	
CO2	3	1	2			2					2	3	2	
CO3	3	2	2									3	2	
CO avg(M)	3	2	2			2					2	3	2	

T. Kitti
HOD
Head of the Department
Electrical & Electronics Engineering
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