AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

(Approved by A.I.C.T.E., New Delhi & Permanently Affiliated to JNTU-GV, Vizianagaram)
NAAC Accredited with A+ grade
Tamaram (V), Makavarapalem, Narsipatnam (RD), Anakapalle Dist, Pin-531113

DEPARTMENT OF ECE- ELECTRONICS AND COMMUNICATION ENGINEERING

ACADEMIC REGULATIONS

COURSE STRUCTURE AND SYLLABUS

For UG-R24

B.Tech – ELECTRONICS AND COMMUNICATION ENGINEERING

(Applicable for batches admitted from 2024-2025)

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Academic Regulations 2024 (R24) for B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the
Academic Year: 2024-2025 onwards)

1. Award of the B.Tech Degree

(a) Award of the B.Tech. Degree/ B.Tech. Degree with a Minor: If he/ she fulfils the following:

(i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would be in addition to the maximum period permitted for graduation (Eight Years).

(ii) Registers for 160 credits and secures all 160 credits.

(b) Award of B.Tech. Degree with Honors: If he / she fulfils the following:

(i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. Program i.e., 160 credits.

(ii) Registering for Honors is optional.

(iii) Honors are to be completed simultaneously with B.Tech. Programme.

2. Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. Course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).

3. Courses of study:

The following courses of study are offered at present with specialization in the B.Tech

S.No.	Branch Code - Abbreviation	Branch
1.	02-EEE	Electrical and Electronics Engineering
2.	03-ME	Mechanical Engineering
3.	04-ECE	Electronics and Communication Engineering
4.	05-CSE	Computer Science and Engineering

5.	42-CSM	Computer Science and Engineering (Artificial Intelligence and Machine Learning)
6.	44-CSD	Computer Science and Engineering (Data Science)

4. Admissions

Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/ Institution from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government /Institution or to any other order of merit approved by the A.P. Government / Institution, subject to reservations as prescribed by the Government/ Institution from time to time.

5. Program related terms

Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit Definition:

1Hr. Lecture (L) per week	1 Credit
1Hr.Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hr. Practical (Lab) per week	1 Credit

a) **Semester:** A semester comprises 90 working days.
b) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
c) **Choice Based Credit System (CBCS):** The CBCS provides a choice for students to select from the prescribed courses.

6. Semester / Credits:

i) A semester comprises 90 working days and an academic year is divided into two semesters.
ii) The summer term is for eight weeks during summer vacation. Internship / apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.
iii) Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

7. Structure of Undergraduate Programme

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total credits	AICTE Recommendation(%)
1.	Humanities and Social Science including Management (HM)	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21 %	19 - 23%
6.	Internships & Project work (PR)	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-credit	Non-credit	-

8. Course Classification:

All subjects/ courses offered for the undergraduate programme in Engineering (B.Tech. Degree programmes) are broadly classified as follows:

S. No.	Broad Course Classification	Course Category	Description
1.	Foundation Core Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; Humanities, Social sciences and Management courses
2.	Professional Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline/department/branch of Engineering
3.	Open Elective Courses	Professional Elective Courses (PE)	Include selective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary Subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domains Specific Skill Enhancement Courses (SEC)	Interdisciplinary/ job-oriented / domain courses which are relevant to the industry
4.	Project Internships	Project	B.Tech. Project (or) Major Project
		Internships	Summer Internships–Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

9. Programme Pattern

i. Total duration of the B.Tech (Regular) Programme is four academic years.

ii. Each academic year of study is divided into two semesters.

iii. Minimum number of instruction days in each semester is 90 days

iv. There shall be mandatory student induction program for fresher's, with three- week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept. /Branch & Innovations etc., are included as per the guidelines issued by AICTE.

v. Health/wellness/yoga/sports and NCC / NSS / Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students

vi. Courses like Environmental Sciences, Indian Constitution, and Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.

vii. Design Thinking for Innovation & Tinkering Labs is made mandatory as credit courses for all the undergraduate students.

viii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.

ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.

x. A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.

xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.

xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.

xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year

xiv. There shall also be mandatory full internship in the final semester of the programme along with the project work.

xv. Undergraduate degree with Honors is introduced by the Institution for the students having good academic record.

xvi. Each college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

xvii. Each college shall assign a faculty advisor/ mentor after admission to a group of students from same department to provide guidance in courses registration/ career growth/ placements/ opportunities for higher studies/ GATE/ other competitive exams etc.

xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

10. Evaluation Process

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, and mandatory courses with no credits shall be evaluated for 30 MID semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he / she should secure 40% of the total marks.

Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.

ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.

iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 2.5 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.

iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of "T for theory subject and P for practical" subject.

a) Continuous Internal Evaluation

i) For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective questions / short answer questions (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.

ii) Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits / multiple choice questions (MCQ's) for 10 marks. Subjective paper shall contain 3 questions and each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
- The subjective paper shall contain 3 questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted either online or offline by the respective department on the day of subjective paper test.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.

iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.

iv) First midterm examination shall be conducted for 2.5 (I Unit, II Unit and III Unit half part) units of syllabus the second midterm examination shall be conducted for remaining 2.5 Units (III Unit half part, IV and V units).

v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

- Marks obtained in first mid: 25
- Marks obtained in second mid: 20
- Final mid semester Marks: (25 x 0.8) + (20 x 0.2) = 24

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Example:

- Marks obtained in first mid: Absent
- Marks obtained in second mid: 25
- Final mid semester Marks: (25 x 0.8) + (0 x 0.2) = 20

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

(i) There shall be 6 questions and all questions are compulsory.

(ii) Question I shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks. There shall be 2 short answer questions from each unit

(iii) In each of the questions from 2 to 6, there shall be either / or type questions of 10 marks each and each question have internal choice. Student shall answer any one of them.

(iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical & Electronics Engineering shall have the following pattern:

(i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.

(ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.

(iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

(iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

Practical Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

a) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.

b) Day-to-Day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the regularity / record / viva and 15 marks for the internal test.

c) The end examination shall be evaluated for 70 marks, conducted by the

concerned laboratory teacher and a senior expert in the subject from the same department.

- Procedure:20 marks
- Experimental work & Results: 30 marks
- Viva Voce: 20 marks.

In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated 30 marks in each part. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

d) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Assessment Method	**Marks**
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

Day-to-Day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination.

e) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

f) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

11. Skill oriented Courses

i) There shall be five skill-oriented courses offered during III to VII semesters.

ii) Out of the five skill courses, two shall be skill-oriented courses from the same domain of their main three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.

iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-Day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/ assignments / viva/ mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

iv) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks / grades shall be assigned to the students by the above committee based on their performance.

v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

vi) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the Institute.

12. Massive Open Online Courses (MOOCs):

A Student has to pursue and complete one course compulsorily through MOOCs approved by the Institute. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offered through MOOCs with the approval of Head of the Department. The Head of the Department shall appoint

one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the Institute.

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

13. Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the Institution shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of 32 credits through MOOCs platform.

i) The AIET (A) shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
iii) The Credit transfer policy will be applicable to the Professional & Open Elective courses only.
iv) The concerned department shall identify the courses permitted for credit transfer.
v) The Institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
vii) The Institute shall ensure no overlap of MOOC exams with that of the Institute examination schedule. In case of delay in results, the Institute will re-issue the marks sheet for such students.
viii) Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
ix) The institution shall submit the following to the examination section of the Institute:
(a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.

(b) Undertaking form filled by the students for credit transfer.

x) The Institution` shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the Institute from time to time.

14. Academic Bank of Credits (ABC)

The Institute has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

i) Provide option of mobility for learners across the universities of their choice.
ii) Provide option to gain the credits through MOOCs from approved digital platforms.
iii) Facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC
iv) Execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students account.

15. Mandatory Internships

Summer Internships: Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/ NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / Institute shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and as senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 external marks. There shall be no internal

marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the Institute.

Full Semester Internship and Project work:

In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be show cased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the Institute and is evaluated for 140 marks.

The institute shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

16. Guidelines for offering Minor

To promote inter disciplinary knowledge among the students; the students admitted into B.Tech.in a major stream / branch are eligible to obtain degree in Minor in another stream.

i) The Minor program requires the completion of 12 credits in Minor stream chosen.

ii) Two courses for 06 credits related to a Minor are to be pursued compulsorily for them in or degree, but may be waived for students who have done similar / equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.

iii) Electives (minimum of 2 courses) to complete a total of 12 credits.

Note: A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.

17. Guidelines for offering Honors

The objective of introducing B.Tech. (Honors) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

i) Honors are introduced in the curriculum of all B.Tech. Programs offering a major degree and is applicable to all B.Tech (Regular and Lateral Entry) students admitted in Engineering.

ii) A student shall earn additional 15 credits for award of B.Tech. (Honors) degree from same branch/ department/ discipline registered for major degree. This is in addition to the credits essential for obtaining the under graduate degree in Major Discipline (i.e., 160 credits).

iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.

iv) The concerned head of the department shall arrange separate class work and timetable of the courses offered under Honors program.

v) Courses that are used to fulfill the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.

vi) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.

vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.

viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.

ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.

x) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xi) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering.

Enrolment into Honors:

i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline

ii) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester incase of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.

iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

iv) Transfer of credits from Honors to regular B.Tech degree and vice-versa shall not be permitted.

v) Honors are to be completed simultaneously with a Major degree program.

Registration for Honors:

i) The eligible and interested students shall apply through the HOD of his / her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.

iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/ mentor from parent department shall be assigned to a group of students to monitor the progress.

iv) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

18. Attendance Requirements:

i) A student shall be eligible to appear for the Institution's / Institute's external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College's Academic Committee.

ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the Institute.

iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

v) A student will not be promoted to the next semester unless he/she satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.

vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

viii) For induction programme attendance shall be maintained as per AICTE norms.

19. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 18.

i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per college norms.

ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any **decimal** fraction should be **rounded off** to **lower** digit) up to in the subjects that have been studied up to III semester.

iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any **decimal** fraction should be **rounded off** to **lower** digit) in the subjects that have been studied up to V semester. And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

iv) When a student is detained due to lack of credits/ shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

20. Grading:

As measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed: **A**fter each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding

letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points Assigned
90 & above	S (Superior)	10
80 - 89	A (Excellent)	9
70 - 79	B (Very Good)	8
60 - 69	C (Good)	7
50 -59	D (Average)	6
40-49	E (Pass)	5
<40	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade "F" or Grade "Ab" in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/ Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

SGPA: The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses under gone by a student, i.e.,

$$\mathbf{SGPA=\Sigma\ (C_i \times G_i)\ /\ \Sigma\ C_i}$$

Where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

CGPA: The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses under gone by a student over all the semesters of a program, i.e.

$$\mathbf{CGPA=\Sigma\ (C_i \times S_i)\ /\ \Sigma C_i}$$

Where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits up to that semester.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA the subjects in whom the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D, E and F.

Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and are eligible for the award of B.Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5 (Without any supplementary appearance)
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 5.0 < 5.5

Note: Students who have written supplementary examinations to fulfill the credit requirement will not be awarded First Class with Distinction. For such students the highest degree that is awarded will be First Class Only.

CGPA to Percentage conversion Formula: (CGPA–0.75) x 10

21. With-holding of Results

If the candidate has any dues not paid to the Institute or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be with held in such cases.

22. Multiple Entry/ Exit Option

(a) Exit Policy:

The students can choose to exit the four-year programme at the end of First / Second/ Third year.

i) **UG Certificate (in Field of study/ discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship / apprenticeship that would help the candidates acquire job-ready competencies required to

enter the workforce.

ii) **UG Diploma (in Field of study/ discipline)** – Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship / apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

iii) **Bachelor of Science (in Field of study/discipline)** i.e., **B.Sc. Engineering in (Field of study/discipline)** - Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. Programme will be provided in due course of time.

Note: The Institute shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE/APSCHE and State government.

23. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/ to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the Institute. An evaluation committee constituted by the Institute shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not.

24. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subjected to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subjected to Section **2** and they

will follow the academic regulations in to which they are readmitted.

25. Minimum Instruction Days for a Semester:

The minimum instruction days including internal exams for each semester shall be 90 days.

26. Medium of Instruction:

The medium of instruction of the entire B.Tech undergraduate programme in Engineering (including examinations and project reports) will be in English only.

27. Student Transfers:

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh / JNTU-GV and the Institute from time to time.

28. General Instructions:

i) The academic regulations should be read as a whole for purpose of any interpretation.

ii) Malpractices rules-nature and punishments are appended.

iii) Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.

iv) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal / Dean-Academics of the institution is final.

v) The Institute may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Institute.

vi) In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Principal / Dean-Academics of the institution is final.

ACADEMIC REGULATIONS (R24) for B.Tech (LATERAL ENTRY SCHEME)

(Effective for the students getting admitted into II year through Lateral Entry Scheme from the Academic Year **2025-2026** onwards)

1. Award of the Degree

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfills the following:

(i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).

(ii) Registers for 120 credits and secures all 120 credits.

(b) **Award of B.Tech. Degree with Honors**

A student will be declared eligible for the award of the B.Tech. with Honors if he / she fulfils the following:

i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. Program i.e., 120 credits.

ii) Registering for Honors is optional.

iii) Honors are to be completed simultaneously with B.Tech programme.

2. Students, who fail to fulfill the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.**2**

i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.

ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.

And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

i) The entire course of study is three academic years on semester pattern.

ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.

iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfillment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

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(Dr. R Prasad Rao)
Dean(Academics) &
Member Secretary (AC)

(Dr.C P V N J Mohan Rao)
Chairman
Academic Council

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
(Approved by A.I.C.T.E., New Delhi & Permanently Affiliated to JNTU-GV, Vizianagaram)
NAAC Accredited with A+ grade
Tamaram (V), Makavarapalem, Narsipatnam (RD), Anakapalle Dist, Pin-531113.
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Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Course Structure

Program– B. Tech Electronics and CommunicationEngineering

Regulation-R24

(Applicable from the academic year 2024-2025 to 2026-2027)

Induction Programme

S. No	Course Title	Category	L-T-P-C
1	Physical Activities--Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counseling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Program: B. Tech- Electronics and Communication Engineering **Regulation: R24**

I Year I Semester- Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	BS	R24BS01	Linear Algebra and Calculus	3	0	0	3
2	BS	R24BS05	Applied Chemistry	3	0	0	3
3	ES	R24ES02	Problem Solving and Computer Programming with C	3	0	0	3
4	ES	R24ES06	Engineering Graphics	1	0	4	3
5	ES	R24ES05	Basic Electrical and Electronics Engineering	3	0	0	3
6	BS	R24BS06	Applied Chemistry Lab	0	0	2	1
7	ES	R24ES03	Problem Solving and Computer Programming with C Lab	0	0	3	1.5
8	ES	R24ES07	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5
9	ES	R24ES08	Engineering Workshop	0	0	3	1.5
10	MC	R24MC01	Health and Wellness, Yoga and Sports	0	0	1	0.5
Total				**13**	**0**	**16**	**21.0**

Category	Courses	Credits
BS-Basic Sciences Course	3	7.0
ES-Engineering Science Course	6	13.5
MC-Mandatory Course	1	0.5
Total	**10**	**21.0**

Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Program: B. Tech Electronics and Communication Engineering **Regulation: R24**

I Year II Semester- Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	BS	R24BS04	Differential Equations and Vector Calculus	3	0	0	3
2	BS	R24BS02	Engineering Physics	3	0	0	3
3	HS	R24HS01	Communicative English	2	0	0	2
4	ES	R24ES01	Basic Civil and Mechanical Engineering	3	0	0	3
5	PC	R24ECPC01	Network Analysis	3	0	0	3
6	HS	R24HS02	Communicative English Lab	0	0	2	1
7	BS	R24BS03	Engineering Physics Lab	0	0	2	1
8	ES	R24ES04	IT Workshop	0	0	2	1
9	PC	R24ECPC02	Network Analysis and Simulation Lab	0	0	3	1.5
10	MC	R24MC02	NSS/NCC/Scouts Guides/Community Service	0	0	1	0.5
Total				**14**	**0**	**10**	**19.0**

Category	Courses	Credits
BS- Basic Sciences Course	3	7.0
ES-Engineering Science Courses	2	4.0
HS-Humanities and Management Sciences Courses	2	3.0
PCC-Professional Core Courses	2	4.5
MC-Mandatory Course	1	0.5
Total	**10**	**19.0**

Linear Algebra and Calculus
I B.TECH- I SEMESTER (Common to all Branches)

Course Title: **Linear Algebra and Calculus**	Course Code**: R24BS01**
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: Linear algebra is a prerequisite for calculus, and that you should have a deep understanding of linear algebra before moving on to calculus.	

COURSE OVERVIEW:

A course on linear algebra and calculus typically covers fundamental concepts like vectors, matrices, linear systems, differentiation, and integration.

COURSE OBJECTIVES:

The objectives of this course are to:

1. To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.
2. To enable the students to apply linear algebra to solve engineering problems.
3. To enable the students to apply calculus to solve engineering problems.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Develop matrix algebra techniques that are needed by engineers for practical applications.
CO2	To find the eigen values and eigen vectors and solve the problems by using linear transformation.
CO3	Apply the knowledge of mean value theorems, solve inequality.
CO4	Familiarize with functions of several variables which is useful in optimization.
CO5	Familiarize with double and triple integrals of functions of several variables in two and three dimensions.

COURSE CONTENT (SYLLABUS)

UNIT-I: Matrices and Linear System of Equations **10 Hours**

Matrices: Vector Space, Linear independent, dependent (only definitions).

Rank of a matrix by echelon form, normal form. Cauchy-Binet formulae (without proof). Inverse of Non-singular matrices by Gauss- Jordan method.

System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method. **COs-CO1**

Self-Learning Topic: Encoding and Decoding messages by using matrices

UNIT- II: Linear Transformation and Orthogonal Transformation **10 Hours**

Eigen values and Eigen vectors and their properties(without proof), Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley– Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation. **COs-CO2**

Self-Learning Topic: Google's page rank Algorithm.

UNIT–III: Calculus **10 Hours**

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), problems on the above theorems. **COs-CO3** Self-Learning Topic: Application of mean value theorems

UNIT- IV: Partial differentiation and Applications **10 Hours**

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobian, maxima and minima of functions of two variables, method of Lagrange multipliers. **COs-CO4**

Self-Learning Topic: Jacobian of implicit functions.

UNIT-V: Multiple Integrals **10 Hours**

Double integrals - change of variables (Cartesian and Polar coordinates), change of order of integration, Cylindrical and Spherical coordinates, triple integrals. Finding areas (by double integrals) and volumes (by double integrals and triple integrals). **COs-CO5**

Self-Learning topic: Calculating Centers of Mass and Moment of inertia

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

Reference Books:

1. Dennis G. Zill and Warren S. Wright , Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Michael Green berg, Advanced Engineering Mathematics, 9th edition, Pearson edn.
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science
5. International Ltd., 2021 (9th reprint).
6. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017.

Web References:

1. http://onlinecourses.nptel.ac.in
2. https://nptel.ac.in/courses/111105121
3. https://onlinecourses.nptel.ac.in/noc24_ma91/course
4. https://onlinecourses.nptel.ac.in/noc24_ma53/course
5. https://onlinecourses.nptel.ac.in/noc24_ma11/course

APPLIED CHEMISTRY
IB.TECH-I SEMESTER (Common to ECE ,EEE)

Course Title: APPLIED CHEMISTRY	Course Code: **R24BS05**
Teaching Scheme(L:T:P): 3:0:0	Credits:3
Type of Course: Lecture	
Continuous Internal Evaluation: 30Marks	Semester End Exam: 70Marks
Prerequisites:	

COURSE OVERVIEW:

An Applied Chemistry course is typically designed to bridge the gap between theoretical Chemical principles and engineering applications, providing students with a foundation solve real-world problems and design products

COURSE OBJECTIVES:

The objectives of this course are to

1. To familiarize Applied Chemistry and its application.
2. To train the students on the principles and applications of electrochemistry and polymers
3. To elucidate the Structure and bonding of molecules
4. To impart Basic concepts of Semiconductors
5. To introduce modern engineering materials
6. To introduce instrumental methods, chromatographic technique

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Describe Molecular orbital diagrams
CO2	Importance of Graphenes. Apply the principle of band diagrams in the application of Super conductors and semiconductors.
CO3	Compare the Materials of Construction for Battery and Electro Chemical Sensors.
CO4	Explain the Preparation, Properties and applications of thermos plastics and thermos setting plastics, Elastomers and conducting polymers.
CO5	Summarize the concepts of instrumental methods

COURSE CONTENT(SYLLABUS)

UNIT- I: Structure and Bonding models **10 hours**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory–bonding in homo-and hetero nuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbital's of butadiene and Benzene, calculation of bondorder. **COs-CO1**

Self-Learning Topics: Energy Level Diagrams of N2 & CN Molecule.

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UNIT- II: SeriesModern Engineering materials **10 hours**

Semiconductors – Introduction, Classification semiconductor devices P-N junction diode as a rectifier and transistor, applications.Super conductors- Introduction basic concept, Classification, applications.
Super capacitors: Introduction , Basic Concept-Classification–Applications.
Nanomaterial: Introduction, classification, properties and applications of Fullerenes, carbon nanotubes and

Graphenes **COs-CO2**

Self Learning Topics: Band Theory of Solids, Sol-Gel method.

UNIT- III: Electrochemistry and Applications: 14 hours

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry-potentiometric titrations(redoxtitrations), concept of conductivity,conductivitycell Conductometry-conducto metric titrations (acid-base titrations). Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primarycells–Zinc-airbattery,Secondarycells–lithium-ionbatteries-working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. **COs-CO3**

Self-Learning Topics: Frequency dependence of polarization.

UNIT- IV: Polymer Chemistry 14 hours

Introduction to polymers,functionality of monomers, chain growth and step growth polymerization, Coordination polymerization,with specific examples and mechanisms of polymerformation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of –PVC, Teflon,Bakelite,Nylon-6 6, carbon fibres.

Elastomers– Buna-S,Buna-N–preparation, properties and applications.

Conducting polymers–polyacetylene mechanism of conduction and applications.

Bio-Degradablepolymers-Poly Glycolic Acid(PGA),Poly Lactic Acid (PLA). C**Os-CO4**

Self Learning Topics: Differences between Thermo and Thermo Setting Plastics.Vulcanization of Rubber

UNIT- V: Instrumental Methods and Applications 10 hours

Electromagnetic spectrum.Absorption of Radiation:Beer-Lambert'slaw.UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC:Principle,Instrumentation and Applications. **COs-CO5**

Self Learning Topics: Intensity Shifts in UV-Spectroscopy, Gas Chromatography.

TEXT BOOKS:

1. JainandJain, Engineering Chemistry,16/e,DhanpatRai,2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford UniversityPress,2010

REFERENCE BOOKS:

1. Skoog and West, Principles of Instrumental Analysis, 6/e,Thomson,2007.
2. J.D.Lee,Concise Inorganic Chemistry,5thEdition,WileyPublications,Feb.2008
3. Text book of PolymerScience, FredW.BillmayerJr,3rdEdition.

Web References:

1. https://swayam.gov.in/nc_details/NPTEL
2. https://onlinecourses.nptel.ac.in/noc19_cy29
3. https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-cy50

Problem Solving & Programming with C
I B.TECH- I SEMESTER (Common to all Branches)

Course Title: **Problem Solving & Programming with C**	Course Code: **24ES02**
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: for learning C programming, a strong background in problem-solving skills and an understanding of data structures and algorithms.	

COURSE OVERVIEW:

1. To understand computer programming and its roles in problem solving.
2. To understand and develop well-structured programs using C language.

COURSE OBJECTIVES:

The objectives of this course are to:

1. To impart adequate knowledge on the need of programming languages and problem-solving techniques and develop programming skills.
2. To express algorithms and draw flowcharts in a language independent manner.
3. To enable effective usage of Operators &Control Structures.
4. To learn about the design concept of Arrays, Strings and Functions.
5. To understand Structures and Unions and their usage.
6. To assimilate about Pointers, Dynamic Memory Allocation and know the significance of Pre-processors, perform operations on files.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Illustrate the fundamental concepts of computers and basic computer programming and problem-solving approach.
CO2	Understand the Control structures, Branching and Looping.
CO3	Make use of Arrays and Develop Programs on modular programming using functions and strings.
CO4	Demonstrate the ability to write programs using Structures and Unions.
CO5	Apply File handling operations.

COURSE CONTENT (SYLLABUS)

UNIT-I: Introduction to Programming and Algorithm for Problem Solving: 10 Hours

Introduction to Programming: The Basic Model of Computation, Algorithms, Flow-charts, Programming Languages, Compilation, Linking and Loading, Testing and Debugging, Documentation,

Algorithm for Problem Solving: Exchanging values of two variables, summation of a set of numbers, Decimal Base to Binary Base conversion, Reversing digits of an integer, GCD (Greatest Common Division) of two numbers, Test whether a number is prime, Organize numbers in ascending order, Find square root of a number, factorial computation, Fibonacci sequence, Evaluate 'sin x' as sum of a series, Reverse order of elements of an array, Find largest number in an array, Print elements of upper triangular matrix, multiplication of two matrices, Evaluate a Polynomial. **COs–CO1**
Self-Learning Topics: Compilation and Interpretation

UNIT- II: Introduction to the 'C' Programming **15 Hours**

Introduction: Character set, Variables and Identifiers, Built-in Data Types, Input/output statements, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Type Casting and Type def Simple 'C' programs.Storage Classes**:** Scope and extent, Storage Classes in a single source file: auto, extern and static, register, Storage Classes in multiple source files: extern and static.

Conditional Statements and Loops: Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, Break statement, Go to statement. **COs-CO2**

Self-Learning Topics: Escape Sequences

UNIT – III: Arrays **15 Hours**

Arrays: One dimensional array: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; two dimensional arrays with examples.

Strings: Concepts, String Types, String Input / Output functions, String manipulation functions, Null terminated strings as array of characters, **COs–CO3**

Self-Learning Topics: String Pattern Matching

UNIT- IV: Functions&Pointers **15 Hours**

Functions: Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, passing arguments to a Function: call by reference; call by value, Recursive Functions, arrays as function arguments, Standard library string functions..

Pointers: Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation. **COs– CO4**

Self-Learning Topics: How do you pass a structure to a function?

UNIT-V: Structures and Unions **10 Hours**

Structures and Unions: Structure variables, initialization, structure assignment, nested structure, structures and functions, structures, and arrays: arrays of structures, structures containing arrays, unions, Enumeration.

File Processing: Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input/output functions (standard library input/output functions for files), file status functions (error handling), Positioning functions **Cos-CO5**
Self-Learning Topics: Binary Files and operations on Binary files

TEXT BOOKS:

1. Byron S Gottfried “Programming with C” Second edition, Tata McGrawhill, 2007 (Paperback)
2. R.G. Dromey, “How to solve it by Computer”, Pearson Education, 2008.
3. Kanetkar Y, “Let us C”, BPB Publications, 2007.
4. 4. Hanly J R & Koffman E.B, “Problem Solving and Program design in C”, Pearson Education, 2009.

REFERENCE BOOKS:

1. E. Balaguruswamy, “Programming with ANSI-C”, Fourth Edition,2008, Tata McGraw Hill.
2. Venugopal K. R and Prasad S. R, “Mastering ‘C’”, Third Edition, 2008, Tata McGraw Hill.
3. B.W. Kernighan & D. M. Ritchie, “The C Programming Language”, Second Edition, 2001, Pearson Education
4. ISRD Group, “Programming and Problem-solving Using C”, Tata McGraw Hill, 2008.
5. Pradip Dey, Manas Ghosh, “Programming in C”, Oxford University Press, 2007.

Web References:

1. http://www.c4learn.com/
2. http://www.geeksforgeeks.org/c/
3. http://nptel.ac.in/courses/122104019/
4. http://www.learn-c.org/
5. https://www.tutorialspoint.com/c programming/

Engineering Graphics

I B.TECH- I SEMESTER (Common to All Branches)

Course Title : Engineering Graphics	Course Code : R24ES06
Teaching Scheme (L:T:P): 1:0:4	Credits: 3
Type of Course: Lecture + Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites:	

COURSE OVERVIEW:

- The Engineering Graphics and Drawing course provides essential skills in visualizing and representing three-dimensional objects on two-dimensional media. Through structured units, students learn fundamentals such as line work, lettering, dimensioning, and geometric construction. The syllabus includes constructing curves, understanding scales, and mastering orthographic and isometric projections, essential for accurately depicting objects in engineering design.
- Additionally, students gain experience with computer-aided drafting using AutoCAD, learning to create 2D and 3D drawings and perform basic transformations. This course provides a strong foundation for technical drawing, crucial for design, manufacturing, and communication in engineering.

COURSE OBJECTIVES:

The objectives of this course are to

1. Understand the fundamentals of engineering drawing, including lines, lettering, and dimensioning.
2. Develop skills in geometrical constructions, including regular polygons and curves.
3. Learn orthographic projection techniques, including projections of points, lines, and planes.
4. Understand how to project solids in simple positions and create sectional views.
5. Develop skills in converting isometric views to orthographic views and vice versa.
6. Apply computer-aided design (CAD) techniques using AutoCAD to create 2D and 3Ddrawings.
7. Understand the importance of reference planes and reference lines in orthographic projection.
8. Develop problem-solving skills in engineering drawing, including creating and interpretingdrawings.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand the basics of EngineeringGraphics to construct the polygon, curves,and scales.
CO2	Draw the orthographic projections of points and straight lines inclined to both the planes.
CO3	Draw the projections of planes in variousconditions.
CO4	Draw the projections of regular solids, with its axis inclined to one plane and sections of solids.
CO5	Visualize the 3D isometric views from 2Dorthographic views and vice versa along with basic introduction to CAD.

COURSE CONTENT (SYLLABUS)

UNIT -I:

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general method.

Curves: construction of ellipse, parabola, and hyperbola by general method, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT-II:

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections ofa point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes.

UNIT-III:

Projections of Planes: Regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT-IV:

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of sections for simple position only.

UNIT-V:

Conversion of Views: Conversion of isometric views to orthographic views and Conversion of orthographic views to isometric views for simple objects only.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformationsusing Auto CAD (Not for end examination).

TEXT BOOKS:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House.

REFERENCE BOOKS:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc.
3. Engineering Drawing with an Introduction to AutoCAD, DhananjayJolhe, Tata McGraw Hill.

ONLINE RESOURCES:

1. https://www.iitg.ac.in/rkbc/me111.htm
2. https://archive.nptel.ac.in/courses/112/105/112105294/

E-BOOKS:

https://www.pdfdrive.com/textbook-of-engineering-drawing-e28918244.html

Basic Electrical and Electronics Engineering
I B.TECH- I SEMESTER (Common to ECE & EEE)

Course Title: Basic Electrical and Electronics Engineering	Course Code: R24ES05
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: Solid state physics, Linear algebra, calculus.	

COURSE OVERVIEW:

- This course introduces to the concepts and definitions of Ohms law, KCL, KVL, power and energy. By applying Kirchhoff's current and voltage laws to circuits in order to determine voltage, current and power in branches of any circuits excited by DC voltages and current sources. Apply simplifying techniques to solve DC circuit problems using basic circuit theorems and structured methods like node voltage and mesh current analysis. This course also introduces the construction and operating principle of AC machines, DC machines, Generators and Transformers.
- This course explores the evolution of electronics, characteristics of PN junction and Zener diodes, and bipolar junction transistors in various configurations. It includes rectifiers, power supplies, and amplifiers, focusing on circuit diagrams and frequency responses and covers number systems, Boolean algebra, and logic gates, along with simple combinational circuits like adders. It also introduces sequential circuits, including flip-flops and counters, and concludes with a block diagram of an electronic instrumentation system.

COURSE OBJECTIVES:

The objectives of this course are to

1. To expose to the field of electrical & electronics engineering.
2. To understand the importance of electrical safety.
3. To teach the fundamentals of semiconductor devices and its applications.
4. To teach the working process and analysis of different rectifying and Amplifying Circuits.
5. To teach the fundamental principles and rules of digital electronic circuits like gates, Sequential and Combinational Circuits.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand the problem-solving concepts associated to AC and DC circuits
CO2	Remember the fundamental laws, construction and operation of AC and DC machines, instruments.
CO3	Understand different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.
CO4	Understand the fundamental principles of electronic devices, analyzing the different rectifying and Amplifying Circuits.
CO5	Analyze and design different digital electronic circuits like gates, Sequential and Combinational Circuits and Understand the basic Electronic instrumentation system.

COURSE CONTENT (SYLLABUS)

Part A-BASIC ELECTRICAL ENGINEERING

UNIT -I: DC & AC Circuits

DC Circuits: Electrical circuit elements (R, Land C),Ohm's Law and its limitations, KCL& KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

COs – CO1

Self-Learning Topics: Source Transformation

UNIT-II: Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

COs – CO2

Self-Learning Topics: Magnetic materials.

UNIT-III: Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of house hold appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

COs– CO3

Self-Learning Topics: Different types of electrical tools.

Part B: ELECTRONICS ENGINEERING

UNIT-IV: Semiconductor Devices and Basic Electronic Circuits

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Breakdown Effects in diodes — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Introduction to Small Signal CE configuration. Rectifiers and power supplies: Block diagram description of a dc power supply, Half-Wave Rectifiers, Full-Wave Rectifiers, capacitor filter (no analysis). Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response.

COs –CO4

Self-Learning Topics: Electronic components and characteristics, Design Amplifier circuit at different R, C Values

UNIT -V: DIGITAL ELECTRONICS and INSTRUMENTTAION

Overview of Number Systems, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits– Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only), Electronic Instrumentation: Block diagram of an electronic instrumentation system

COs–CO5

Self-Learning Topics: Develop digital circuits using minimum no. of gates, design principles of electronic instruments.

TEXT BOOKS:

1. Basic Electrical Engineering, D.C.Kulshreshtha,Tata McGrawHill,2019,First Edition.
2. Power System Engineering, P.V.Gupta, M.L.Soni, U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co, 2013.
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition
4. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.
5. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

REFERENCE BOOKS :(Basic Electrical Engineering)

1. Basic Electrical Engineering, D.P.Kothari and I.J.Nagrath, McGrawHill, 2019,Fourth Edition.
2. Principles of Power Systems, V.K.Mehtha, S.Chand Technical Publishers, 2020.
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S.Sukhija, Oxford University Press, 2017.
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Pearson Publications,2018, Second Edition.

REFERENCE BOOKS: Electronics Engineering

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, PrenticeHall,India, 2002.
3. R.T.Paynter, Introductory Electronic Devices & Circuits – Conventional FlowVersion,Pearson

ONLINE RESOURCES:

Web References: (Basic Electrical Engineering)

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

Web References: (Electronics Engineering)

1. https://archive.nptel.ac.in/courses/108/101/108101091/
2. https://www.tutorialspoint.com/basic_electronics/index.htm
3. https://www.tutorialspoint.com/digital_circuits/index.htm

E-BOOKS:

https://www.pdfdrive.com/basic-electronics-for-scientists-and-engineers-e28939124.html

APPLIED CHEMISTRY LAB

I B.TECH-I SEMESTER

Course Title: APPLIED CHEMISTRY LAB	Course Code: **R24BS06**
Teaching Scheme(L:T:P): 0:0:2	Credits:1
Type of Course: Practical	
Continuous Internal Evaluation:30Marks	Semester End Exam: 70Marks
Prerequisites:	

COURSE OVERVIEW:

To succeed in an *APPLIED CHEMISTRY Lab* course, certain foundational skills and knowledge are necessary for effective participation and understanding. Here are the key prerequisites:

1. Basic Chemistry Knowledge
2. Measurement
3. Basic Laboratory Skills
4. Problem-Solving and Analytical Skills
5. Familiarity with Safety Practices

COURSE OBJECTIVES:

1.Verify the fundamental concepts with experiments.

2 Learn and carry out some of the important experiments related to batteries and their properties.

3. Learn the preparation of engineering polymer materials like Bakelite

4. Know the fundamental principles of chemistry lab experiments which include volumetric analysis, dichrometry, conductometry and potentiometer

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Determine the cell constant an conductance of solutions. Determine redox potentials
CO2	Prepare advanced polymer Bakelite materials. Calculate strength of acid in Pb-Acid battery and Ferrous Iron by Dichrometry
CO3	Measure the strength of an acid present in secondary batteries. Moisture content in a coal sample.

COURSE CONTENT(SYLLABUS)

List of Experiments

1.Conductometric titration of strong acid vs. strong base

2. Conductometric titration of weak acid vs. strong base

3. Determination of cell constant and conductance of solutions

4. Potentiometry - determination of redox potentials and emfs

5. PH metric titration – determination of Strength of Strong acid vs Strong base

6. Determination of Strength of an acid in Pb-Acid battery

7. Determination of Hardness of Water

8. Determination of $KMnO_4$ Using Standard Oxalic Acid Solution

9. Adsorption of acetic acid by charcoal

10. Estimation of Ferrous Iron by Dichrometry

11.Preparation of a Bakelite

12.Preparation of nanomaterials by precipitation method.

REFERENCEBOOKS:

Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

Problem Solving &Programming with C Lab
I B.TECH- I SEMESTER (Common to all Branches)

Course Title: **Problem Solving &Programming with C Lab**	Course Code: **R24ES03**
Teaching Scheme (L:T:P): **0 0 3**	Credits: 1.5
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: **Problem Solving & Programming with C lab include: Understanding programming fundamentals, Writing C programs, Applying programming techniques, Using algorithms, Using pseudocode and flowcharts**	

COURSE OVERVIEW:

3. To understand computer programming and its roles in problem solving.
4. To understand and develop well-structured programs using C language.

COURSE OBJECTIVES:

The objectives of this course are to:

The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Read, understand, and trace the execution of programs written in C language.
CO2	Select the right control structure for solving the problems .and demonstrate the application of arrays functions and strings
CO3	Develop Debug and Execute programs to demonstrate the applications of Pointers, Structures& Unions, and Files.

COURSE CONTENT (SYLLABUS)

Developing the following programs:

Week 1:

1. Write a C program using printf() and Scanf(). COs:CO1
2. Write a C program on swapping of two nos. COs:CO1
3. Write a C program using arithmetic Expressions. COs:CO1

Week 2:

4. Simple interest calculation COs:CO2
5. Finding compound interest COs:CO2
6. Area of a triangle using heron's formulae COs:CO2
7. Distance travelled by an object COs:CO2

Week 3:

8. Find the maximum of three numbers using conditional operator COs:CO2

9. Take marks of 5 subjects in integers, and find the total, average in float COs:CO2
10. Write a C program to shift/rotate using bit fields. COs:CO2
11. Finding the square root of a given number COs:CO2
12. Write a C program using if-else statement. COs:CO2

Week 4:

13. Write a C program to find the max and min of four numbers using if-else. COs:CO2
14. Write a C program to generate electricity bill. COs:CO2
15. Find the roots of the quadratic equation. ` COs:CO2
16. Write a C program to find the given year is a leap year or not. COs:CO2
17. Write a C program to simulate a calculator using switch case. COs:CO2

Week 5:

18. Find the factorial of given number using any loop. COs:CO2
19. Find the given number is a prime or not. COs:CO2
20. Compute sine and cos series. COs:CO2
21. Checking a number palindrome. COs:CO2
22. Construct a pyramid of numbers. COs:CO2

Week 6:

23. Write a C program on Linear Search. COs:CO3
24. Find the min and max of a 1-D integer array. COs:CO3
25. Perform linear search on1D array. COs:CO3
26. The reverse of a 1D integer array. COs:CO3

Week 7:

27. Find 2's complement of the given binary number. COs:CO3
28. Eliminate duplicate elements in an array. COs:CO3
29. Sort array elements using bubble sort. COs:CO3
30. Addition of two matrices. COs:CO3

Week 8:

31. Multiplication two matrices. COs:CO3
32. Write a C program using call by reference. COs:CO3
33. Write a C program to find factorial of n using recursion. COs:CO3
34. Write a C function to calculate NCR value COs:CO3
35. Concatenate two strings without built-in functions. COs:CO3

Week 9:

36. Write a C function to transpose of a matrix. COs:CO3
37. Write a C function to find the length of a string. COs:CO3
38. Reverse a string using built-in and without built-in string functions. COs:CO3
39. Write a C program to find the sum of a 1D array using malloc ( ). COs:CO3

Week 10:

40. Write a recursive function to find the lcm of two numbers. COs:CO3
41. Write a recursive function to find the sum of series. COs:CO3
42. Write a C program to swap two numbers using call by reference. COs:CO3
43. Write a C program using Pointers, Structures and Unions. COs:CO4
44. Write a C program to find the total, average of n students using structures. COs:CO4

Week 11:

45. Enter n students data using calloc() and display failed students list. COs:CO4
46. Read student name and marks from the command line and display the student details along with the total. COs:CO4
47. Write a C program to implement realloc(). COs:CO4
48. Write a C program to copy one structure variable to another structure of the same type. COs: CO4

Week 12:

49. Demonstrate Dangling pointer problem using a C program. COs: CO4
50. Write a C program to copy one string into another using pointer. COs: CO4
51. Write a C program to find no of lowercase, uppercase, digits and other characters using pointers. COs: CO4

Week 13:

52. Write a C program using Files operations. COs:CO5
    a. Sum and average of 3 numbers
    b. Conversion of Fahrenheit to Celsius and vice versa.
53. Write a C program to write and read text into a file. COs:CO5

Week 14:

54. Write a C program to write and read text into a binary file using fread() and fwrite() COs:CO5
55. Copy the contents of one file to another file. COs:CO5
56. Write a C program to merge two files into the third file using command-line arguments. COs:CO5

Week 15:

57. Find no. of lines, words and characters in a file. COs:CO5
58. Write a C program to print last n characters of a given file. COs:CO5

Scenario Based Case Study:

1. **Objective:** To develop a simple utility program to calculate the area of geometric shapes.

   Target Audience: Beginner programmers and students.

A basic utility program in C that can:

1. Calculate the area of a circle.

2. Calculate the area of a rectangle.

3. Calculate the area of a triangle.

The program should be easy to understand and serve as an educational tool for new programmers.

1. Program Design:

- The utility program will be designed with a simple menu-driven interface allowing the user to select the shape for which they want to calculate the area. The program will then prompt the user to input the necessary dimensions and display the result.
- This basic C program demonstrates fundamental programming concepts such as variables, functions, and control structures in a practical context. It provides a clear introduction to C programming for

beginners by solving a simple problem using these core concepts.

- This case study outlines a straightforward approach to teaching and implementing basic C programming concepts effectively.

2. Students Marks Sum Hacker Rank Solution

- You are given an array of integers, marks, denoting the marks scored by students in a class.
- The alternating elements marks0, marks2, marks4 and so on denote the marks of boys.
- Similarly,marks1, marks3, marks5 and so on denote the marks of girls.
- The array name, marks, works as a pointer which stores the base address of that array. In other words, marks contains the address where marks0 is stored in the memory.

3. Sorting Array of Strings Hacker Rank Solution

- To sort a given array of strings into lexicographically increasing order or into an order in which the string with the lowest length appears first, a sorting function with a flag indicating the type of comparison strategy can be written. The disadvantage with doing so has to rewrite the function for every new comparison strategy.
- A better implementation would be to write a sorting function that accepts a pointer to the function that compares each pair of strings. Doing this will mean only passing a pointer to the sorting function with every new comparison strategy.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

Basic Electrical and Electronics Engineering Lab
I B.TECH- I SEMESTER (Common to ECE & EEE)

Course Title: Basic Electrical and Electronics Engineering Lab	Course Code: R24ES07
Teaching Scheme (L:T:P): 0:0:3	Credits: 1.5
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: Understanding of Circuit Components, Breadboard connections.	

COURSE OVERVIEW:

In this lab, the students of all engineering streams are trained on basic concepts of electrical engineering, such as DC circuits, AC circuits, Resonance for series RLC and Parallel RLC circuit, AC to DC conversion, measurement, Efficiency and voltage regulation of transformer, electrical machines, verification of basic laws and theorems.

COURSE OBJECTIVES:

The objectives of this course are to impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
CO2	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
CO3	Plot and discuss the characteristics of various electron devices/instruments.
CO4	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.
CO5	Understand the usage of electronic measuring instruments.
CO6	Plot and discuss the characteristics of various electron devices.

List of Experiments:

Part A-Basic Electrical Engineering

1. Verification of KCL and KVL **COs: CO1**
2. Verification of Superposition theorem **COs: CO1**
3. Measurement of Resistance using Wheat stone bridge **COs: CO1**
4. Magnetization Characteristics of DC shunt Generator **COs: CO1**
5. Measurement of Power and Power factor using Single-phase wattmeter **COs: CO2**
6. Verification of ohms law **COs: CO1**
7. Calculation of Electrical Energy for Domestic Premises **COs: CO3**

Part B: Basic Electronics Engineering

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias. **COs: CO3**
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator **COs: CO3**
3. Implementation of half wave and full wave rectifiers **COs: CO3**
4. Plot Input & Output characteristics of BJT in CE and CB configurations **COs: CO3**
5. Frequency response of CE amplifier. **COs: CO3**
6. Simulation of RC coupled amplifier with the design supplied **COs: CO3**
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates

using ICs. **COs: CO2**

8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. **COs: CO2**

REFERENCE BOOKS:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti,Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition
4. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
5. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
6. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Engineering Workshop
I B.TECH- I SEMESTER (Common to All Branches)

Course Title : Engineering Workshop	Course Code: R24ES08
Teaching Scheme (L:T:P): 0:0:3	Credits: 1.5
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites:	

COURSE OVERVIEW:

- The Engineering Workshop Lab introduces students to essential hands-on skills across multiple trades, fundamental for understanding material manipulation, joining techniques, and assembly processes. Through eight core experiments, students learn woodworking, sheet metal fabrication, fitting, foundry molding, welding, electrical wiring, plumbing, and blacksmithing. These exercises build practical knowledge in creating structures, forming metal parts, achieving precision fits, casting molds, and assembling electrical and plumbing systems. This workshop lays a solid foundation for understanding and applying basic engineering processes, crucial for practical problem-solving and project execution in various engineering fields.

COURSE OBJECTIVES:

The objectives of this course are to

- Describe how different tools are used in home wiring, tin smiting, blacksmithing, carpentry, and fitting.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Identify workshop tools and their operational capabilities. Practice on manufacturing of components using workshop trades including carpentry, fitting, sheet metal
CO2	Practice on manufacturing ofcomponents using workshop trades including foundry and welding.
CO3	Apply fitting operations in various applications and engineering knowledge for Plumbing, House Wiring Practice, and Making square rod and L-bend from the round rod in black smithy

COURSE CONTENT (SYLLABUS)

1. Wood Working

a) Half Lap joint
b) Mortise and Tenon joint
c) Corner Dovetail joint or Bridle joint

2. Sheet Metal Working

a) Tapered tray
b) Conical funnel
c) Elbow pipe
d) Brazing

3. Fitting

a) V- fit
b) Dovetail fit

c) Semi-circular fit
d) Bicycle tire puncture and change of two-wheeler tyre

4. **Foundry Trade:** Preparation of Green Sand Moulds
   a) Single piece pattern
   b) Double piece pattern

5. **Welding Shop: Arc welding Practice**
   a) Lap joint
   b) Butt joint
6. **Electrical Wiring**
   a) Parallel and series connection
   b) Two-way switch connection
   c) Tube light connection
   d) Soldering of wires
7. **Plumbing**
   a) Prepare Pipe joint with coupling for 1 inch diameter
   b) Prepare Pipe joint with coupling for 1.5inch diameter
8. **Black smithy**
   a) Round rod to Square
   b) Round rod to S-Hook

TEXT BOOKS:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 &2017

REFERENCE BOOKS:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan 2021-22

ONLINE RESOURCES:

1. https://youtube.com/playlist?list=PLzkMouYverALpuDJ4g4TiICc6_vLcS1Ny&si=YGrVJY8uB0tHy_iQ

E-BOOKS:

1. https://www.pdfdrive.com/workshop-processes-practices-and-materials-third-edition-d158706794.html
2. https://www.pdfdrive.com/introduction-to-basic-manufacturing-processes-and-workshop-e217530.html
3. https://www.pdfdrive.com/workshop-technology-e55714020.html

HEALTH AND WELLNESS, YOGA AND SPORTS
I B.TECH- I SEMESTER (Common to all Branches)

Course Title: **HEALTH AND WELLNESS, YOGA AND SPORTS**	Course Code: **R24MC01**
Teaching Scheme (L:T:P): 0:0:1	Credits: 0.5
Type of Course: Practical	
Continuous Internal Evaluation: 100 Marks	Semester End Exam: 0 Marks
Pre requisites: Prerequisites for courses in **Health and Wellness, Yoga, and Sports** can vary by institution and program. However, here's a general outline of common prerequisites and recommended qualifications for these types of courses.	

COURSE OVERVIEW:

Here's a general course overview for programs in **Health and Wellness**, **Yoga**, and **Sports**. Each area may have specific courses and focuses depending on the institution, but this will provide a foundational understanding of what to expect.

Health and Wellness

- **Overview**: This program focuses on promoting overall health, wellness strategies, and preventive health measures. It often includes the study of physical, mental, and social well-being.
- **Core Courses**:
  - **Introduction to Health and Wellness**: Basics of health concepts, wellness promotion, and lifestyle choices.
  - **Nutrition and Health**: Understanding dietary needs, nutritional guidelines, and the role of nutrition in health.
  - **Mental Health and Wellness**: Exploring psychological well-being, stress management, and mental health issues.
  - **Exercise Physiology**: The study of how physical activity affects the body and mind.
  - **Health Education and Promotion**: Strategies for promoting health within communities and organizations.
- **Practical Experience**: Some programs may include internships or fieldwork in health settings, community organizations, or wellness programs.

1. Yoga

- **Overview**: Yoga programs typically cover the physical, mental, and spiritual aspects of yoga practice. They can be geared toward practitioners or those looking to teach.
- **Core Courses**:
  - **Yoga Philosophy**: Study of the history and philosophy of yoga, including key texts and principles.
  - **Asana Practice**: Detailed exploration of yoga postures (asanas), including alignment, modifications, and variations.
  - **Meditation and Pranayama**: Techniques for breath control and meditation practices.
  - **Anatomy for Yoga**: Understanding the human body in relation to yoga practice, focusing on anatomy and physiology.
  - **Teaching Methodology**: Instruction on how to teach yoga classes, including class planning, communication skills, and sequencing.
- **Practical Experience**: Teaching practice sessions, observation of experienced teachers, and peer teaching.

Sports

- **Overview**: Sports programs often encompass a broad understanding of physical education, sports science, coaching, and athletic training.
- **Core Courses**:
  - **Introduction to Sports Science**: Overview of the key principles in sports science, including biomechanics and exercise physiology.
  - **Coaching Principles**: Theories and techniques related to effective coaching and athlete development.
  - **Sport Psychology**: Understanding the mental aspects of sports performance and strategies for enhancing motivation and focus.
  - **Exercise and Sport Nutrition**: Nutrition principles specifically tailored for athletes and active individuals.
  - **Sport Management**: Insights into the business side of sports, including marketing, finance, and event management.

COURSE OBJECTIVES:

The objectives of this course are to:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand the importance of yoga and sports for Physical fitness and sound health.
CO2	Demonstrate an understanding of health-related fitness components.
CO3	Compare and contrast various activities that help enhance their health.
CO4	Assess current personal fitness levels.
CO5	Develop Positive Personality

COURSE CONTENT (SYLLABUS)

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball,Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
ii) Practicing general and specific warm up, aerobics
iii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022

2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice

3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993

4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014

5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.

2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.

3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Differential Equations and Vector Calculus
I B.TECH- II SEMESTER (Common to all Branches)

Course Title: **Differential Equations and Vector Calculus**	Course Code: R**24BS04**
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: To succeed in Differential Equations and Vector Calculus, you'll need a strong foundation in several key areas of mathematics. Here are the typical prerequisites: Calculus I (Single-variable Calculus), Calculus II (Single-variable Calculus, continuation), Calculus III (Multivariable Calculus), Linear Algebra.	

COURSE OVERVIEW:

This course is often taken after completing Calculus I, II, and III, and Linear Algebra. It combines methods and applications of differential equations with essential topics in vector calculus, as used in fields like physics, engineering, and applied mathematics.

COURSE OBJECTIVES:

The objectives of this course are to:

1. To enlighten the learners in the concept of differential equations and multivariable calculus.
2. To furnish the learners with basic concept and techniques at plus two level to lead them in to advanced level by handling various real-world applications.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Solve the first order differential equations related to various engineering fields.
CO2	Model engineering problems as higher order differential equations and solve analytically.
CO3	Identify solution methods for partial differential equations that model physical processes.
CO4	Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO5	Estimate the work done against a field, circulation and flux using vector calculus.

COURSE CONTENT (SYLLABUS)

UNIT- I: Differential equations of first order and first degree **10 Hours**

Formation of differential equations, order, degree, separation of variables (only Review). Linear differential equations-Bernoulli's equations-Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling – Law of natural growth and decay, Electrical circuits (RL and LC). **COs-CO1**

Self-Learning Topic: Mixed tank problems

UNIT- II: Higher order Linear differential equations with Constant Coefficients **10 Hours**

Definitions, homogenous and non-homogenous, complimentary function, particular integral $\left(e^{ax}, \sin ax, \cos ax, \text{Polynomial in } x, e^{ax}V(x), xV(x)\right)$, general solution, Wronskian, method of variation of parameters.

Applications: L-C-R Circuit problems **COs-CO2**

Self-Learning Topic: Simple Harmonic motion

UNIT–III: Partial Differential Equations **10 Hours**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solution of first order linear equations using Lagrange's method. Homogenous Linear Partial differential equations with constant coefficients. **COs-CO3**

Self-Learning Topic: Method of Separation of Variables

UNIT- IV: Vector differentiation **10 Hours**

Vector, Scalar, dot product, cross product, unit vector, equation of a line passing through two points (Review only)

Scalar and vector point functions, vector operator del, del applies to scalar point function-Gradient, del applied to vector point function – Divergence and Curl, Vector Identities

Application: Scalar Potential **COs-CO4**

Self-Learning Topic: Equation of tangent plane and Normal plane.

UNIT-V: Vector integration **10 Hour**

Line integral – circulation – work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

COs-CO5

Self-Learning Topic: Application of above theorems.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Michael Green berg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science
5. International Ltd., 2021 (9th reprint).
6. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017.

Web References:

1. http://onlinecourses.nptel.ac.in
2. https://nptel.ac.in/courses/111105121
3. https://onlinecourses.nptel.ac.in/noc24_ma86/course

ENGG PHYSICS
I B.TECH- II SEMESTER (Common to ECE,EEE,MEC)

Course Title: Engg.Physics	Course Code: **R24BS02**
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites:	

COURSE OVERVIEW:

An *Engineering Physics* course is typically designed to bridge the gap between theoretical physics principles and engineering applications, providing students with a solid foundation to analyze and solve complex engineering problems.

COURSE OBJECTIVES:

The objectives of this course are to

1. bridge the gap between the physics in school at 10+2 level and UG level engineering courses.
2. identify the importance of the optical phenomenon i.e. interference and diffraction related to its engineering applications.
3. understand the mechanism of emission of light, utilization of lasers as coherent light sources for low and high energy applications.
4. enlightening the periodic arrangement of atoms in crystalline solids and classify various crystal systems.
5. explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
6. enlightenment of the concepts of quantum mechanics and to provide fundamentals of de-Broglie matter waves and the importance of free electron theory for metals.
7. understand the physics of semiconductors and identify the type of semiconductor using Hall effect.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Analyze the intensity variation of light due to interference, diffraction and classify various types of lasers.
CO2	Identify various crystal systems and analyze the crystalline structure.
CO3	Summarize various types of polarization of dielectrics and classify the magnetic materials.
CO4	Explain fundamentals of quantum mechanics and apply to one dimensional motion of particles.
CO5	Outline the properties of charge carriers in semiconductors

COURSE CONTENT (SYLLABUS)

UNIT-I Wave Optics **12 Hours**

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index
Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit- Fraunhofer diffraction due to N Slits -Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).
Lasers: Introduction–Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Population inversion – Lasing action - Pumping mechanisms – Ruby laser –He-Ne laser-Applications of lasers. **COs – CO1**

Self-Learning Topics: Interference in thin films due to Transmission of light

UNIT-II Crystallography and X-ray diffraction **12 Hours**

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.
X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods. **COs– CO2**

Self-Learning Topics: Effect of crystallite size on diffracted X-Ray intensity.

UNIT-III Magnetic and Dielectric Materials **12 Hours**

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro& Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.
Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector –Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius-Mossotti equation–dielectric loss. **COs– CO3**

Self-Learning Topics: Frequency dependence of polarization.

UNIT-IV Quantum Mechanics and Free electron theory **12 Hours**

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.
Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory –electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Fermi energy. **COs– CO4**

Self-Learning Topics: Density of states, Origin of energy bands in solids

UNIT-V Semiconductors **8 Hours**

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors:– Fermi level – Extrinsic semiconductors- P-Type semiconductors- N-Type semiconductors- principle of operation and characteristics of P-N Junction diode - Drift and diffusion currents –Einstein's equation - Hall effect and its applications. **COs – CO5**

Self-Learning Topics: Zener diode, Solar cells

TEXT BOOKS:

1. "ATextbook of EngineeringPhysics"by M.N. Avadhanulu, P.G.Kshirsagar-S.Chand Publications, 2017.
2. "Engineering Physics" byD. K. Bhattacharya and PoonamTandon,Oxfordpress (2015).
3. "Engineering Physics"byR.KGaur.and S.LGupta.,-Dhanpat Rai publishers, 2012.

REFERENCE BOOKS:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning.
2. The Principles of Quantum Mechanics, P. A. M. Dirac, fourth Edition (Oxford University Press,Oxford, 1958).
3. Physics-Resnick, Halliday, Krane, Fifth edison, Volume-1, Wiley student edition.
4. Engineering Physics - Dr.R. Swapna, Scientific International Publishing House.
5. Concepts of Modern Physics. Arthur Beiser, Tata McGraw-Hill, New Delhi (2010).
6. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
7. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

ONLINE RESOURCES:

Web References:

1. https://www.ebooksdirectory.com/
2. http://www.sciencedirect.com/Science
3. https://onlinecourses.nptel.ac.in/
4. https://www.link.springer.com/physics/
5. https://www.loc.gov/rr/scitech/selected-internet/physics.html

E-BOOKS:

1. https://www.ebooksdirectory.com/

COMMUNICATIVE ENGLISH
I B.TECH- II SEMESTER (Common to ECE,EEE&MECH)

Course Title: **COMMUNICATIVE ENGLISH**	Course Code: **R24HS01**
Teaching Scheme (L:T:P): **2 0 0**	Credits: 2
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: To excel in a *Communicative English* course, certain foundational skills and prerequisites are helpful such as Basic Grammar Knowledge, **Listening Skills,** Basic Vocabulary, Reading Comprehension, Confidence in Speaking, Writing Skills.	

COURSE OVERVIEW:

A *Communicative English* course is designed to develop students' proficiency in spoken and written English through practical and interactive learning methods. The course focuses on improving students' ability to communicate effectively in real-life situations, emphasizing both fluency and accuracy.

COURSE OBJECTIVES:
The objectives of this course are to:

1. To identify the English Communication Skills among the first year B.Tech students and to initiate measures to bridge the gap.
2. To enlighten the students on the necessity of cultivating good language habits through practising LSRW skills.
3 To explain them various topics of grammar and the importance of being grammatically correct in speech and writing.
4 To make them practise Phonetics and impart the nuances of fine speech.
5 To instruct them about the various types of format related to writing letters, paragraph, emails, essays and reports.
6 To make them appreciate English text and deepen their comprehension through reading of textual and non-detailed topics.

COURSE OUTCOMES:

CO#	**Course Outcomes**
CO1	To utilize the text, online resources, and other social, and real time situations with an aim to practice Communicative English
CO2	To apply grammatical knowledge for speaking, and writing purposes
CO3	To analyze and practice various devices of speech for effective conversation and presentations
CO4	Appraising the language competence of the learners and suggesting remedial action
CO5	To make the learners practice writing tasks which are relevant for job training and academic purposes.

COURSE CONTENT (**SYLLABUS**)

UNIT-I **12 Hours**

Lesson: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye (Short story)

Listening: Identifying the topic, the context and specific pieces of information
By listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words. **COs-C01**

Self learning topics : The Great Indian Scientists-Biography of CV Raman

UNIT-II **10 Hours**

Lesson: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian and contemporary)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices-linkers, use of articles and zero article prepositions.

Vocabulary: Homonyms, Homophones, Homographs. **COs-C02**

Self learning Topics : Seven Ages of Man by William Shakespeare.

UNIT-III **12 Hours**

Lesson: BIOGRAPHY: Steve Jobs

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs-tenses; Subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations **COs-C03**

Self learning topics: Elon Musk

UNIT-IV **8 Hours**

Lesson: INSPIRATION: The Knowledge Society by APJ Abdul Kalam (Ignited minds)

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/ patterns / relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters and Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons **COs-C04**

Self learning Topics: The writings of Sudha Murthy- "The day I stopped drinking milk"

UNIT-V **10 Hours**

Lesson: MOTIVATION: The Power of Intra personal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that

test comprehension.
Speaking: Formal Oral Presentation topics from academic contexts
Reading: Reading comprehension.
Writing: Writings structured essays on specific topics.
Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject-verb agreement)
Vocabulary: Technical Jargons **COs-C05**
Self learning Topics: Body Language (Allan Pease)

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition,Orient BlackSwan, 2023 (Units 1,2,3 &5)
2. Empowering English by Cengage Publications, 2023
3. The Great Indian Scientists-Cengage Publications
4. English Essentials- Maruthi Publications.(Unit 4)

Reference Books:

1. P. Elian : A Hand book of English for Engineers and Technologists,
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy Raymond English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. English for Engineers by Shyam Ji Dubey- Vikas Publishing House

Web References:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx
7. https://www.youtube.com/c/DailyVideoVocabulary/videos
8. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

BASIC CIVIL AND MECHANICAL ENGINEERING
I B.TECH- II SEMESTER (Common to ALL BRANCHES)

Course Title: Basic Civil and Mechanical Engineering	Course Code: R24ES01
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites:	

COURSE OVERVIEW:

- Basic Civil and Mechanical Engineering course provides a broad foundation for all engineering disciplines, equipping students with a holistic understanding of the principles, design methods, and innovations shaping each branch, fostering interdisciplinary knowledge and skills.
- This introductory course covers fundamental concepts in Civil and Mechanical Engineering, emphasizing their roles in society and diverse applications. In Civil Engineering, students explore various disciplines, including structural, transportation, water resources, and environmental engineering, along with essential materials and construction techniques, surveying, and advancements in sustainable practices.
- The Mechanical Engineering segment introduces students to core sectors such as energy, manufacturing, and automotive, along with basic design principles and engineering materials. Key topics include thermal engineering, power cycles, IC engines, and power plant operations, as well as principles in manufacturing, CNC, 3D printing, and robotics. This course provides a foundational understanding of both fields, preparing students for more specialized study and practical applications in engineering.

COURSE OBJECTIVES:

The objectives of this course are to

1. **Understand the Role of Civil Engineers**: Familiarize students with the roles and responsibilities of civil engineers in society and the various sub-disciplines within civil engineering.
2. **Construction Materials**: Provide knowledge about different construction materials such as cement, aggregates, bricks, concrete, steel, soil, stones and their applications in building construction.
3. **Transportation Engineering**: Offer insights into the importance of transportation engineering for national economic development and the fundamentals of highway pavements, harbor, tunnel airport and railway engineering.
4. **Water Resources and Environmental Engineering**: Cover the basics of water sources, water quality specifications, hydrology, rainwater harvesting, and water storage structures, emphasizing their importance in environmental sustainability.
5. **Scope and Importance of Mechanical Engineering**: Familiarize students with the scope and significance of mechanical engineering in various sectors, including energy, manufacturing, automotive, aerospace and marine industries.
6. **Engineering Materials and Manufacturing Processes**: Explain different engineering materials and various manufacturing processes and computational manufacturing.
7. **Thermal Engineering**: Provide an overview of thermal engineering principles, including the working of boilers, IC engines, and power plants, and introduce concepts related to electric and hybrid vehicles.
8. **Mechanical Power Transmission Systems**: Describe different mechanical power transmission systems such as belt drives, chain drives, gear drives, and their applications.
9. **Basics of Robotics**: Introduce the basics of robotics, including joints, links, configurations, and applications, along with advancements in robotics technology.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand the role of civil engineers in various disciplines, the scope of each discipline, and the materials used in building construction and principles of surveying.
CO2	Describe the fundamentals of transportationengineering, water resources, and environmental engineering, including highway pavements, water quality, hydrology, and water storage structures.
CO3	Understand and apply different manufacturing processes and engineering materials, including their applications, and basic mechanical design principles.
CO4	Explain the basics of thermal engineering, including working principles of engines, power plants, and related thermal cycles, along with their applications.
CO5	Describe the working of different mechanical power transmission systems and the basics of robotics and their applications.

COURSE CONTENT (**SYLLABUS**)

UNIT -I:

Role of Civil Engineers in Society, Various Disciplines of Civil Engineering, Structural Engineering, Geo-technical Engineering, Transportation Engineering, Hydraulics and Water Resources Engineering, Environmental Engineering, Scope of Each Discipline, Building Construction and Planning, Construction Materials Cement, Aggregate, Bricks, Cement Concrete- Steel, soils and stones. Introduction to Prefabricated construction Techniques.

Surveying: Objectives of Surveying, Horizontal Measurements, Angular Measurements, Introduction to Bearings Simple problems on bearings-Contour mapping.

Self-Learning Topic: Advancements in Prefabricated Construction Techniques

UNIT-II:

Transportation Engineering: Importance of Transportation in Nation's economic development, Types of Highway Pavements, Flexible Pavements and Rigid Pavements, Simple Differences. Basics of Harbor, Tunnel, Airport, and Railway Engineering

Water Resources and Environmental Engineering: Introduction, Sources of water, Quality of water, Specifications, Introduction to Hydrology, Rainwater Harvesting, Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Self-Learning Topic: Sustainable Transportation Engineering

UNIT-III:

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Basic Mechanical Design Principles: Fundamentals of Mechanical Design- Introduction to the design process, understanding design requirements, and conceptual design, Design of Simple Machine Components - Design considerations for basic machine components like shafts, bearings, gears, and fasteners.

Engineering Materials – Metals - Ferrous and Non-ferrous, Ceramics, Composites, Smart materials**.**

Self-Learning Topics: Sustainable Engineering Practices, Advancements in Smart Materials.

UNIT-IV:

Thermal Engineering–Working principle of Boilers

Cycles- Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles,
Engines-IC engines, 2-Stroke and 4-Strokeengines, SI/CI Engines,
Power plants – Working principle of Steam, Diesel, Hydro, Nuclear power plants, Introduction to Electric and Hybrid Vehicles.
Self-Learning Topics: Advanced Engine Technologies, Thermodynamics in Renewable Energy Systems.

UNIT-V:
Manufacturing Processes: Principles of Casting, Forming, joining processes,
Computational Manufacturing: Introduction to CNCmachines,3Dprinting and Smart manufacturing.
Machining– Conventional & Non-Conventional,
Mechanical Power Transmission-Belt Drives, Chain, Rope drives, Gear Drives and their applications.
Introduction to Robotics-Joints & links, configurations, and applications of robotics.
Self-Learning Topics: Additive Manufacturing Technologies, Innovations in Mechanical Power Transmission

TEXT BOOKS:

1. Basic Civil and Mechanical Engineering, by Ommi Srikanth, M.Sreenivasa Reddy S. Chand Publications
2. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
3. A Text book of Theory of Machines by S.S.Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
4. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, cengage learning India pvt. Ltd.

REFERENCE BOOKS:

1. Appuu Kuttan K K, Robotics, I.K.International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata Mc graw Hill publications (India)Pvt. Ltd.
4. G.Shanmugam and M.S.Palanisamy,BasicCivilandtheMechanical Engineering, Tata Mc graw Hill publications (India) Pvt. Ltd.

ONLINE RESOURCES:

1. https://www.youtube.com/playlist?list=PLyqSpQzTE6M_SM0Lrnzk2dJFwElh0Ebhu
2. https://nptel.ac.in/courses/105101087
3. https://archive.nptel.ac.in/courses/105/105/105105110/
4. https://archive.nptel.ac.in/courses/112/105/112105125/
5. https://www.youtube.com/watch?v=-cr5vfV4YAI
6. https://nptel.ac.in/courses/112105266
7. https://archive.nptel.ac.in/courses/112/104/112104301/

NETWORK ANALYSIS
I B.TECH- II SEMESTER (ECE)

Course Title: Network Analysis	Course Code: R24ECPC01
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: KVL, KCL, Nodal and Mesh analysis	

COURSE OVERVIEW:

- This course will build on the basic principles of electrical theories. The course will introduce classification of electrical elements, transformation techniques and reduction techniques of active and passive networks. Also it includes steady state analysis and transient analysis of AC and DC circuits and circuit analysis techniques such as nodal analysis, mesh analysis, linearity and superposition techniques, it includes solution for complex networks, like Thevenin and Norton Theorems. The course also includes magnetic circuits and two port networks.

COURSE OBJECTIVES:

The objectives of this course are to

1. To introduce basic laws, mesh & nodal analysis techniques for solving electrical circuits
2. To impart knowledge on applying appropriate theorem for electrical circuit analysis
3. To explain transient behavior of circuits in time and frequency domains
4. To teach concepts of resonance
5. To introduce open circuit, short circuit, transmission, hybrid parameters and their inter relationship

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand basic electrical circuits with nodal and mesh analysis
CO2	To impart Knowledge on applying appropriate theorem for electrical circuit analysis
CO3	Explain phasor diagrams for R, R-L, R-C and R-L-C circuits and Teach Concept of Resonance
CO4	Find Transient response and steady response of a network
CO5	Analyze the behavior of magnetically coupled circuits, two port network and calculate various parameters of two port network

COURSE CONTENT (SYLLABUS)

UNIT -I: INTRODUCTION TO ELECTRICAL CIRCUITS

Electric Charge, Electric current, Voltage, Ohm's law, Classification of circuit elements, Current and Voltage division rules, Network Reduction Techniques in both Series and Parallel Combination of Elements, Source Transformation Techniques, Nodal Analysis and Mesh Analysis in both A.C. and D.C. Networks with Dependent and Independent Sources, Problem Solving.

COs – CO1

Self-Learning Topics: Basic Components of R,L,C,KCL & KVL laws

UNIT-II: **NETWORK THEOREMS (with AC & DC)**

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Millliman's Theorem and Compensation Theorem., Problem Solving.

COs – CO2

Self-Learning Topics: Tellegen's Theorem

UNIT-III: STEADY STATE ANALYSIS OF AC CIRCUITS & RESONANCE

AC circuit analysis for R, L, C, series R-L, R-C, and R-L-C circuits and their respective phasor diagrams, Active, Reactive, Apparent and complex powers, power factor, Average, Effective values, Peak factor, and Form factor of various AC waveforms and functions ,Impedance concept, phase angle, series R-L, R-C,

R-L-C circuits problem solving.

Resonance: Series Resonance: Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth, Basic Types of Active & Passive Filters.

COs – CO3

Self-Learning Topics: Realization of RLC Networks & Practical applications of Resonance

UNIT-IV: **TRANSIENTS**

Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem-solving using R-L-C elements with DC excitation and AC excitation

COs – CO4

Self-Learning Topics: Complex and Polar Form of Representation, Transient Response of RC Circuit for Impulse Input

UNIT-V: **COUPLED CIRCUITS**

Analysis of Magnetically coupled circuits, Series aiding, series opposing, parallel aiding and parallel opposing, and Dot convention

TWO-PORT NETWORKS - Z, Y, h, ABCD parameters of two port networks, Parallel Connection of Two Port Networks, Cascading of Two Port Networks, Series Connection of Two Port Networks, Problem Solving

COs – CO5

Self-Learning Topics: Inverse Transmission and Inverse Hybrid Parameters

TEXT BOOKS:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.
3. Network lines and Fields by John. D. Ryder 2nd Edition, PHI

REFERENCE BOOKS:

1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N.O. Sadiku, McGraw-Hill Education.

ONLINE RESOURCES:

1 .https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

E-BOOKS:

https://www.pdfdrive.com/basic-electronics-for-scientists-and-engineers-e28939124.html

COMMUNICATIVE ENGLISH LAB
I B.TECH- II SEMESTER (Common to ECE,EEE&MECH)

Course Title: **COMMUNICATIVE ENGLISH LAB**	Course Code: **R24HS02**
Teaching Scheme (L:T:P): **0 0 2**	Credits: 1
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: To excel in a *Communicative English* course, certain foundational skills and prerequisites are helpful such as Basic Grammar Knowledge, **Listening Skills,** Basic Vocabulary, Reading Comprehension, Confidence in Speaking, Writing Skills.	

COURSE OVERVIEW:

A *Communicative English* course is designed to develop students' proficiency in spoken and written English through practical and interactive learning methods. The course focuses on improving students' ability to communicate effectively in real-life situations, emphasizing both fluency and accuracy.

COURSE OBJECTIVES:
The objectives of this course are to:

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. Students undergo training in basic communication skills to make them into confident communicators in all situations.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand and recognize the various facets of English language ability with a focus on the four basic skills- namely -LSRW abilities.
CO2	Implement various activities for language learners to practise communication skills.
CO3	To enhance listening and speaking comprehension, analyze the sounds, stress, rhythm, intonation, and syllable division of English speech.
CO4	Assess the professionalism of students when taking part in group discussions, debates, JAM sessions, Presentations and Interviews.
CO5	Equipping oneself with Interview Skills and a range of Soft Skills for life and career.

COURSE CONTENT (**SYLLABUS**)

Week1:

1. To explain and guide the students in decoding the sounds of English.
2. List all the consonant sounds and vowel sounds in English

Week2:

1. What is a syllable and describe the syllable structure.
2. Define stress, functional stress and various rules of stress.
3. What is connected speech?

Week3:

1. What is Intonation and mention the various pitch movements like rise, fall, fall-rise or rise-fall?
2. What is connected speech?

Week4:

1. To equip students to speak in English language confidently without any inhibitions.
2. Why are majority of the companies conducting JAM session as a preliminary interview?
3. What are the key skills tested in JAM round?

Week5:

1. To help students learn and understand different functions of language like greeting, asking
2. For information, giving information, meetings, requests, exchanging dialogues in formal and informal contexts.
3. Introduce yourself and others, give instructions and directions

Week 6:

1. To help the students understand and work on the digital age connector for personal correspondence, business communication, etc.
2. Write about email etiquette.
3. Draft an email to the HR Manager of Wipro Technologies requesting to consider your application for the post of Software Engineer.

Week 7:

1. To update students about the importance of Resume, the various types and the essentials of an effective resume
2. Draft a resume for a software post in reputed organization.

Week 8:

1. To educate students about the various styles of writing formal letters.
2. What is a cover letter? What are the different types of cover letters?
3. Write a job application letter for any post of your choice in a reputed company?

Week 9:

1. To help students know the importance of an SOP in their professional advancements?
2. What is an SOP and what are the different kinds and parts of an SOP?
3. Prepare an SOP to apply for a Master's Programme in any University of your choice.

Week 10:

1. To educate and guide the students about presentation skills and its importance in the technical evolving world.
2. To inform explain students about the importance of body language in various personal and professional forums
3. To help students to present papers, PPT's in seminars, workshops, conferences, research projects, interviews, etc.

Week 11:

1. To help students to give effective PPT's in various academic and professional platforms.
2. Describe various aspects that make PPT more effective.
3. Make a PPT on any topic of your choice and present it to the class.

Week 12:

1. To foster, creative, critical thinking skills, analytical skills and problem solving skills.
2. Suggest a few tips for preparing a poster.
3. Prepare posters from or outside your curriculum.

List of Activities:

1. Sounds of English (Vowels and Consonants) **COs: CO1,CO2**
2. Neutralization and Accent Rules **COs: CO1,CO2**
3. Improving communication skills /JAM. **COs: CO3,CO4**
4. Letter Writing and E-mail Writing **COs: CO1,CO2**
5. Cover letters and Resume Writing **COs: CO1,CO2**
6. Statement of Purpose. **COs: CO1,CO2**

7. Debates **COs: CO4:CO5**
8. Presentation skills- PPT and Poster **COs: CO4:CO5**
9. Group Discussions , types and practice **COs: CO4,CO5**
10. Interview skills – Mock interviews **COs: CO4,CO5**

Reference Books:

1. Prof. M. Hari Prasad, Prof. Vijaya Babu, Prof. Padmaja Kalapala, Skill Craft – A Communicative English Laboratory Workbook, Maruthi Publications first Edition, 2023
2. Meenakshi Ramana, Sangeeta-Sharma, 4thEdition, Technical Communication, Oxford Press, 2022.
3. Grant Taylor: English Conversation Practice, 1st Edition, Tata ,Mc Graw-Hill Education India, 2001.
4. Hewing,s, Martin, Cambridge Academic English(B2), Cambridge University Press,2012.
5. T. Balasubramanyam, A Textbook of English Phonetics for Indian Students, 3rd Edition, Trinity, 2022.
6. Dr. ShaliniSharma's Body Language Your Success Mantra, S. Chand publications 2010.
7. Sunitha Mishra and C.Murali Krishna's Communication Skills for Engineers Pearson Education Edition 2009.

Suggested software:

- English Wordsworth –Language Lab- Wordsworth Software

Web References for:
Spoken English

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. . https://www.youtube.com/c/ArnelsEverydayEnglish/featured
7. https://www.youtube.com/c/engvidAdam/featured
8. . https://www.youtube.com/c/EnglishClass101/featured
9. https://www.ted.com/watch/ted-ed
10. http://www.edest.org/

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

ENGG PHYSICS LAB
I B.TECH- II SEMESTER (Common to ECE,EEE,MEC)

Course Title: Engg.Physics lab	Course Code: **R24BS03**
Teaching Scheme (L:T:P): 0:0:2	Credits: 1
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites:	

COURSE OVERVIEW:

To succeed in an *Engineering Physics Lab* course, certain foundational skills and knowledge are necessary for effective participation and understanding. Here are the key prerequisites:

6. Basic Physics Knowledge
7. Mathematics Skills
8. Measurement and Unit Conversions
9. Basic Laboratory Skills
10. Problem-Solving and Analytical Skills
11. Familiarity with Safety Practices
12. Basic Computing Skills

COURSE OBJECTIVES:

1. To study the concepts of optical phenomenon like interference, diffraction etc.,
2. To recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors
3. To study the parameters and applications of dielectric and magnetic materials by conducting experiments.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Demonstrate the modern engineering physics Techniques and tools in real times applications in engineering studies.
CO2	Develop the laboratory skills in handling of electrical and optical instruments.
CO3	Conduct experiment Independently and In team to record the measurements
CO4	Compare the experimental results with standard values and estimate errors

COURSE CONTENT (SYLLABUS)

List of Experiments

11. Determination of radius of curvature of a given plano convex lens by Newton'sring;s method.
12. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
13. Determination of thickness of thin object by air wedge method
14. Determination of wavelength of Laser Source by diffraction gratting.

15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method.
17. Determination of dispersive power of the prism.
18. Determination of acceleration due to gravity and radius of Gyration by using Compound pendulum.
19. Determination of energy gap of a semiconductor using p-n junction diode.
20. Determination of dielectric constant using charging an discharging method.
21. Sonometer: Verification of laws of stretched string.
22. Estimation of Planck's constant using photoelectric effect.
23. Study the variation of B versus H by magnetization the magnetic material (B-H curve)
24. Determination of frequency of electrically maintained tunning fork by Melde's experiment.
25. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
26. Determination of the resistivity of semiconductor by four probe method.
27. Determination of young's modulus for the given material of wooden scale by non- uniform bending (or double cantilever) method .
18. Determination of magnetic suseptibility by Kundt's tube method

REFERENCE BOOKS:

1.S. Balasubramanian, M.N.Srinivasan "A Text Book of Practical Physics"-S ChandPublishers,2017.
2 .J.Raja Gopalam Patnaik, "Physics Laboratory Manual for Undergraduate Students "Paramount Book Disributors 2023.

ONLINE RESOURCES:

Web References:

1. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype
URL:www.vlab.co.in

IT Workshop
I B.TECH- II SEMESTER (Common to ECE,EEE & MECH)

Course Title: **IT Workshop Lab**	Course Code**: R24ES04**
Teaching Scheme (L:T:P): **0 0 3**	Credits: 1.5
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: an IT workshop for engineering students: **Familiarity with hand tools, equipment, and machines, Computer skills.**	

COURSE OVERVIEW:

1. To understand computer programming and its roles in problem solving.
2. To understand and develop well-structured programs using C language.

COURSE OBJECTIVES:

The objectives of this course are to:

1. To assemble and disassemble a computer.
2. To solve hardware and software problems.
3. To learn about Networking of computers and use Internet facility for Browsing and Searching.
4. To develop project documentation using MS word
5. To work with various productivity tools including Excel, PowerPoint.
6. To work with different online repositories such as GITHUB, AI CHATBOT.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Perform Hardware troubleshooting and Perform Hardware troubleshooting
CO2	Apply different way of hooking the PC on to the internet from home and Workplace.
CO3	Design word documents by learning word processing and Create presentations by using different styles and using AI Tools-Chat GPT and GITHUB

COURSE CONTENT (**SYLLABUS**)

PC Hardware & Software Installation **9 Hours**

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the Block diagram of the CPU along with the configuration of each peripheral and submit it to your Instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab Instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab Instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. Lab instructor should verify the installation and follow it up with a Viva. **COs-CO1**

Internet &World Wide Web **6 Hours**

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students Should demonstrate to the instructor, how to access the websites and email. If there is no internet Connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN Proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to Use the search engines. A few topics would be given to the students for which they need to search On Google. This should be

demonstrated to the instructors by the student. **COs-CO2**

MS WORD **6 Hours**

Task 1: Creating project abstract Features to be covered: -Formatting Styles, Inserting table, Bullets And Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
Task 2: Creating a Newsletter: Features to be covered: - Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL **6 Hours**

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool; give the details of the four tasks and features that would be covered in Each. Using Excel – Accessing, overview of toolbars, saving excel files, using help and resources. **Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, and auto Fill, Formatting Text**.**
Task 2: Calculating GPA -. Features to be covered: - Cell Referencing, Formulae in excel – Average, std. deviation, Charts, Renaming and Inserting worksheets, hyper linking, Count Function

POWER POINT **6 Hours**

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.
Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.
Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.**Cos-CO3**

AI TOOLS – Chat GPT **6 Hours**

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model Responds. Try asking questions, starting conversations, or even providing incomplete sentences to See how the model completes them. Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"
Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to Brainstorm creative ideas Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Explore – GITHUB **6 Hours**

Task 1: Students should understand GITHUB and should possess accounts in it.
Task 2: Students should explore different repositories available in GITHUB and student should Create his/ her own simple repositories.
Task 3: Students should take simple experiments /presentations and upload them in their GITHUB Account.
Task 4: Students should understand how GITHUB Enterprise Cloud is used and also explore the GIT and GIT HUB resources. **COs-CO3**

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
6. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan–CISCOPress, Pearson Education, 3rd edition
7. **"Microsoft Word 2021: A Beginner's Guide"**by Steve Lambert.
8. **"Excel 2021: A Comprehensive Guide"**by Chris Benham.
9. **"Microsoft PowerPoint 2021: A Beginner's Guide"** by Steve Lambert
10. GITHUB Quick Start Tutoria

NETWORK ANALYSIS & SIMULATION LABORATORY
I B.TECH- II SEMESTER (ECE)

Course Title: Network Analysis & Simulation Lab	Course Code: R24ECPC02
Teaching Scheme (L:T:P): 0:0:3	Credits: 1.5
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: Understanding of Circuit Components, Breadboard connections.	

COURSE OVERVIEW:
This course deals practical approach of basic concepts of electrical engineering, such as DC circuits, AC circuits and reduction techniques, It also includes DC transients, Resonance circuit and two-port networks.

COURSE OBJECTIVES:
1. To gain hands on experience in verifying Kirchhoff's laws and network theorems
2. To analyze transient behavior of circuits
3. To study resonance characteristics
4. To determine 2-port network parameters

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Demonstrate fundamental circuit laws, network theorems, and node and mesh analysis of electrical circuits.
CO2	Design resonance circuit for given specifications**.**
CO3	Measure time constants of RL & RC circuits**.**

List of Experiments:
1. Study of components of a circuit and Verification of KCL and KVL. **COs: CO1**
2. Verification of mesh analysis for AC circuits **COs: CO1**
3. Verification of nodal analysis for AC circuits **COs: CO1**
4. Verification of Superposition theorem. **COs: CO1**
5. Verification of maximum power transfer theorem for AC circuits **COs: CO1**
6. Verification of Thevenin's & Norton theorems for AC circuits **COs: CO1**
7. verification of reciprocity theorem **COs: CO1**
8. Find the Q Factor and Bandwidth of a Series Resonance circuit **COs: CO2**
9. Find the Q Factor and Bandwidth of a Parallel Resonance circuit. **COs: CO2**
10. Study of DC transients in RL,circuit. **COs: CO3**
11. Study of DC transients in RC circuits **COs: CO3**
12. Study of DC transients in RLC circuit **COs: CO3**
13. Determination of open circuit (Z) and short circuit (Y) parameters **COs: CO1**
14. Determination of hybrid (H) and transmission (ABCD) parameters **COs: CO1**

NOTE: Any 10 experiments are to be conducted

HARDWARE REQUIREMENTS:
Regulated Power supplies, Analog/Digital Function Generators, Digital Millimeters, Decade Resistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active & Passive Electronic Components,Variac

SOFTWARE REQUIREMENTS:
Multisim/ Pspice /Equivalent simulation software tool, Computer Systems with required specifications.

REFERENCES:
1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020

NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE
I B.TECH- II SEMESTER (Common to all Branches)

Course Title: **NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE**	Course Code: **R24MC02**
Teaching Scheme (L:T:P): 3:0:0	Credits: 0.5
Type of Course: Lecture	
Continuous Internal Evaluation: 100 Marks	Semester End Exam: 0 Marks
Pre requisites: Prerequisites for programs related to **NSS (National Service Scheme)**, **NCC (National Cadet Corps)**, **Scouts and Guides**, and **Community Service** can vary by institution and specific program. However, here are general guidelines and common prerequisites for each: National Service Scheme (NSS), National Cadet Corps (NCC), Scouts and Guides, Community Service Programs.	

COURSE OVERVIEW:

Here's a general course overview for programs related to NSS (National Service Scheme)**,** NCC (National Cadet Corps)**,** Scouts and Guides**, and** Community Service**. Each program focuses on different aspects of personal development, leadership, and community engagement.**

1. National Service Scheme (NSS)

- **Overview**: NSS is a voluntary program aimed at fostering a sense of social responsibility and community service among students. It emphasizes the importance of personal and community development.
- **Core Components**:
  - **Community Service Projects**: Participation in various community development activities, such as health camps, environmental awareness programs, and literacy initiatives.
  - **Workshops and Seminars**: Educational sessions on social issues, health, hygiene, and community development strategies.
  - **Leadership Development**: Training sessions focused on leadership skills, teamwork, and effective communication.
  - **Camps and Activities**: Organizing and participating in camps, rallies, and other events that promote social awareness and civic responsibility.

2. National Cadet Corps (NCC)

- **Overview**: NCC is a youth development movement that aims to develop character, discipline, leadership, and a spirit of adventure among young people.
- **Core Components**:
  - **Military Training**: Basic training in drill, weapons handling, and military tactics, combined with emphasis on discipline and teamwork.
  - **Adventure Activities**: Participation in activities such as trekking, mountaineering, and camping to foster adventure skills and resilience.
  - **Community Service**: Involvement in social service initiatives and community development projects.
  - **Leadership and Management Skills**: Training sessions focused on leadership, communication, and management, preparing cadets for future responsibilities.

3. Scouts and Guides

- **Overview**: Scouts and Guides programs promote personal development, leadership skills, and community service among young people through various outdoor and indoor activities.

- **Core Components**:
  - **Skill Development**: Learning practical skills such as first aid, navigation, and survival skills.
  - **Community Projects**: Engaging in community service projects and environmental conservation efforts.
  - **Outdoor Activities**: Camping, hiking, and other outdoor adventures that promote teamwork, resilience, and a love for nature.
  - **Values and Ethics**: Education on values such as integrity, respect, and service, aligning with the principles of scouting.

4. Community Service Programs

- **Overview**: Community service programs are designed to engage individuals in volunteer work that benefits their communities, fostering civic responsibility and social awareness.
- **Core Components**:
  - **Volunteer Projects**: Participation in various service projects, such as assisting in local shelters, food banks, environmental clean-ups, and educational initiatives.
  - **Skill-Building Workshops**: Workshops on leadership, teamwork, and project management to enhance volunteers' capabilities.
  - **Awareness Campaigns**: Engaging in campaigns to raise awareness about social issues, such as health, education, and the environment.
  - **Reflection and Evaluation**: Opportunities to reflect on experiences, discuss challenges, and evaluate the impact of their service.

COURSE OBJECTIVES:

The objectives of this course are to:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand the importance of discipline, character and service motto.
CO2	Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3	Explore human relationships by analyzing social problems.
CO4	Determine to extend their help for the fellow beings and downtrodden people
CO5	Develop leadership skills and civic responsibilities.

COURSE CONTENT (SYLLABUS)

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills

ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.

iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.

iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature & Care

Activities:

i) Best out of waste competition.

ii) Poster and signs making competition to spread environmental awareness.

i) Recycling and environmental pollution article writing competition.
ii) Organising Zero-waste day.
iii) Digital Environmental awareness activity via various social media platforms.
iv) Virtual demonstration of different eco-friendly approaches for sustainable living.
v) Write a summary on any book related to environmental issues.

UNIT III Community Service Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health,Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. Red Book - National Cadet Corps – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., ―Introduction to Environmental Engineering‖,McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. ―Introduction to Environmental Engineering and Science‖, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi.

Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Program: B. Tech Electronics and Communication Engineering **Regulation: R24**

II Year I Semester- Course Structure

S. No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	BS	R24ECBS07	Probability theory and Stochastic Process	3	0	0	3
2	HS	R24HS03	Universal Human Values-Understanding Harmony and Ethical Human Conduct	2	0	0	2
3	ES	R24ECES09	Signals and Systems	3	0	0	3
4	PC	R24ECPC03	Electronic Devices and Circuits	3	0	0	3
5	PC	R24ECPC04	Digital Logic Design	3	0	0	3
6	PC	R24ECPC05	Electronic Devices and Circuits Lab	0	0	3	1.5
7	PC	R24ECPC06	Digital Logic Design & Signal Processing Lab	0	0	3	1.5
8	SC	R24ECSC01	Python Programming	0	1	2	2
9	HS	R24HS04	Quantitative Aptitude & Logical reasoning	0	1	2	2
10	MC	R24MC03	Environmental Science	2	0	0	-
			Total	**16**	**02**	**10**	**21**

Category	Courses	Credits
BS- Basic Sciences Course	1	3.0
ES-Engineering Science Courses	1	3.0
HS-Humanities and Management Sciences Courses	2	4.0
PC-Professional Core Courses	4	9.0
MC-Mandatory Course	1	0
SC- Skill Enhancement course	1	2.0
Total	**10**	**21**

Course Title: PROBABILTY THEORY AND STOCHASTIC PROCESS	Course Code: **R24ECBS07**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Random Variables and Stochastic Processes, you need a strong foundation in several key areas of mathematics. Here are the typical prerequisites: Basic Probability Theory, Calculus (Single-variable and basics of Multivariable Calculus), Linear Algebra, Basic Statistics, Elementary Differential Equations, and Set Theory.	

Course Objectives:

- To give students an introduction to elementary probability theory, in preparation to learn the concepts of statistical analysis, random variables and stochastic processes.
- To mathematically model the random phenomena with the help of probability theory concepts.
- To introduce the important concepts of random variables and stochastic processes.
- To analyze the LTI systems with stationary and random process as input and noise sourses of a system.

Course Outcomes:

After completing the course, the student should be able to

COs	PO1	PO2	PO3	PO4	PO5	PO11	PSO1	BT Level
CO1: Mathematically model the random phenomena and solve simple probabilistic problems	3	3	2	2	2	2	2	**L3**
CO2: Identify different types of random variables and compute statistical averages of single random variable	3	3	2	2	2	2	2	**L2,L3**
CO3: Understand multiple random variable concepts, compute statistical averages of multiple random variables	3	3	2	2	2	2	2	**L2,L3**
CO4: Characterize the random processes in the time domain	3	3	2	3	2	2	2	**L4**
CO5: Characterization in frequency domain and analyze the LTI systems with random inputs and noise sources	3	3	3	3	3	2	2	**L4,L5**

SYLLABUS

Unit-I

Probability & Random Variable

Probability- Probability introduced through sets and relative Frequency: Experiments and sample spaces, discrete and continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's theorem, Independent Events.

Random Variable- Definition of a Random Variable, Conditions for a Function to be a

Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties. **COs- CO1-CO2**

Unit-II

Operation On One Random Variable-Expectations

Introduction, Expected Value of a Random Variable, function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebyshev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable. **COs- CO2**

Unit-III

Multiple Random Variables

Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

Operations On Multiple Random Variables

Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, properties.

COs- CO3

Unit-IV

Random Processes–Temporal Characteristics

The Random Process Concept, Classification of Processes, Deterministic and Non deterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, Nth-order and Strict- Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

Random Signal Response of Linear Systems

System Response–Convolution, Mean and Mean- squared Value of System Response, Auto correlation Function of Response, Cross-Correlation Functions of Input and Output

COs- CO4

Unit-V

Random Processes-Spectral characteristics

The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Auto correlation Function, The Cross-Power Density Spectrum, Properties,

Relationship between Cross-Power Density Spectrum and Cross-Correlation Function.

Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output.

Noise sources: Resistive/Thermal Noise source, arbitrary noise sources, Effective noise temperature, Noise equivalent Bandwidth, Average Noise figures, Average Noise figure of Cascaded networks. **COs-CO5**

Text Books:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH,4th Edition,2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI,4th Edition,2002.
3. Probability and Random Processes with Applications to Signal Processing, Henry Stark and JohnW.Woods, Pearson Education, 3rd Edition, 2001.

Reference Books:

1. Schaum's Outline of Probability, Random Variables, and Random Processes,1997.
2. An Introduction to Random Signals and Communication Theory, B.P.Lathi, International Textbook, 1968.
3. Probability Theory and Random Processes, P.Ramesh Babu, McGrawHill, 2015.

E-Resources:

1. https://nptel.ac.in/courses/111102111
2. https://nptel.ac.in/courses/111102160
3. https://ocw.mit.edu/

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Course Title: UNIVERSAL HUMAN VALUES UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT	**Course Code: R24HS03**
Teaching Scheme (L:T:P): 2:0:0	**Credits:** 2
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Universal Human Values: Understanding Harmony and Ethical Human Conduct, you'll need a basic foundation in critical thinking, moral reasoning, and communication skills. Familiarity with fundamental concepts of ethics, basic social sciences, and an openness to introspection and dialogue are also important.	

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

After completing the course, the student should be able to

COs	PO1	PO2	PO6	PO7	PO8	PO9	PO11	PSO1	BT LEVEL
CO1: Define the terms like Natural Acceptance, Happiness and Prosperity.	1	2	2	3	–	2	3		L1, L2
CO2: Analyze the coexistence of the self and the body, distinguish between their needs, and apply practices that promote self-regulation and overall well-being.	1	2	3	3	2	2	3		L4
CO3: Relate human values with human relationship and human society.	1	2	2	3	2	2	3		L4
CO4: Justify the need for universal human values and harmonious existence.	1	2	3	3	3	2	3		L5
CO5: Develop as socially and ecologically responsible engineers.	2	2	3	3	3	2	3		L3, L6

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I

Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value

Education

Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance **COs- CO1, CO2, CO3**

UNIT II

Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: Understanding Human being as the Co-existence of the self and the body.

Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.

Lecture 9: The body as an Instrument of the self

Lecture 10: Understanding Harmony in the self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the

self-Lecture 11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body **COs- CO2, CO3**

UNIT III

Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction

Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust

Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect

Lecture 16: Other Feelings, Justice in Human-to-Human

Relationship Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal **COs- CO2, CO4, CO5**

UNIT IV

Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment

among the Four Orders of Nature

Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature

Lecture 21: Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence. **COs- CO2, CO5**

UNIT V

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human

Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order **COs- CO3, CO5**

Practice Sessions for

UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust PS8

Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Readings:

Textbook and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,*Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.

2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.

6. Slow is Beautiful - Cecile Andrews

7. Economy of Permanence - J C Kumarappa

8. Bharat Mein Angreji Raj – PanditSunderlal

9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

E- Resources:

1. https://fdp-si.aicte-india.org/UHV- II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV- II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV- II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-

Harmony%20in%20the%20Family.pdf

4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3- S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV- II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte- india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
7. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human- values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
8. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

Course Title: SIGNALS AND SYSTEMS	**Course Code: R24ECES09**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Signals and Systems, a strong foundation in several key areas of mathematics and engineering. Here are the typical prerequisites: Calculus (Single-variable and Multivariable Calculus), Differential Equations, Linear Algebra, Basic Complex Numbers, and Circuit Theory and a basic understanding of Fourier Transforms, Laplace Transforms, and Z-Transforms is essential.	

Course Objectives:

- Understanding the fundamental characteristics of signals and systems.
- Understanding the concepts of vector space, inner product space and orthogonal series.
- Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
- Development of the mathematical skills to solve problems involving convolution, correlation and sampling.

Course Outcomes:

After completing the course, the student should be able to

CO Statement	PO1	PO2	PO3	PO4	PO5	PO11	PSO1	BT LEVEL
CO1: Understand the mathematical description and representation of signals and apply linear algebra concepts.	3	3	2	2	2	2	2	**L2,L3**
CO2: Classify systems based on their properties and determine the response of LTI system using convolution.	3	3	2	2	2	2	1	**L4**
CO3: Analyze the frequency spectra of various continuous-time signals using Fourier Analysis.	3	3	2	3	2	2	2	**L4**
CO4: Apply the Laplace and Z-transform for analysis of continuous-time and discrete-time signals and systems.	3	3	2	3	3	2	2	**L3**
CO5: Apply sampling theorem and different transform techniques to solve signals and systems related problems.	3	3	2	3	3	2	1	**L3,L4**

SYLLABUS

UNIT-I

Signals & Systems: definition of signal & system, basic operations on signals, classification of signals, basic continuous time signals and continuous time systems, classification of discrete time signals and systems. Analogy between vectors and signals, Orthogonality, mean square error, complete set of orthogonal functions. Vector spaces, Inner Product spaces, Schwartz inequality, Hilbert spaces, Bessel's inequality and Parseval's relations.

COs- CO1

UNIT-II

Linear Time Invariant (LTI) Systems: Time-Domain representation & Characterization of LTI systems, Impulse response representation, Convolution integral & Convolution sum, properties of LTI systems, Stability criteria for LTI systems, Elements of Continuous time & Discrete-time LTI systems. Circular Convolution. Concepts of Correlation of signals, properties, applications. **COs- CO2**

UNIT-III

Fourier Representation of Signals: Fourier representation of Signals, Continuous -time Fourier series and their properties, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum. Application of Fourier series to LTI systems, Fourier Transform & its properties, Applications of Fourier Transform to LTI systems, Discrete-time Fourier Transform & its properties, Relationship to other transforms. Hilbert transform and its properties. **COs- CO3**

UNIT-IV

Laplace Transform: Introduction & Definition, Region-of- convergence, Properties of Laplace transform, Inverse Laplace Transform, Applications of Laplace Transform in analysis of LTI systems, Unilateral Laplace transform & its applications to solve differential equations, Analysis of Electric circuits.
Z-Transform: The Z-Transform, Region-of-convergence, properties of Z-Transform, Inverse Z-Transform, Transform Analysis of Discrete-time LTI systems, Unilateral Z-Transform & its applications to LTI systems described by difference equations. Relation between various transforms. **COs- CO4**

UNIT-V

Sampling: Graphical & Analytical proof of Band-limited signals, Impulse Sampling, Natural and Flat top Sampling, Low pass and band pass sampling theorems, sampling and reconstruction of band limited signals, Aliasing, Anti- aliasing filter, Illustrative Problems.
COs- CO5

Textbooks:

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", 2nd Edition, PHI, 2009.
2. Signals, Systems & Communications - B.P. Lathi, B S Publications, 2003.
3. S.Haykin and B.VanVeen "Signals and Systems, Wiley, 1998.

Reference Books:

1. Signals and Systems – K Deergha Rao, Springer International Edition, 2018.
2. Principles of Linear Systems and Signals – BP Lathi, Oxford University Press, 2015
3. Hwei Hsu, "Schaum's Outline of Signals and Systems", 4thEdition, TMH, 2019.
4. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.

E- Resources:

1. https://nptel.ac.in/courses/117101055
2. https://nptel.ac.in/courses/108104100

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Course Title: ELECTRONIC DEVICES & CIRCUITS	**Course Code: R24ECPC03**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Electronic Devices and Circuits, students should have a basic understanding of Circuit Theory, basic electronics engineering and Differential Equations for analyzing circuit behavior. Familiarity with Semiconductor Physics and Linear Algebra will be helpful.	

Course Objectives:

- The students can understand the basic principles and characteristics of semiconductor devices like Diode, BJT, JFET and MOSFET.
- The students can able to analyze diode & transistor circuits, various biasing methods, equivalent circuits of transistor amplifiers and their comparison.
- The students can able to study and analyze various applications such as rectifiers, filters, transistor amplifiers with necessary equivalent circuits.

Course Outcomes

After completing the course, the student should be able to

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO11	PS01	BT LEVEL
CO1: Understand the construction, operation, and characteristics of semiconductor devices such as PN junction diodes, BJTs, JFETs, and MOSFETs.	3	2			2		2		**L2**
CO2: Analyze the behavior of diode and transistor circuits including rectifiers, voltage regulators, and switching applications.	3	3	2	2	2				**L4**
CO3: Compare and evaluate various transistor configurations and biasing techniques to determine the operating point and ensure thermal stability.	3	3	2	2			2		**L4**
CO4: Analyze and interpret the performance of small-signal BJT and FET amplifier circuits using h-parameter and hybrid-π models at both low and high frequencies.	3	3	2	2	1				**L4,L5**
CO5: Apply electronic device principles to design and evaluate analog circuits in practical applications such as amplification, switching, and signal conditioning.	3	3	3	2	2	1	3		**L3,L4,L5**

SYLLABUS

UNIT-I:

P-N Junction Diode Characteristics

Qualitative theory of the p-n junction, Energy band diagram of p-n junction diode, open circuited p-n Junction, the p-n junction as a Diode, Diode act as a Rectifier, V-I characteristics and its temperature dependence, the current components in a p-n Diode, Diode Resistance and Diode Capacitance**,** piece-wise linear model**,** Diode current equation, Quantitative analysis of Half-wave and Full-wave Rectifiers with and without filters, Breakdown mechanisms, Zener diode, Zener diode as a voltage Regulator, LED, LCD, photo diode, solar cell, Varactor Diode, Tunnel Diode, SCR, UJT **COs- CO1, CO2**

UNIT-II:

Bipolar Junction Transistor (BJT) Characteristics

The junction transistor-construction, symbols and operation, transistor current components, transistor current equation, transistor configurations, characteristics of CB, CE and CC configurations and their comparison, the early effect, punch through/reach through, transistor as an amplifier, Ebers-Moll model of a transistor, large signal, dc and small signal CE values of current gain, analytical expressions for transistor characteristics, typical transistor-junction voltages, transistor as a switch, transistor switching times, maximum voltage rating, photo transistor. **COs- CO1, CO2**

UNIT-III:

Field Effect Transistor (FET) Characteristics

The Junction Field-effect Transistor (JFET)-types, construction and operation, the pinch-off voltage, JFET characteristics, JFET parameters, JFET equivalent circuits, JFET applications, comparison between BJT and JFET, Metal-oxide-Semiconductor FET (MOSFET)- types, Construction, operation and characteristics, comparison between JFET and MOSFET, introduction to MOS, CMOS and Bi-CMOS logics, nMOS, CMOS and Bi-CMOS inverter circuits and their operation. **COs- CO2, CO3**

UNIT-IV:

Transistor Biasing and Thermal Stabilization

Need for biasing, the operating point, load line analysis, BJT biasing- methods, fixed bias, collector to base bias, self-bias, bias stability, stabilization against variations in V_{BE}, I_C, and β, stability factors, (S, S', S"), bias compensation, thermal runaway, thermal stability, Biasing of FETs & Stabilization. **COs- CO3, CO4**

UNIT-V:

Small Signal Transistor Amplifier Circuits

Introduction to two-port network, transistor hybrid model, determination of h- parameters, conversion of h-parameters, generalized analysis of transistor amplifier using h- parameters (exact analysis & approximate analysis).

Low Frequency BJT & FET Amplifier Circuits: Analysis of CB, CE and CC amplifiers using h-parameter model, comparison of BJT transistor amplifiers, FET small signal model, analysis of CG, CS and CD amplifiers, comparison of FET amplifiers. High Frequency BJT & FET Amplifier Circuits: Transistor at high frequencies, Hybrid- π model, Hybrid-π conductance's, Hybrid-π capacitances, Hybrid-π parameters in terms of h- parameters, CE short circuit current gain, current gain with resistive load, high frequency analysis of FET common source and common drain amplifier circuits. **COs- CO4, CO5**

Text Books:

1. Integrated Electronics – JacobMillman, C. Halkias, C.D.Parikh , Tata Mc-Graw Hill Education (India) Private Limited, Second Edition, 2011.

2. Electronic Devices and Circuits- J. Millman, C. Halkias, Mc-Graw HillEducation (India) Private Limited, Fourth Edition, 2015.

References:

1. Electronic Devices and Circuits- S Salivahanan, N Suresh Kumar, Tata Mc-Graw Hill, Third Edition, 2012.
2. Electronic Devices and Circuit Theory-R.L. Boylestad and LouisNashelsky, Pearson Publications, Tenth Edition.

E-Resources:

1. https://nptel.ac.in/courses/117103063
2. https://nptel.ac.in/courses/117102061

Course Title: DIGITAL LOGIC DESIGN	**Course Code: R24ECPC04**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Digital Logic Design, students should have a basic understanding of Boolean Algebra. Familiarity with Mathematical Logic concepts such as truth tables and basic logic gates (AND, OR, NOT) will be essential. A foundational understanding of Linear Algebra will also be helpful for analyzing and optimizing digital circuits.	

Course Objectives:

- Understand the properties of Boolean algebra, logic operations, and minimization of Boolean functions.
- Analyze the design concepts of combinational circuits
- Analyze the concepts of sequential logic circuits.
- Understand the concepts of FSM and compare various Programmable logic devices.
- Apply Verilog HDL on implementing Combinational and Sequential circuits.

Course Outcomes

After completing the course, the student should be able to

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO9	PO10	PO11	PSO1	BT LEVEL
CO1: Understand the properties of Boolean algebra, logic operations, and minimization of the Boolean functions	2	1								L2,L3
CO2: Analyze combinational circuits	3	3	2		1					L3,L4
CO3: Analyze sequential circuits	3	3	2		1					L3,L4
CO4: Analyze the concepts of finite state machines and Compare various Programmable logic devices	2	2	2		2					L3,L4
CO5: Design and Model combinational and sequential circuits using HDLs	3	3	3	1	3	1	1	1		L4,L5

SYLLABUS

UNIT-I

Boolean algebra, logic operations, and minimization of Boolean functions

Number Systems and Codes(Including Gray codes, Residue codes-Basics for fault tolerance), Representation of unsigned and signed integers, Floating Point representation of real numbers, Laws of Boolean Algebra, Theorems of Boolean Algebra, Realization of functions using logic gates, Canonical forms of Boolean Functions, Minimization of Functions using Karnaugh Maps, QM algorithm. Basics of Error detection and correction in Digital design. **COs- CO1**

UNIT-II

Combinational Logic Circuits

Combinational circuits, Design with basic logic gates, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, magnitude comparator, multiplexers, demultiplexers, decoders, encoders and priority encoders. **COs- CO2**

UNIT-III

Sequential Logic Circuits

Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, registers, shift registers, universal shift register, design of synchronous and asynchronous counters, ring counter, Johnson counter. Introduction to low power Sequential circuit design. **COs- CO3**

UNIT-IV

Finite State Machines and Programmable Logic Devices

Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flip-flops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique using D,T and JK Flipflops, Design of sequence detector, Introduction to logic families, Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs. **COs- CO4**

UNIT-V

Hardware Description Language

Introduction to Verilog- gate level, behavioral level and structural level modeling of logic circuits, specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, for loop, Verilog Operators, using Verilog constructs for storage elements, Blocking and Non-blocking Assignments, flip- flop with clear capability, Using Verilog Constructs for Registers and Counters. **COs- CO5**

Text Books:

1. M. Morris Mano, "Digital Design", 3rd Edition, PHI. (Unit I to IV)
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, McGraw-Hill (Unit V)

Reference Books:

1. Charles H. Roth, Jr, "Fundamentals of Logic Design", 4th Edition, Jaico Publishers.
2. ZviKohavi and NirajK.Jha, "Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2nd Edition, Prentice Hall PTR.
4. D.P. Leach, A.P. Malvino, "Digital Principles and Applications", TMH, 7th Edition.

E- Resources:

1. **https://nptel.ac.in/courses/108105132**
2. **https://www.allaboutcircuits.com/textbook/digital/**
3. **https://www.khanacademy.org/computing/computer-science/logic-gates**

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Course Title: ELECTRONIC DEVICES & CIRCUITS LAB	**Course Code: R24ECPC05**
Teaching Scheme (L:T:P): 0:0:3	**Credits:** 1.5
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in the Electronic Devices and Circuits Lab, students should have a basic understanding of Circuit Theory (Ohm's Law, Kirchhoff's laws) and Semiconductor Devices (diodes, transistors, etc.). Familiarity with using Multimeters, Oscilloscopes, and other basic lab instruments is essential.	

Course Objectives:

- Verify the theoretical concepts by conduct suitable experiment using necessary hardware.
- Analyze the characteristics of Diodes, Rectifiers, BJT, FET by conduct experiments.
- Design an amplifier circuit using specifications and obtain the performance parameters experimentally.
- Simulate the electronic circuits using EDA tools like PSPICE/Multisim.

Course Outcomes:

After completing the course, the student should be able to

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO11**	**BT LEVEL**
CO1: Theoretical concepts verified by conducting experiments using hardware.	3	2	–	–	2	2	L3
CO2: Analyze the characteristics of Diodes, Rectifiers, BJT, FET by conducting experiments.	3	3	2	2	2	2	L4
CO3: Design an amplifier circuit using specifications and obtain performance parameters using hardware equipment.	3	3	3	3	3	2	L6
CO4: Simulate the electronic circuits using EDA tools like PSPICE/Multisim or equivalent.	3	2	2	3	3	2	L3

PART A: Electronic Workshop Practice

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards. **CO1,CO2**
2. Identification, Specifications and Testing of active devices like Diode, LED, BJT, FET and MOSFET. **CO1,CO2**
3. Soldering Practice- Simple circuits using active and passive components. **CO1**
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO. **CO1**

PART B: List of Experiments: (Minimum Twelve Experiments has to be performed)

1. P-N Junction Diode Characteristics **CO2**

Part A: Germanium Diode (Forward bias& Reverse bias)

Part B: Silicon Diode (Forward Bias only)

2. Zener Diode Characteristics **CO2**

   Part A: V-I Characteristics

   Part B: Zener Diode as Voltage Regulator

3. Rectifiers (without and with c-filter) **CO2**

   Part A: Half-wave Rectifier

   Part B: Full-wave Rectifier

4. BJT Characteristics (CE & CB Configuration) **CO2**

   Part A: Input Characteristics

   Part B: Output Characteristics

5. FET Characteristics (CS Configuration) **CO2**

   Part A: Drain Characteristics

   Part B: Transfer Characteristics

6. SCR Characteristics **CO2**

   Part A: Forward Characteristics

   Part B: Reverse Characteristics

7. Transistor Biasing **CO2, CO3**

   Part A: Operating Point

   Part B: Load line analysis

8. Design and analysis of voltage- divider bias/self-bias circuit using BJT. **CO3**
9. Design and analysis of self-bias circuit using FET/MOSFET. **CO3**
10. CRO Operation and its Measurements **CO1**
11. Determination of h-parameters of a given BJT using hybrid model. **CO2**
12. Frequency response of BJT-CE Amplifier **CO3**
13. Frequency response of Emitter Follower-CC Amplifier **CO3**
14. Frequency response of FET-CS Amplifier **CO3**
15. Frequency response of FET-CD Amplifier **CO3**

PART C:

Hardware Required: Regulated Power supplies, Analog/Digital Storage Oscilloscopes, Analog/Digital Function Generators, Digital Multimeters, Decade Résistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active & Passive Electronic Components **CO4**

Software Required: Software like Multisim/ PSPICE or Equivalent EDA Tool.

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Course Title: DIGITAL LOGIC DESIGN & SIGNAL PROCESSING LAB	**Course Code: R24ECPC06**
Teaching Scheme (L:T:P): 0:0:3	**Credits:** 1.5
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in the Digital & Signal Laboratory, students should have a solid grasp of Boolean algebra, truth tables and combinational/sequential circuit theory. They should be familiar with an HDL (e.g., Verilog or VHDL) and the workflow for simulation or FPGA implementation. Comfort with MATLAB or equivalent signal-processing software for coding and visualization will greatly enhance lab performance	

Course Objectives:

- Verify the truth tables of various logic circuits.
- Design sequential/combinational circuit using Hardware Description Language and verify their functionality.
- Simulate various Signals and Systems through MATLAB
- Analyze the output of a system when it is excited by different types of deterministic and random signals.

Course Outcomes:

After completing the course, the student should be able to:

COs	PO1	PO2	PO3	PO4	PO5	PO11	BT LEVEL
CO1: Design and verify the functionality of various combinational logic circuits using HDL.	3	3	3	–	2	2	L6
CO2: Design and verify the functionality of various sequential logic circuits using HDL.	3	3	3	–	2	2	L6
CO3: Understand how to simulate different types of signals and system response.	3	2	2	3	3	2	L3
CO4: Analyze the response of different systems when they are excited by different signals and plot power spectral density of signals.	3	3	3	3	3	2	L4

List Of Experiments:

PART A

1. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table. **CO1**
2. Verify the of functionality of 3 to 8-line Decoder **CO1**
3. 4 variable logic function verification using 8 to1 multiplexer. **CO1**
4. Design and verify the functionality of full adder circuit, full subtractor. **CO1**
5. Draw the circuit diagram of a single bit comparator and verify the output. **CO1**
6. Design and verify the functionality of different flipflops **CO2**
7. Design and verify the operation of 4-bit Universal Shift Register for different Modes of operation. **CO2**

8. Design up counter and down counters **CO2**
9. Design MOD–8 synchronous counter /asynchronous counters. **CO2**

Note: Any seven experiment are to be simulated using Hardware Description Language. **CO2**

References:

1. M. Morris Mano, "Digital Design", 3rd Edition, PHI

PART B:

1. Generate various Signals and Sequences: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc function. **CO3**
2. Operations on Signals and Sequences: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power. **CO3**
3. Write a program to find the trigonometric & exponential Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings- Plot the discrete spectrum of the signal.**CO4**
4. Write a program to find Fourier transform of a given signal. Plot its amplitude and phase spectrum. **CO4**
5. Write a program to convolve two discrete time sequences. Plot all the sequences. **CO4**
6. Write a program to find autocorrelation and cross correlation of given sequences. **CO4**
7. Write a program to verify Linearity and Time Invariance properties of a given Continuous System. **CO4**
8. Write a program to generate discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal. **CO4**
9. Write a program to generate Complex Gaussian noise and find its mean, variance, Probability Density Function (PDF) and Power Spectral Density (PSD). **CO4**
10. Note: Any seven experiments are to be simulated using MATLAB or equivalent software. **CO4**

References:

Stephen J. Chapman, "MATLAB Programming for Engineers", Cengage, November 2012.

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Course Title: PYTHON PROGRAMMING (Skill Enhancement Course)	**Course Code: R24ECSC01**
Teaching Scheme (L:T:P): 0:1:2	**Credits:** 2
Type of Course: Tutorial+ Practical	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in the Python Programming course, students should have a basic understanding of computer usage, including file handling and typing. Familiarity with mathematical logic, such as arithmetic operations and logical reasoning, is important. A general awareness of algorithmic thinking (using flowcharts or pseudocode) and a willingness to learn problem-solving techniques will help students grasp programming concepts more easily.	

Course Objectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

Course Outcomes:

After completion of the course, students will be able to

COs	PO1	PO2	PO3	PO4	PO5	PO11	PSO1	BT LEVEL
CO1: Showcase adept command of Python syntax, utilizing variables, data types, control structures, functions, modules, and exception handling to engineer efficient code solutions.	3	3	3	3	3	2	1	L3
CO2: Apply Python programming concepts to solve a variety of computational problems.	3	3	3	2	3	2	2	L3
CO3: Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs.	3	3	3	3	3	2	1	L6
CO4: Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas.	3	3	3	3	3	2	1	L3
CO5: Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries.	3	3	3	3	3	2	2	L3

UNTI-I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators

5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number. **COs- CO1,CO2**

UNIT-II:

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments. Lambda Functions: Syntax and usage of lambda functions.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings. Regular Expressions (Regex)

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.

3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
   i. Addition ii. Insertion iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list. **COs- CO2,CO5**

UNIT-III:

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset. Defaultdict and OrderedDict (from collections).

Sample Experiments:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary. **COs- CO5**

UNIT-IV:

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism. **COs- CO3,CO4**

Sample Experiments:

1. Write a program to sort words in a file and put them in another file. The output files should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.

5. Write a program to add, transpose and multiply two matrices.
6. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V:

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
   a) Apply head () function to the pandas data frame
   b) Perform various data selection operations on Data Frame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib. **COs- CO4,CO5**

Reference Books:

1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

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Course Title: QUANTITATIVE APTITUDE & LOGICAL REASONING	**Course Code: R24HS04**
Teaching Scheme (L:T:P): 0:1:2	**Credits:** 2
Type of Course: Tutorial+ Practical	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in the Quantitative Aptitude & Logical reasoning course, students should have a basic understanding arithmetic, algebra, and geometry from school-level mathematics. Analytical thinking and English comprehension skills for interpreting logical patterns and problems.	

Course objective:

- Build a strong foundation in quantitative aptitude and logical reasoning.
- Enhance problem-solving skills for topics like percentages, profit and loss, time and work, and logical reasoning puzzles.
- Improve speed, accuracy, and critical thinking for efficient problem-solving.
- Prepare students for competitive exams and real-world applications of math and logic.

Course outcome:

COs	PO1	PO2	PO3	PO4	PO5	PO11	PSO1	BT LEVEL
CO1: Mastery of Key Concepts – Understand number systems, percentages, time/work, profit/loss, and series completion.	3	2	1	2	1	-	1	L2
CO2: Improved Problem-Solving Skills – Solve mathematical and logical problems with speed and accuracy.	3	3	2	3	1	-	1	L3
CO3: Enhanced Analytical Thinking – Develop critical thinking for reasoning puzzles and real-life challenges.	2	3	2	3	2	-	1	L4
CO4: Competitive Exam Preparedness – Be well-prepared for exams requiring aptitude and reasoning.	3	2	1	2	2	1	2	L3

Aptitude:

Unit 1: Number System: Speed Maths, Numbers, Factors, Prime & Co-Primes, LCM, HCF, Divisibility rules, finding unit place digit and last two digits of an expression.

Averages and Ages: Average of different groups, change in averages by adding, deleting and replacement of objects, problems on ages.

Ratio, Proportion and Variations: Definition of Ratio, Definition of Proportion, Types of ratios, Types of proportions, mixture model, age model, salary model questions, Direct and indirect proportion. Allegation and mixtures: Allegation rule. **COs- CO1**

Unit 2: Percentages: Converting fractions and decimal into percentages, successive percentage, populations, expenditure and savings.

Profit and loss: Relation between Cost price and Selling price, Discount and Marked price, Gain or Loss percentages on selling price

Simple and Compound Interest: Problems on Interest (I), Amount (A), Principal (P)and Rate of Interest(R), Difference between the simple interest and compound interest for 2 and 3years.

COs- CO1, CO2

Unit 3: Time and Work: Men and Days, Work and Wages, Hours and Work, Alternate days concept, Chain rule.

Time and Distance: Difference between the average and relative speeds, reaching the destination late and early, Stopp age time per hour, time and distance between two moving bodies.

Trains, Boats and Streams: Train crossing man, same and opposite directions, Speed ofboat and stream. **COs- CO2, CO3**

Logical Reasoning No of lecture hours:25

Unit 4: Series completion: Number series, Alphabet series and letter series.

Blood Relations: Defining the various relations among the members of a family, Solving Blood Relation Puzzles by using symbols and notations. Problems on Coded relations.

Coding and Decoding: Letter coding, Number coding, Number to letter coding, Matrix coding, Substitution, Mixed letter coding, Mixed number coding, deciphering individual letter codes by analysis.

Direction sense test: Sort of directions in puzzles distance between two points, problems on shadows, Application of triangular triplets. **COs- CO3, CO4**

Unit 5: Clocks: Relation between minute-hour hands, anglevs. time, exceptional cases in clocks

Calendars: Definition of a Leap Year, Finding the odd days, finding the day of any random calendar date, repetition of calendar years. **COs- CO3, CO4**

Text Books:

1. R.S.Aggarwal“QuantitativeAptitude”,Reviseded.,SChandpublication,2017 ISBN:8121924987
2. R.S.Aggarwal “Verbal- Non verbal Reasoning”,Reviseded.,SChandpublication,2017

E- resources:

1. https://www.indiabix.com/aptitude/questions-and-answers/
2. https://www.tutorialspoint.com/quantitative_aptitude/
3. https://www.careerbless.com/aptitude/qa/home.php

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Course Title: ENVIRONMENTAL SCIENCE	**Course Code: R24MC03**
Teaching Scheme (L:T:P): 2:0:0	**Credits:** -
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in the Environmental Science course, students should have a basic knowledge of high school-level biology, physics, and chemistry. Awareness of environmental issues like pollution, climate change, and conservation is helpful. Interest in sustainability and nature will enhance understanding and engagement.	

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes:

After completion of the course, students will be able to

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO11	PSO1	BT LEVEL
CO1: Understand the scope, importance, and multidisciplinary nature of environmental studies, and analyze the exploitation of natural resources.	2	3	1	2	2	1	2	2	L2,L4
CO2: Describe the structure, function, and energy flow in ecosystems, and understand the importance of biodiversity and its conservation.	3	2	2	3	2	1	3	1	L2,L3
CO3: Evaluate the causes, effects, and control measures of different types of environmental pollution, and understand the strategies for solid waste management.	3	3	2	3	3	2	2	1	L4,L5
CO4: Examine the concept of sustainable development, urban environmental issues, and the role of environmental ethics and legislation in protecting the environment.	3	2	3	3	3	2	3	2	L4,L5
CO5: Analyze the relationship between human population growth and environmental degradation, and evaluate the role of population management and health programs in sustainable development.	3	2	2	2	3	2	3	1	L4,L5

SYLLABUS

UNIT I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources. **COs- CO1**

UNIT II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. **COs- CO2**

UNIT III

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides. **COs- CO3**

UNIT IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns.

Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming,

acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products.

Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness. **COs- CO4**

UNIT V

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc. **COs- CO5**

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

References:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
2. M.Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice Hall of India Private limited
5. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited.

Dr.E.Govinda, HOD
BoS Chairperson, Dept Of ECE

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Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Program: B. Tech Electronics and Communication Engineering **Regulation: R24**

II Year II Semester- Course Structure

S. No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	HS	R24HS05	Managerial Economics and Financial Analysis	2	0	0	2
2	PC	R24ECPC07	Digital signal processing	3	0	0	3
3	PC	R24ECPC08	EM Waves and Transmission Lines	3	0	0	3
4	PC	R24ECPC09	Analog Circuits Design	3	0	0	3
5	PC	R24ECPC10	Analog and Digital Communications	3	0	0	3
6	PC	R24ECPC11	Analog Circuits Design Lab	0	0	3	1.5
7	PC	R24ECPC12	Analog and Digital Communications Lab	0	0	3	1.5
8	SC	R24ECSC02	Soft Skills & Verbal Ability	0	1	2	2
9	HS	R24HS06	Design Thinking and Innovation	0	1	2	2
10	MC	R24MC04	Indian Traditional Knowledge	2	0	0	-
Total				**16**	**2**	**10**	**21**
Summer internship 2 months (Mandatory) after second year (to be evaluated during III year I Semester) (community service project)							

Category	Courses	Credits
HS-Humanities and Management Sciences Courses	2	4
PC-Professional Core Courses	6	15
SC-Skill Enhancement Course	1	2
MC- Mandatory course	1	0
Total	**10**	**21**

Course Title: MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	**Course Code: R24HS05**
Teaching Scheme (L:T:P): 2:0:0	**Credits:** 02
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Managerial Economics and Financial Analysis, students should have a basic understanding of Microeconomics (demand, supply, market structures) and Financial Accounting (balance sheet, income statement, etc.). Familiarity with mathematical tools like ratios, percentages, and the time value of money is essential.	

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes:

After completion of the course, students will be able to

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PSO1	BT LEVEL
CO1: Define the key concepts related to Managerial Economics. (L2)	2						L2
CO2: Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)	2						L2
CO3: Apply the Concept of Production cost and revenues for effective Business decision (L3)	3	2	2		1		L3
CO4: Develop the accounting statements and evaluate the financial performance of business entity (L5)	3	3	2	2			L5
CO5: Analyze strategies for investing capital to maximize returns, and evaluate the capital budgeting techniques. (L4) (L5)	3	2	2	3	2		L5

SYLLABUS

UNIT - I Managerial Economics

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Schedule, Demand curve Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting **–CO1,CO2**

UNIT - II Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even

Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems). **–CO2,CO3**

UNIT - III Business Organizations and Markets

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies – Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies **–CO2,CO3**

UNIT - IV Capital Budgeting

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems) **–CO4,CO5**

UNIT - V Financial Accounting and Analysis

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability. **–CO5**

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja Hl Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

E-Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market
https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
https://www.slideshare.net/ashu1983/financial-accounting

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Course Title: DIGITAL SIGNAL PROCESSING	**Course Code: R24ECPC07**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Signals and Systems, a strong foundation in several key areas of mathematics and engineering. Here are the typical prerequisites: Calculus (Single-variable and Multivariable Calculus), Differential Equations, Linear Algebra, Basic Complex Numbers, and Circuit Theory and a basic understanding of Fourier Transforms, Laplace Transforms, and Z-Transforms is essential.	

Course Objectives:

- Analyze the stability and invertibility of Linear Time-Invariant (LTI) systems and understand their response to arbitrary inputs.
- Apply Fast Fourier Transform (FFT) algorithms, including Radix-2 decimation in time and decimation in frequency, for efficient signal processing.
- IIR digital filters from analog filters using analog filter approximations like Butterworth and Chebyshev, and perform analog-to-digital frequency transformations.
- Design FIR digital filters using window techniques and frequency sampling techniques, and compare them with IIR filters.
- Understand the architecture of programmable DSPs, including key components like multipliers, memory access schemes, and on-chip peripherals,

Course Outcomes:

After completing the course, the student should be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PSO1	BT LEVEL
CO1: Understand the properties of discrete-time signals and systems and analyze their behavior using Z-transforms.	3	2		2			L2
CO2: Apply Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) techniques to evaluate signals.	3	3	2	2	2		L3
CO3: Design IIR digital filters using analog filter approximations and transformation methods.	3	3	3	2	2		L6
CO4: Design FIR digital filters using Fourier series, windowing, and frequency sampling techniques.	3	3	3	2	2		L6
CO5: Understand the architecture and key features of programmable DSP processors like the TMS320C5X.	3	2	2		2		L2

SYLLABUS

UNIT I

INTRODUCTION: Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, Casualty, BIBO stability of LTI systems, Invertability, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations with initial conditions, Solution of Linear constant coefficient difference equations using Z Transform. Frequency domain representation of discrete time signals and systems, Review of Z-transforms, solution of difference equations using Z-transforms, System function.**—CO1**

UNIT II

DISCRETE FOURIER SERIES & FOURIER TRANSFORMS:

Introduction, DFS, Properties of discrete Fourier series, DFS representation of periodic sequences, DTFT (Discrete time Fourier Transforms), Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Circular convolution. Relation between Fourier transform and Z Transform.

Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT. **—CO2**

UNIT III

DESIGN OF IR DIGITAL FILTERS & REALIZATIONS: Analog filter approximations - Butter worth and Chebyshev, Design of IIR Digital filters from analog filters by impulse invariant and bi-linear transformation method, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR Filters- Direct Form-I, Direct Form-II, Cascade Form and Parallel Form realization. **—CO3**

UNIT IV

DESIGN OF FIR DIGITAL FILTERS & REALIZATIONS:

FIR Filters Introduction, Characteristics of FIR Filters with linear phase, frequency response of Linear Phase FIR Filters, Design of FIR Digital Filters using Fourier series method, Frequency Sampling technique and Window Techniques (Rectangular, Triangular, Raised Cosine, Hanning, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters- Direct Form, Cascade Form, Linear Phase realization. **—CO4**

UNIT V

INTRODUCTION TO DSP PROCESSORS: Introduction to programmable DSPs:

Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs Multiple Access Memory, Multi ported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals.

Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals **—CO5**

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, Pearson Education / PHI, 2007.

2. Discrete Time Signal Processing - A.V.Oppenheim and R. W. Schaffer, PHI

E-Resources:

1. https://nptel.ac.in/courses/108101174
2. https://nptel.ac.in/courses/108105055
3. https://ocw.mit.edu/courses/6-341-discrete-time-signal-processing-spring-2005/

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Course Title: EM WAVES AND TRANSMISSION LINES	Course Code: R24ECPC08
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in EM Waves and Transmission Lines, students should have a strong grasp of vector calculus concepts such as gradient, divergence, and curl, typically learned in engineering mathematics. A solid foundation in basic electricity and magnetism from physics, including electric and magnetic fields, is important. Familiarity with differential equations is essential for understanding wave behavior and solving field equations. Knowledge of complex numbers and phasors helps in analyzing wave propagation and impedance. Basic circuit theory, including RLC circuits and Ohm's law, also supports understanding of transmission line behavior.	

Course Objectives:

- To understand and analyze different laws and theorems of electrostatic fields.
- To introduce fundamentals of static and time varying electromagnetic fields.
- To analyze the wave concept with the help of Maxwell's equations.
- To demonstrate the concepts of wave theory and propagation of waves through various mediums.
- To develop skills in solving various problems related to transmission lines.

Course Outcomes:

After completing the course, the student should be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PSO1	BT LEVEL
CO1: Apply the laws & theorems of electrostatic fields to solve the related problems.	3	2					L3
CO2: Demonstrate the behavior of time-varying electromagnetic fields using Maxwell's equations.	3	2	2				L3
CO3: Analyze the electromagnetic wave propagation in different mediums.	3	3	2	2			L4
CO4: Determine the parameters of transmission lines for various frequencies.	3	3	3	2	2		L3
CO5: Apply various impedance matching techniques to solve problems in transmission lines.	3	3	3		2		L3

SYLLABUS

UNIT I

Electrostatics: Review of Co-ordinate systems and Vectors**,** Coulomb's Law, Electric Field Intensity, Field due to a continuous volume charge distribution, Field of a line charge, sheet of charge, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.**—CO1**

UNIT II

Magnetostatics: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems**.**

Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in all possible forms and related Word Statements, Conditions at a Boundary Surface, Illustrative Problems. **—CO2**

UNIT III

EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems.

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem, Illustrative Problems. **—CO3**

UNIT IV

Transmission Lines - I: Types, Parameters, T & π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Illustrative Problems. **—CO4**

UNIT V

Transmission Lines – II: Input Impedance Relations, Reflection Coefficient, VSWR, Average Power, Shorted Lines, Open Circuited Lines, and Matched Lines, Low loss radio frequency and UHF Transmission lines, UHF Lines as Circuit Elements, Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems. **—CO5**

Textbooks:

1. Elements of Electromagnetics, Matthew N.O. Sadiku, 4th Edition, Oxford University Press, 2008.
2. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, 2nd Edition, PHI, 2000.
3. Transmission Lines and Networks, Umesh Sinha, 8th Edition, Satya Prakashan Tech. India Publications, New Delhi, 2003.

References:

1. Electromagnetic Field Theory and Transmission Lines, G. S. N. Raju, 2nd Edition, Pearson Education, 2013.
2. Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, 7th Edition, Tata McGraw Hill, 2006.
3. Electromagnetics, John D. Krauss, 3rd Edition, McGraw Hill, 1988.
4. Networks, Lines, and Fields, John D. Ryder,2nd Edition, PHI publications, 2012.

E-Resources:

1. https://nptel.ac.in/courses/108104087
2. https://nptel.ac.in/courses/108106157

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Course Title: ANALOG CIRCUITS DESIGN	**Course Code: R24ECPC09**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Analog Circuit Design, students should have a basic understanding of Electrical Circuit Theory (Ohm's Law, Kirchhoff's Laws, Thevenin/Norton theorems) and Electronic Devices (diodes, BJTs, MOSFETs, and operational amplifiers). Familiarity with mathematical tools like complex numbers, differential equations, and the Laplace transform is essential. Knowledge of AC/DC analysis**,** frequency response basic signal behavior is also important.	

Course Objectives:

- Understand the characteristics of multi stage, differential amplifiers, feedback, power and tuned amplifiers.
- Analyze the performance parameters of various amplifier circuits.
- Analyze different oscillator circuits based on the frequency of operation.
- Study and analyze the various pulse electronic circuits.

Course Outcomes:

After completing the course, the student should be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PSO1	BT LEVEL
CO1: Understand the characteristics of differential amplifiers, feedback and power amplifiers.	3	2					L2
CO2: Examine the frequency response of multistage and differential amplifier circuits using BJT & FETs at low and high frequencies.	3	3	2				L3
CO3: Investigate different feedback and power amplifier circuits based on the application.	3	3	2	2			L4
CO4: Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillator circuits.	3	3		2			L4
CO5: Evaluate and design the performance of different tuned amplifiers and pulse analog circuits for the given specifications and application.	3	3	2	2	2		L5,L6

SYLLABUS

UNIT-I

Multistage Amplifiers: Classification of amplifiers, distortion in amplifiers, frequency response of an amplifier, step response of an amplifier, methods of coupling, band pass of cascaded stages, analysis of **c**ascaded transistor amplifier, two stage RC coupled amplifier, Darlington pair amplifier, Boot-strap emitter follower, Cascode amplifier, differential amplifier.**—CO1,CO2**

UNIT -II

Feedback Amplifiers: Classification of basic amplifiers**,** Feedback concept, types of feedback, feedback topologies, characteristics of negative feedback amplifiers, generalized analysis of feedback amplifiers, performance comparison of feedback amplifiers, method of analysis of feedback amplifiers.

Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wein bridge oscillators using BJT and FET, generalized analysis of LC oscillators, Hartley and Colpitt's oscillators using BJT and FET, crystal oscillator, frequency stability of oscillators. **—CO3,CO4**

Unit-III

Power Amplifiers: Classification of amplifiers, Class A power Amplifiers, harmonic distortions, Class B amplifier, Push-pull amplifier, Complementary symmetry push pull amplifier, Class AB amplifier, Class-C amplifier, Class-D power amplifier, thermal stability and heat sink, distortion in power amplifiers. **—CO1,CO3**

Unit-IV

Tuned Amplifiers: Introduction, Q-Factor, small signal tuned amplifiers, effect of cascading single tuned and doubled tuned amplifiers on band width, stagger tuned amplifiers, comparison of tuned amplifiers, applications of tuned amplifiers, large signal tuned amplifiers, stability of tuned amplifiers. **—CO5**

Unit-V

Pulse Electronic Circuits: Response of High pass & Low pass RC circuits with sinusoidal, step, pulse, square inputs. RC network as differentiator and integrator, Attenuators Wave shaping circuits, Wave shaping circuits, diode clippers, diode comparator, diode clampers, astable, mono stable and bi-stable multivibrators using BJT, Schmitt trigger using BJT, Tunnel diode, UJT, Blocking oscillator, Miller and Bootstrap time base generators, Current time base generators. time base circuits **—CO6**

Text Books:

1. Electronic Devices and Circuits - J.Millman, C.C. Halkias & S.Jit, TMH, 4thEdition, 2015.
2. Pulse and Digital Circuits- A.Anand Kumar, PHI Learning Private Limited, 2012.

References:

1. Integrated Electronics- Jacob Millman, C. Halkies&C.D.Parikh, TMH, 2nd Edition,2010.
2. Electronic Devices and Circuits- S.Salivahanan& N.Suressh Kumar,TMH,3rd Edition, 2012.
3. Electronic Devices and Circuits – A.K.Maini & V.Agarawal, Wiley India Pvt.Ltd., First Edition, 2009.

E-Resources:

1. **https://nptel.ac.in/courses/108101094**
2. **https://www.khanacademy.org/science/electrical-engineering**

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Course Title: ANALOG AND DIGITAL COMMUNICATIONS	Course Code: R24ECPC10
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Analog and Digital Communications, students should have a solid understanding of signals and systems, including concepts like time and frequency domains, Fourier transforms, and convolution. A background in probability and random variables is important for analyzing noise and signal behavior. Familiarity with basic electronic circuits, especially filters and amplifiers, is helpful in understanding modulation and transmission.	

Course Objectives:

- To develop a fundamental understanding on Communication Systems
- To analyse various analog modulation & demodulation schemes
- Analyze the performance of various modulation techniques in the presence of AWGN
- To understand operation of AM & FM radio receivers

Course Outcomes:

After completing the course, the student should be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO11	PSO1	BT LEVEL
CO1: Understand the basics of communication system and analog modulation techniques.	3	2						L2
CO2: Apply the basic knowledge of signals and systems and understand the concept of Frequency modulation.	3	3	2					L3
CO3: Apply the basic knowledge of electronic circuits and understand the effect of Noise in communication system and noise performance of AM and FM systems.	3	3	2	2				L3
CO4: Understand TDM and Pulse Modulation techniques.	3	2		2				L4
CO5: Evaluate the performance of digital modulation techniques.	3	3	2	2	2	2		L5

SYLLABUS

UNIT I

Amplitude Modulation- Basic blocks of Communication System, Need for modulation, Amplitude (Linear) Modulation – AM, DSB-SC, SSB-SC and VSB-SC. Methods of generation and detection, Comparison of different AM techniques, Application of different AM techniques. **–CO1**

UNIT II

Angle (Non-Linear) Modulation - Frequency and Phase modulation. Frequency Modulation: Single tone frequency modulation, Narrow band FM, Wide band FM, Transmission bandwidth of FM signals. Generation: Direct Method, Indirect Method. Detection: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM, Applications. **–CO2**

UNIT III

Noise Analysis - Internal and External Noise, Noise Calculation, Noise Figure, Noise temperature, Noise analysis in AM receivers, Noise analysis in FM receivers, Threshold effect, Pre-emphasis and De-emphasis.

Transmitters& Receivers: Classification of Transmitters, AM Transmitters, FM Transmitters. Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers. **–CO3**

UNIT IV

Pulse Analog Modulation techniques – Pulse Amplitude Modulation, Pulse width Modulation, Pulse Position Modulation, Methods of generation and detection. Time division multiplexing, Frequency Division Multiplexing, Noise performance.

Pulse Digital Modulation techniques- Elements of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Companding in PCM systems. Differential PCM systems (DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems. **–CO4**

UNIT V

Digital Modulation Techniques: BASK, BFSK, BPSK, QPSK, generation and detection, DPSK and QAM. Introduction to M-ary systems.

Baseband transmission: Base band signal receiver, probability of error and its mathematical analysis, the optimum receiver, matched filter, coherent and non-coherent reception of FSK. **–CO5**

Text Books:

1. Communication Systems - Simon Haykin, John Wiley& Sons, 2nd Edition.
2. B. P. Lathi, Zhi Ding "Modern Digital and Analog Communication Systems", Oxfordpress, 2011.
3. Digital Communication- Simon Haykin, John Wiley, 2005.

Reference Books:

1. Digital Communications – John Proakis, TMH, 1983
2. Digital and Analog Communication Systems - Sam Shanmugam,JohnWiley& Sons, 1999.
3. Digital Communications: Fundamentals and Applications -Bernard Sklar, F. J. Harris, Pearson Publications, 2020.
4. Principles of Communication Systems- Taub and Schilling,Tata McGraw Hill, 2007.

E-Resources:

1. https://nptel.ac.in/courses/108104091
2. https://nptel.ac.in/courses/108104098

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Course Title: ANALOG CIRCUITS DESIGN LAB	**Course Code: R24ECPC11**
Teaching Scheme (L:T:P): 0:0:3	**Credits:** 1.5
Type of Course: Practicals	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Analog Circuit Design Lab, students should understand basic electronic components like diodes, BJTs, MOSFETs, and op-amps. Familiarity with circuit analysis techniques such as mesh and nodal analysis is essential. Hands-on experience with lab instruments like mustimeters and oscilloscopes is important for testing circuits. Basic skills in circuit simulation and schematic interpretation are also beneficial.	

Course Objectives:

- Design and analysis of multistage, differential, feedback, power and tuned amplifiers.
- Design and analysis of diode clippers, diode clampers, astable, monostable multivibrators and Schmitt trigger using BJT.
- Categorize different oscillator circuits based on the application.
- Design the electronic circuits for the given specifications and for a given application.

Course Outcomes:

At the end of this course the student will be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PSO1	BT LEVEL
CO1: Know about the usage of equipment /components/software tools used to conduct experiments in analog circuits.	2		1		2		L3
CO2: Conduct the experiment based on the knowledge acquired in the theory about various analog circuits using BJT/FET/MOSFETs.	3	2	2		2		L3
CO3: Analyze the given analog circuit to find required important metrics of it theoretically and design the electronic circuits.	3	3	2	1			L4,L6
CO4: Compare the experimental results with that of theoretical ones and infer the conclusions.	3	3	2	2			L5

List Of Experiments:

1. Design and analysis of Two-Stage RC-Coupled Amplifier
2. Design and Analysis of Darlington Pair Amplifier.
3. Design and Analysis of Cascode Amplifier.
4. Design and analysis of Differential Amplifier.
5. Design and Analysis of Voltage-Series/Voltage-Shunt Feedback Amplifier.
6. Design and Analysis of Current-Series/Current-Shunt Feedback Amplifier.
7. Design and Analysis of RC Phase Shift Oscillator
8. Design and Analysis of LC Heartley/Colpitts Oscillator
9. Design and Analysis of Class A power amplifier

10. Design and Analysis of Class AB amplifier
11. Design and analysis of Single Tuned amplifier.
12. Diode Clippers and Diode clampers
13. Astable and Monostable Multivibrators using BJT
14. Schmitt Trigger using BJT

Note: At least twelve experiments shall be performed using BJT/FET/ MOSFET devices and the relevant circuits shall be designed and perform the analysis using both hardware and equivalent EDA software tools.

Faculty members who are handling the laboratory shall see that students are given design specifications for a circuit appropriately and monitor the design and analysis aspects of the circuit.

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Course Title: ANALOG AND DIGITAL COMMUNICATIONS LAB	**Course Code: R24ECPC12**
Teaching Scheme (L:T:P): 0:0:3	**Credits:** 1.5
Type of Course: Practicals	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Analog and Digital Communications Lab, students should have a basic understanding of modulation and demodulation techniques such as AM, FM, ASK, FSK, and PSK. Familiarity with signal generation and analysis using function generators and oscilloscopes is essential. Knowledge of Fourier analysis and filtering concepts helps in interpreting frequency-domain behavior.	

Course Objectives:

- Understand the basics of analog and digital modulation techniques.
- Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course.
- Design and implement different modulation and demodulation techniques and their applications.
- Develop cognitive and behavioral skills for performance analysis of various modulation techniques.

Course Outcomes:

At the end of this course the student will be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PSO1	BT LEVEL
CO1: Know about the usage of equipment/ components/software tools used to conduct experiments in analog and digital modulation techniques.	2		2		2		L3
CO2: Conduct the experiment based on the knowledge acquired in the theory about modulation and demodulation schemes.	3	2	2		2		L3
CO3: Analyze the performance of a given modulation scheme to find the important metrics of the system theoretically.	3	3	2	1			L4
CO4: Compare the experimental results with that of theoretical ones and infer the conclusions.	3	3	2	2			L5

List Of Experiments:

Design the circuits and verify the following experiments taking minimum of six from each section shown below.

Section-A

1. AM Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. FM Modulation and Demodulation
4. Radio receiver measurements
5. PAM Modulation and Demodulation
6. PWM Modulation and Demodulation

7. PPM Modulation and Demodulation

Section-B

1. Sampling Theorem.
2. Time Division Multiplexing
3. Frequency Division Multiplexing
4. Delta Modulation and Demodulation
5. PCM Modulation and Demodulation
6. BPSK Modulation and Demodulation
7. BFSK Modulation and Demodulation
8. QPSK Modulation and Demodulation
9. DPSK Modulation and Demodulation

Note: Faculty members (who are handling the laboratory) are requested to instruct the students not to use readymade kits for conducting the experiments. They are advised to make the students work in the laboratory by constructing the circuits and analyzing them during the lab sessions.

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Course Title: SOFT SKILLS and VERBAL ABILITY	**Course Code: R24ECSC02**
Teaching Scheme (L:T:P): 0:1:2	**Credits:** 02
Type of Course: Tutorials+practicals	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Soft Skills and Verbal ability, students should have a basic understanding of effective communication principles, including verbal and non-verbal communication. Familiarity with teamwork and collaboration techniques is essential for group activities and presentations. A positive attitude and willingness to receive feedback help in personal development. Time management and problem-solving abilities support efficient task handling. Basic proficiency in English and presentation tools also enhances overall performance in soft skills training	

Course objective:

1. Enhance proficiency in English grammar, vocabulary, and reasoning skills for recruitment exams.
2. Develop effective communication skills for group discussions, resume building, and interviews.
3. Equip students with techniques for reading comprehension, logical reasoning, and professional presentation.
4. Prepare students for successful career placements through improved language and soft skills.

Course Outcomes:
At the end of this course the student will be able to

Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**BT LEVEL**
CO1: Demonstrate strong command over English grammar, vocabulary, and reasoning skills	3	3	2	2	1	1	1	1	2	1		L3
CO2: Effectively communicate in group discussions, create impactful resumes, and excel in interviews	2	1	1	1	2	2	2	3	3	2		L4
CO3: Develop critical thinking and problem-solving abilities for recruitment exams	3	3	2	2	1	1	1	1	2	1		L3
CO4: Be well-prepared for career placements with enhanced professional communication and soft skills	2	2	1	1	2	2	2	3	3	2		L3

Unit I – English Grammar and Usage (10 Hours)

This unit focuses on core grammar concepts frequently tested in company recruitment exams.
***Topics include*:**

Parts of Speech, Tenses and Subject-Verb Agreement, Articles and Prepositions, Sentence Correction and Spotting Errors, Active and Passive Voice, Direct and Indirect Speech

Learning Outcome: Students will demonstrate accurate grammar usage and error detection skills in various sentence structures.

Vocabulary Development and Application (10 Hours)
This unit enhances vocabulary required for business communication and aptitude tests. Topics include:

Synonyms and Antonyms, One-word Substitution, Idioms and Phrases, Confusing Word Pairs, Phrasal Verbs and Collocations

Learning Outcome: Students will improve their vocabulary strength and apply words appropriately in verbal and written contexts.

Unit II – Reading Comprehension Skills (5 Hours)
Students will learn techniques to understand, interpret, and analyze passages. Focus areas:

Main Idea and Supporting Details, Inference-Based Questions, Vocabulary in Context, Tone and Author's Perspective

Learning Outcome: Students will effectively comprehend and answer questions based on unseen passages within time constraints.

Verbal Reasoning and Logic-Based Language Skills (5 Hours)
This unit covers logical verbal questions commonly seen in recruitment exams:

Sentence Completion, Cloze Tests, Para Jumbles / Sentence Rearrangement, Statement and Conclusion / Assumptions.

Learning Outcome: Students will develop reasoning skills to solve pattern-based language puzzles.

Unit III – Group Discussion Skills (10 Hours):

This unit develops students' ability to communicate effectively in a group setting. It includes understanding the GD format, evaluation criteria, and participation strategies. Sessions will train students on body language, tone modulation, handling abstract and controversial topics, and presenting logical arguments. Multiple GD simulations will be conducted with personalized feedback to improve spontaneity and structure in speaking.

Learning Outcome: students will be able to communicate their ideas clearly, listen actively, contribute effectively to discussions, and demonstrate leadership and teamwork while maintaining professionalism and respect for diverse opinions.

Unit IV – Resume Preparation and Personal Branding (10 Hours):

This unit guides students in preparing an impactful, professional resume suited for technology and consulting sectors. Key areas include formatting, project and internship presentation, using effective language, and highlighting strengths and certifications. Students will also learn to optimize their LinkedIn profiles and online presence to reflect a professional digital identity.

Learning Outcome: Students will be able to create a professional, well-structured resume that highlights their skills and experiences, and build a strong personal brand to effectively present them in the job market.

Unit V – Interview Preparation (10 Hours):

This unit addresses all aspects of interview readiness. It covers commonly asked HR and technical questions, behavioral questions using the STAR (Situation, Task, Action, Result) method, and communication strategies during online interviews. Students will receive training in grooming, attire, voice modulation, and confidence building

Learning Outcome: students will be able to confidently handle both technical and HR interviews, presenting themselves professionally and effectively communicating their skills and experiences

Text Books:

1. **Wren, P. C., and H. Martin,** *High School English Grammar and Composition,* S. Chand Publishing, 1990.
2. **Lewis, N.,** *Word Power Made Easy,* Goyal Publishers, 1993.
3. **Aggarwal, R. S.,** *A Modern Approach to Verbal & Non-Verbal Reasoning,* S. Chand Publishing, 2017.
4. **Bakshi, S. P.,** *Objective General English,* Arihant Publications, 2018.

E-Resources :

1. **Grammarly,** *AI-powered writing assistant,* Grammarly, https://www.grammarly.com/
2. **IndiaBIX,** *Online Aptitude & Reasoning Practice,* IndiaBIX, https://www.indiabix.com/.
3. **AmbitionBox,** *Interview Experiences and Reviews,* AmbitionBox, https://www.ambitionbox.com/.
4. **Canva,** *Online Resume Builder and Templates,* Canva, https://www.canva.com/resumes/templates
5. **Testbook,** *Testbook: Online Mock Tests and Practice Papers,*https://testbook.com/.

Course Title: DESIGN THINKING & INNOVATION	**Course Code: R24HS06**
Teaching Scheme (L:T:P): 0:1:2	**Credits:** 02
Type of Course: Tutorials+Practicals	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Design Thinking & Innovation**,** students should have a basic understanding of problem-solving methodologies and critical thinking. Familiarity with user experience (UX) principles and empathy mapping is essential for understanding user needs. Knowledge of brainstorming techniques and collaborative tools aids in effective ideation. Basic skills in prototyping and rapid iteration are important for testing and refining solutions. Additionally, an understanding of business strategy and market research supports the creation of viable and innovative solutions.	

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes:

After completing the course, the student should be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	BT LEVEL
CO1: Define the concepts related to design thinking.	2	1			2	1			L1, L2
CO2: Explain the fundamentals of Design Thinking and innovation.	2	2	1		2	2			L1, L2
CO3: Apply the design thinking techniques for solving problems in various sectors.	3	3	2	2	3	2	2		L3
CO4: Analyse to work in a multidisciplinary environment.	3	3	3	2	3	3	3		L4
CO5: Evaluate the value of creativity. Formulate specific problem statements of real-time issues.	3	3	3	3	3	3			L5,L6

UNIT I

Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry. **–CO1,CO2**

UNIT II

Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development **–CO2,CO3,CO5**

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III

Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation. **–CO2,CO3,CO5**

UNIT IV

Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies**– CO3,CO4,CO5**

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT V

Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes. **– CO3,CO4,CO5**

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown,Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough. H, The Era of Open Innovation – 2013

E-Resources:

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/

Course Title: INDIAN TRADITIONAL KNOWLEDGE	**Course Code: R24MC04**
Teaching Scheme (L:T:P): 2:0:0	**Credits: -**
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Indian Traditional Knowledge, students should have a basic understanding of cultural heritage, environmental sustainability, and indigenous practices. Familiarity with legal and constitutional frameworks, especially related to biodiversity and forest rights, is essential.	

Course Objectives:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system

- The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system.
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003.
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection.
- To know the student traditional knowledge in different sector.

Course Outcomes:

After completion of the course, students will be able to:

Course Outcomes	PO1	PO2	PO6	PO7	PO8	PSO1	BT LEVEL
CO1: Understand the concept of Traditional knowledge and its importance	2	0	2	2	2		L2
CO2: Know the need and importance of protecting traditional knowledge	2	2	3	2	3		L2
CO3: Know the various enactments related to the protection of traditional knowledge	2	2	3	2	3		L1
CO4: Understand the concepts of Intellectual property to protect traditional knowledge	3	2	2	2	2		L2

SYLLABUS

UNIT-I

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.

COs- CO1

UNIT-II

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK. **COs- CO1,CO2**

UNIT-III

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003. **COs- CO2,CO3**

UNIT-IV

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

COs- CO3,CO4

UNIT-V

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. **COs- CO3,CO4**

Reference Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
4. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

e-Resources:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

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BoS Chairperson, Dept Of ECE

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AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
(Autonomous)
(Approved by A.I.C.T.E., New Delhi & Permanently Affiliated to JNTU-GV, Vizianagaram)
NAAC Accredited with A+ grade
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https://avanthienggcollege.ac.in/, E-mail: principal@avanthienggcollege.ac.in

Guidelines for B.Tech Honors in Engineering Regulations-R24

(Effective for the students admitted into I year from the Academic Year 2024-2025 onwards)

1) Introduction

The goal of introducing B.Tech (Honors) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

All the students pursuing regular B. Tech with prerequisite CGPA are eligible to the register Honors degree course. A student has to acquire 18 more credits, in addition to 160 credits (without back log history and meeting other guidelines) required, for the award of the B. Tech Honors degree. Out of the 18 extra credits required to obtain the Honors degree, at least SIX Credits (i.e., two courses of 3 credits each) must be earned from NPTEL / SWAYAM MOOC Courses. The additional courses shall be advanced subjects in the concerned department / discipline. The department concerned will determine required courses for award of Honors degree. The subjects in the Honors degree would be a combination of core (Theory and Lab) and some electives.

2) Objectives

The objectives of initiating the B. Tech (Honors) degree certification are:

a) To encourage the undergraduates towards higher studies and research
b) To prepare the students to specialize in core Engineering streams
c) To attain the high-level competence in the specialized area of UG programme
d) To learn the best educational and professional skills in the specialized area after the completion of his undergraduate courses.
e) To provide the opportunity to learn the advanced courses m the specified undergraduate programme

3) Applicability and Enrolment

a) To all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology

with CGPA of 7.0 up to II Year I Semester (III Semester), without any backlogs and backlog history.

b) It may be noted that both regular degree and Honors degree are to be completed in 4 Years for Regular students and 3 Years for lateral entry admitted students, without any backlog history.

c) For applicability of Honors degree, both regular B. Tech and Honors degree courses shall be successfully completed.

d) Transfer of credits from a particular minor to regular B. Tech or another major degree and vice-versa shall not be permitted

4) Entry level

a) The B. Tech students (both Regular and Lateral Entry) pursing a major degree programme can register for Honors degree at their choice in the same department / allied (as mentioned in AICTE Handbook) offering major degree from IV semester onwards.

b) Students registering for Honors degree shall select the subjects from same branches / department based on the recommendations of BoS committee. For example, if a student pursuing major degree in Electrical & Electronics Engineering, select subjects in Electrical & Electronics Engineering only and he / she will get major and Honors degree in Electrical & Electronics Engineering

c) Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for Honors degree other than Lab courses.

d) The students shall complete Honors degree without supplementary appearance within stipulated period as notified by college / JNTU-GV for the completion of regular major B. Tech programme.

e) Honors degree shall not be awarded at any circumstances without completing the regular major B. Tech programme in which a student got admitted

f) If a student is detained due to lack of attendance, he/ she shall not be permitted to register the courses for Honors degree

g) The subjects completed under Honors degree programme shall not be considered as equivalent subjects in case the student fails to complete the major degree programme

h) Students completed their degree shall not be permitted to register for Honors degree

5) Structure of Honors in B. Tech

a) The student shall earn additional 18 credits for award of Honors degree from same branch /

department / allied (as mentioned in AICTE Handbook) registered for major degree

b) Students can complete Honors degree courses either in the college or online from platforms like NPTEL/SWAYAM etc…

c) The overall attendance in each semester of regular B. Tech courses and Honors degree courses shall be computed separately

d) Student having less than 65% attendance in Honors courses shall not be permitted for "Honors Course (s) semester end examinations".

e) A student detained due to lack of attendance in regular B. Tech programme shall not be permitted to continue Honors programme

f) The teaching, examinations (internal and external) and evaluation procedure of Honors degree courses offered in offline is similar to regular B. Tech courses

g) Students may choose theory or practical courses to fulfill the minimum credit requirement.

h) Students shall be allowed to take maximum two subjects per semester pertaining to their Honors degree other than lab courses

i) The students registered for minor shall not be permitted to register for B. Tech (Honors)

6) Credits requirement

a) A Student will be eligible to get B. Tech (Honors), if he / she completes an additional 18 credits. These may be acquired either in offline or online like NPTEL / SWAYAM etc by doing 8 / 12 / 16-week courses covering 2 / 3 / 4 credits.

b) The colleges offering Honors degree courses shall be ready to teach the courses in offline at their college in the concerned departments. Curriculum and the syllabus of the courses shall be approved by the Board of Studies.

c) Students shall produce a certificate issued by the NPTEL / SWAYAM etc., conducting agency as a proof of credit attainment.

d) The teaching and evaluation procedure of Honors courses offering in offline mode shall be similar to that of regular B. Tech courses

e) After successful completion of all major and Honors degree courses with specified CGPA the College / University will award B. Tech (Honors)

7) Procedure to Apply for Honors degree

a) The department offering the Honors will announce courses required before the start of the session.

b) The interested students shall apply for the Honors course to the HOD of the concerned department.

c) The whole process should be completed within one week before the start of every session.

d) Selected students shall be permitted to register the courses for Honors degree.

8) To Join in Honors Program

a) Each department offering the Honors degree shall submit the final list of selected students to the principal.

b) The selected students shall submit a joining letter to the principal through the concerned HoD.

c) The department offering Honors shall maintain the record of student pursing the Honors degree.

d) With the approval of Principal and suggestion of advisor /mentor, students can choose courses from the approved list and shall register the courses within a week as per the conditions laid down in the structure for the Honor degree.

e) Each department shall communicate the Honors courses registered by the students to the time table drafting committee and accordingly time table will be drafting. Time table drafting committee shall see that no clash in time tables.

f) If the student wishes to withdraw / change the registration of subject / course, he/she shall inform the same to advisor/mentor, subject teacher, HoDs of minor department and parent department and Principal within two weeks after registration of the course.

9) Procedure for Monitoring the Progress of the Scheme

The students enrolled in the Honor courses will be monitored continuously at par with the prevailing practices and examination standards. An advisor / mentor from parent department shall be assigned to a group of students to monitor the progress.

10) Allocation of seats for Honors degree

Total number of seats offered for Honors degree shall be a maximum of 60 (based on merit).

11) Examinations

a) The examination for the Honors degree courses offered in offline shall be conducted along with regular B. Tech programme.

b) The examinations (internal and external) and evaluation procedure of Honors degree courses offered in offline is similar to regular B. Tech courses.

c) It may be noted that both major and Honors courses (from IV Semester to VII Semester) are to be completed in 4 Years for Regular students and 3 Years for lateral entry admitted students.

d) There is no supplementary examination for the failed subjects in an Honors degree programme.

e) Examination Fees: Examination Fees will be as per the College norms

f) For awarding the class, CGPA obtained in Major Degree only will be considered.

g) For awarding the Honor's, obtained credits only will be considered.

h) The student can complete these MOOCs NPTEL courses during III year I semester to IV-year II semester course completion and these courses will be included in the IV-year II Semester grade memo.

College offering B. Tech Honors Degree in the following Streams, and the student can take any one of Stream to get B. Tech Honors by satisfying eligibility criteria.

S.No	Stream	Offered By	Honors (For Students)
1	VLSI DESIGN	ECE	ECE
2	EMBEDDED SYSTEMS	ECE	ECE
3	ADVANCED COMMUNICATION SYSTEMS	ECE	ECE

1. VLSI DESIGN

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECVH201	II-II	Advanced VLSI Design	3	0	0	3
2	R24ECVH302	III-I	Introduction to CAD for VLSI	3	0	0	3
3	R24ECVH303	III-II	Design for testability	3	0	0	3
4	R24ECVH404	IV-I	VLSI Physical Design	3	0	0	3
5	R24ECVH405	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
6	R24ECVH406	---	NPTEL/MOOC Course-II (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	**12**	**0**	**0**	**18**

2. EMBEDDED SYSTEMS

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECEH201	II-II	Advanced Embedded systems	3	0	0	3
2	R24ECEH302	III-I	Real time Operating systems	3	0	0	3
3	R24ECEH303	III-II	Advanced Microcontrollers	3	0	0	3
4	R24ECEH404	IV-I	Embedded LINUX	3	0	0	3
5	R24ECEH405	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
6	R24ECEH406	---	NPTEL/MOOC Course-II (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	**12**	**0**	**0**	**18**

3. ADVANCED COMMUNICATION SYSTEMS

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECAH201	II-II	Modern Communication systems	3	0	0	3
2	R24ECAH302	III-I	RF and Microwave design	3	0	0	3
3	R24ECAH303	III-II	mm Wave Technology	3	0	0	3
4	R24ECAH404	IV-I	GPS and Navigation system	3	0	0	3
5	R24ECAH405	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
6	R24ECAH406	---	NPTEL/MOOC Course-II (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	**12**	**0**	**0**	**18**

STREAM-1. VLSI DESIGN

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECVH201	II-II	Advanced VLSI Design	3	0	0	3
2	R24ECVH302	III-I	Introduction to CAD for VLSI	3	0	0	3
3	R24ECVH303	III-II	Design for testability	3	0	0	3
4	R24ECVH404	IV-I	VLSI Physical Design	3	0	0	3
5	R24ECVH405	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
6	R24ECVH406	---	NPTEL/MOOC Course-II (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	**12**	**0**	**0**	**18**

Course Title: ADVANCED VLSI DESIGN	Course Code: **R24ECVH201**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Advanced VLSI Design, you need a strong foundation in several key areas of VLSI and Logic Families	

Course Objectives

1. Understand the principles of MOS and CMOS circuits, logic families, and layout considerations.
2. Explore advanced technologies beyond CMOS, such as carbon nanotubes and molecular computing.
3. Examine the operation of MIS structures, MESFETs, MODFETs, and MOSFETs.
4. Learn special circuit layouts and technology mapping for optimizing digital circuits.
5. Develop CMOS system design strategies with a focus on hierarchy, modularity, and full-custom design.

Course Outcomes:

At the end of the course, students will be able to

Course Outcome (CO)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO9**	**PSO1**	**BT LEVEL**
CO1: Familiarization of CMOS logic families and layout rules	3		2		2			L1
CO2: Illustrate the advances beyond CMOS and super buffers	3	2	2	2	2			L2
CO3: Illustrate the small signal operation of MOSFETs and MESFETs	3	2	2	2				L2
CO4: Design various circuit layouts using NAND-NAND, NOR-NOR, AOI logic and their technology mapping	3	2	3	2	3	2		L3
CO5: Illustrate the various CMOS design methodologies	3	2	3	2				L3

SYLLABUS

UNIT I

OVERVIEW OF MOS CIRCUITS

MOS and CMOS static plots, CMOS logic families: static, dynamic and dual rail logic circuits; Integrated Circuit Layout: Introduction to CMOS Layout, Design Rules, Parasitic component in layout, latch-up, ESD Protection. **COs-CO1**

UNIT II

BEYOND CMOS

Advances beyond CMOS, carbon Nano tubes, conventional vs. tactile computing, molecular and biological computing and diode- diode logic, Defect tolerant computing; Super Buffers- NMOS super buffer, tri state super buffer, CMOS super buffers. **COs-CO2**

UNIT III

MIS STRUCTURES AND MOSFETS

MESFETS: MESFET and MODFET operations, quantitative description of MESFETS, small signal operation of MESFETS and MOSFETS; MIS systems in equilibrium, under bias.

COs-CO3

UNIT IV

SPECIAL CIRCUIT LAYOUTS AND TECHNOLOGY MAPPING

Introduction, Talley circuits, NAND-NAND, NORNOR, and AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module lay out. **COs- CO4**

UNIT V

SYSTEM DESIGN

CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity & locality, CMOS Chip design Options, programmable logic, Programmable inter connect, programmable structure, Gate arrays standard cell approach, Full custom Design **COs- CO5**

TEXT BOOKS:

1. Kevin F Brennan “Introduction to Semi-Conductor Device”, Cambridge publications
2. Eugene D Fabricius “Introduction to VLSI Design”, McGraw-Hill publications.

REFERENCE BOOKS:

1. D.A Pucknell “Basic VLSI Design”, PHI Publication
2. Wayne Wolf, “Modern VLSI Design” Pearson Education, Second Edition
3. Addison Wesley N. Weste and K. Eshranghian, Principles of CMOS VLSI Design, 1985
4. L. Glaser and D. Dobberpuhl, Addison Wesley, The Design and Analysis of VLSI Circuits,1985

E-Resources:

1. https://nptel.ac.in/courses/117101004
2. https://ocw.mit.edu/courses/6-374-analysis-and-design-of-digital-integrated-circuits-fall-2003/

Course Title: INTRODUCTION TO CAD FOR VLSI	Course Code: **R24ECVH302**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Introduction To CAD For VLSI, you need a strong foundation in several key areas of Digital Electronics, VLSI design.	

Course Objectives

1. Understand the fundamentals of VLSI design methodologies, design domains, and an overview of design automation tools.
2. Learn high-level synthesis techniques including scheduling, allocation, and hardware modeling for computational systems.
3. Gain knowledge of logic synthesis and formal verification using binary-decision diagrams (BDDs) and logic optimization methods.
4. Explore floorplanning, placement, and partitioning strategies for efficient VLSI physical design.
5. Understand routing techniques including local, channel, and global routing algorithms for VLSI layout design.

Course Outcomes:

At the end of the course, students will be able to

Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**BT Level**
CO1: Gain comprehensive knowledge of VLSI design flow and automation	3	2	–	–	2	L2
CO2: Familiarize with the high-level synthesis process	3	–	–	–	3	L2
CO3: Acquire knowledge of logic synthesis process	3	2	–	–	3	L2
CO4: Explain algorithms for floor planning, partitioning, and placement	2	3	3	2	3	L4
CO5: Explain algorithms for routing	2	3	3	2	3	L4

SYLLABUS

UNIT-I

INTRODUCTION TO DESIGN METHODOLOGIES

The VLSI Design Problem, The Design Domains, Design Actions, Design Methods and Technologies Quick Tour of VLSI Design Automation Tools: Algorithmic and System Design, Structural and Logic Design, Transistor-level Design, Layout Design, Verification Methods, Design Management Tools

COs- CO1

UNIT-II

HIGH-LEVEL SYNTHESIS

Hardware Models for High-level Synthesis: Hardware for Computations, Data Storage, and Interconnection, Data, Control, and Clocks

Internal representation of the Input Algorithm: Simple Data Flow, Conditional Data Flow, Iterative Data Flow, Data-flow Graph Representation Allocation, Assignment and Scheduling: Goals and Terminology, A detailed Example, Optimization Issues Some Scheduling Algorithms: ASAP Scheduling, Mobility-based Scheduling, Force-directed Scheduling, List Scheduling Some Aspects of the Assignment Problem:

Optimization Issues, Graph Theoretical problem Formulation, Assignment by Interval and Circular-arc Graph Coloring, Assignment by Clique Partitioning, High-level Transformations **COs- CO2**

UNIT-III **COs- CO3**

LOGIC SYNTHESIS AND VERIFICATION

Introduction to Combinational Logic Synthesis: Basic Issues and Terminology, A Practical Example Binary-decision Diagrams: ROBDD Principles, ROBDD Implementation and Construction, ROBDD Manipulation, Variable Ordering, Applications to Verification, Applications to Combinatorial Optimization Two-level Logic Synthesis: Problem Definition and Analysis, A Heuristic Based on ROBDDs

UNIT-IV

FLOORPLANNING PLACEMENT AND PARTITIONING

Floor-planning Concepts: Terminology and Floorplan Representation, Optimization Problems in Floor-planning, Shape Functions and Floorplan Sizing Placement and partitioning: Circuit Representation, Wire Length Estimation Types of Placement Problem Placement Algorithms: Constructive Placement, Iterative Improvement Partitioning: The Kernighan-Lin Partitioning Algorithm. **COs- CO4**

UNIT-V

ROUTING

Types of Local Routing Problems, Area Routing Channel Routing: Channel Routing Models , The Vertical Constraint Graph , Horizontal Constraints and the Left-edge Algorithm, Channel Routing Algorithms Introduction to Global Routing: Standard-cell layout, Building-block Layout and Channel Ordering Algorithms for Global Routing :Problem Definition and Discussion, Efficient Rectilinear Steiner-tree Construction, Local Transformations for Global Routing. **COs- CO5**

TEXT BOOKS

1. Sabih H. Gerez, Algorithms for VLSI Design Automation, JOHN WILEY & SONS,1998

REFERENCE BOOKS

1. N.A. Sherwani, “Algorithms for VLSI physical design automation”, Kluwer Academic Publishers, 1999.

E-Resources:

1. **https://ocw.mit.edu/courses/res-16-002-how-to-cad-almost-anything-january-iap-2024/**
2. **https://nptel.ac.in/courses/106106089**

Course Title: DESIGN FOR TESTABILITY	Course Code: **R24ECVH303**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Design For Testability, you need a strong foundation in several key areas of Knowledge of Digital Logic Design, VLSI design flow, and hardware description languages (Verilog/VHDL) is essential.	

Course Objectives

1. Understand the basics of fault modeling and testing in digital circuits, including logical fault models and fault detection techniques.
2. Learn test pattern generation methods for combinational and sequential logic circuits, including fault-oriented and random test generation.
3. Explore design for testability concepts, including scan-based design and ad-hoc testability solutions.
4. Gain knowledge in Built-In Self-Test (BIST) concepts, architectures, and test pattern generation techniques.
5. Understand fault diagnosis techniques, including logical-level diagnosis, error detecting/correcting codes, and self-checking circuit design.

Course Outcomes

After completing the course, the student should be able to

Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**BT Level**
CO1: Understand fault models and logic simulation techniques in digital systems	**3**	**2**	**–**	**–**	**3**	**L2**
CO2: Generate test patterns for combinational and sequential circuits using various techniques	**3**	**3**	**3**	**2**	**3**	**L4**
CO3: Apply testability enhancement techniques including scan-based and ad-hoc designs	**3**	**2**	**3**	**–**	**3**	**L3**
CO4: Analyze and design Built-In Self-Test (BIST) architectures and understand ATE and MBIST concepts	**3**	**2**	**2**	**–**	**3**	**L4**
CO5: Understand and apply fault diagnosis and self-checking design techniques	**3**	**2**	**3**	**2**	**2**	**L3**

SYLLABUS

Unit I

Testing and fault modeling

Introduction to testing, Faults in Digital Circuits, Modeling of faults Logical Fault Models, Fault detection and redundancy, Fault equivalence, Fault Location, Fault dominance, Struck at faults, multiple struck at faults, Logic simulation, Types of simulation, Delay models. **COs- CO1**

Unit II

Test pattern generation

Test generation for combinational logic circuits**:** Fault oriented ATG, Fault Independent ATG, Random test generation based on non-uniform distributions. Test generation for sequential circuits**:** TG using iterative

array model, Simulation based TG, TG using RTL models, Random test generation for sequential circuits.

COs- CO2

Unit III

Design for testability

Testability Concepts, Ad-hoc based design: Test points, monostable-multivibrators, logical redundancy. Generic scan based design: Full serial integrated scan, non-serial scan. Classical scan based design.

COs- CO3

UNIT IV

Built-In Self-Test

BIST concepts, hardcore, levels of test. Test pattern generation for BIST**:** Exhaustive testing, Pseudo random testing, Pseudo exhaustive testing, Constant weight patterns. BIST Architectures: BEST, RTS, LOCST, Automatic Test Equipment(ATE)",Memory built in self-Test (MBIST) and Logic Built-in Test(LBIST)

COs- CO4

Unit V

Fault diagnosis

Logical Level Diagnosis**:** Basic concepts, fault dictionary, Guided probe testing, Diagnosis by UUT reduction, Fault Diagnosis for Combinational Circuits. Self-checking design: Basic concepts, Error detecting and error correcting codes, multiple bit errors, self-checking circuits, Parity check function, Self-checking for equality checkers.

COs- CO5

Textbook (s)

1. M.Abramovici, M.A.Breuer and A.D. Friedman, Digital systems and Testable Design, Jaico Publishing House, 2000.
2. P.K. Lala, Digital Circuit Testing and Testability, Academic Press, 1997.

Reference (s)

1. M.L.Bushnell and V.D.Agrawal, Essentials of Electronic Testing for Digital, Memory and Mixed- Signal VLSI Circuits, Kluwer Academic Publishers, 2000.
2. A.L.Crouch, Design Test for Digital IC's and Embedded Core Systems, Prentice Hall International, 2002.

E-Resources:

1. **https://nptel.ac.in/courses/106103016**
2. **https://nptel.ac.in/courses/106103116**

Course Title: VLSI PHYSICAL DESIGN	Course Code: **R24ECVH404**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in VLSI Physical Design, you need a strong foundation in several key areas of digital circuits, VLSI systems, and logic gates; familiarity with high-level programming and algorithmic concepts in hardware design.	

Course Objectives

1. Understand the VLSI design flow and the fundamental steps of physical design including partitioning, floorplanning, placement, and routing.
2. Learn the importance of partitioning and floorplanning, and explore related strategies and algorithms.
3. Study cell placement techniques with objectives like area and wire length minimization, including timing-aware placement.
4. Understand routing in VLSI, including global and detailed routing, and apply basic routing algorithms.
5. Gain knowledge of clock and power routing methods and the fundamentals of physical verification using DRC and LVS.

Course Outcomes

At the end of the course, students will be able to

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	BT Level
CO1: Understand the physical design flow and basic layout rules used in VLSI design.	2	2	-	-	2	-	-	-	2	-	2	L2
CO2: Apply partitioning and floorplanning techniques to design an optimal chip layout.	3	2	3	2	3	2	2	2	3	2	3	L3
CO3: Analyze placement algorithms and evaluate their impact on design quality.	3	3	4	3	3	3	2	2	3	3	4	L4
CO4: Demonstrate understanding of routing strategies and implement basic routing techniques.	3	2	3	2	3	2	2	2	3	2	3	L3
CO5: Explain the importance of clock/power routing and verification checks like DRC and LVS.	2	2	2	-	3	2	-	-	2	-	3	L2

SYLLABUS

UNIT I

Introduction to VLSI Physical Design

Overview of VLSI design flow, basic steps in physical design: partitioning, floorplanning, placement, routing, compaction. Introduction to CMOS fabrication and layout design rules. **COs- CO1**

UNIT II

Partitioning and Floorplanning

Need for partitioning, basic partitioning methods. Floorplanning concepts, block placement strategies, area and aspect ratio, introduction to floorplanning algorithms. **COs- CO2**

UNIT III

Placement Techniques

Basics of cell placement, placement objectives (area and wire length minimization). Simple placement algorithms, timing-aware placement. **COs- CO3**

UNIT IV

Routing

Overview of routing in VLSI. Global routing and detailed routing. Channel routing and switchbox routing. Simple routing algorithms and design rule basics. **COs- CO4**

UNIT V

Clock and Power Routing, Verification

Clock distribution: need and methods. Power routing introduction. Physical verification – DRC (Design Rule Check), LVS (Layout vs Schematic). **COs- CO5**

Textbook (s)

1. Kahng, A.B., Lienig, J., Markov, I.L., Hu, J., "VLSI Physical Design: From Graph Partitioning to Timing Closure", Springer.
2. Sherwani, N.A., "Algorithm for VLSI Physical Design Automation", 2nd Ed., Kluwer.
3. J. Bhasker and Rakesh Chadha, "Static Timing Analysis for Nanometer Designs A Practical Approach" Springer 2009

Reference (s)

1. Bhatnagar, H. "Advanced ASIC Chip Synthesis: Using Synopsys Design Compiler Physical Compiler and Prime Time"; Kluwer Academic Publishers: New York, NY, USA, 2002
2. "Modern VLSI Design: IP-Based Design" – Wayne Wolf, Pearson.

E-Resources:

1. https://nptel.ac.in/courses/106105161
2. https://nptel.ac.in/courses/108107380
3. https://www.vlsiexpert.com/

Dr. E. Govinda, HOD
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STREAM-2. EMBEDDED SYSTEMS

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECEH201	II-II	Advanced Embedded systems	3	0	0	3
2	R24ECEH302	III-I	Real time Operating systems	3	0	0	3
3	R24ECEH303	III-II	Advanced Microcontrollers	3	0	0	3
4	R24ECEH404	IV-I	Embedded LINUX	3	0	0	3
5	R24ECEH405	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
6	R24ECEH406	---	NPTEL/MOOC Course-II (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	**12**	**0**	**0**	**18**

Course Title: Advanced Embedded systems	**Course Code: R24ECEH201**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Advanced Embedded Systems, you need a strong foundation in several key areas of digital electronics and microprocessor fundamentals. Familiarity with assembly language programming and embedded systems concepts is essential.	

Course Objectives

1. Understand the fundamentals, classification, and components of embedded systems along with their quality attributes.
2. Learn hardware-software co-design approaches, firmware development, integration, and debugging tools in embedded system development.
3. Explore the architecture and features of the ARM Cortex-M3 processor including its registers, interrupts, and stack operations.
4. Study the instruction set, memory system, and pipeline architecture of Cortex-M3 for embedded applications.
5. Develop programming skills using ARM assembly, C language, and CMSIS for embedded system development.

Course Outcomes

At the end of the course, students will be able to

COs	PO1	PO2	PO3	PO5	PO11	BT Level
CO1: Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.	2	2	-	2	2	L2
CO2: Explain the hardware-software co-design and firmware design approaches.	2	2	-	2	2	L2
CO3: Understand the suitability of the instruction sets of ARM processors to the design of embedded systems.	2	2	-	2	2	L2
CO4: Acquire the knowledge of the architectural features of ARM Cortex M3, a 32-bit microcontroller including memory map, interrupts, and exceptions.	2	2	-	2	2	L2
CO5: Apply the knowledge gained for programming ARM Cortex M3 for different applications.	3	2	3	3	3	L3

SYLLABUS

UNIT-1

Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto coupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems. **COs- CO1**

UNIT-2

Hardware Software Co-Design, embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and

firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging. **COs- CO2**

UNIT-3

ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence. **COs- CO3**

UNIT-4

Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems,Memory maps, Cortex M3 implementation overview, pipeline and bus interface.

COs- CO4

UNIT-5

Exceptions, Nested Vector interrupt controller design, Systick Timer, Cortex-M3 Programming using assembly and C language, CMSIS. **COs- CO5**

Textbooks

1. Introduction to embedded systems K. V. Shibu TMH education Pvt. Ltd. 2009
2. The Definitive Guide to the ARM Cortex-M3 Joseph Yiu Newnes, (Elsevier) 2ndedn, 2010.

Reference Books:

1. Embedded systems - A contemporary design tool James K. Peckol John Wiley 2008.

E-Resources:

1. https://nptel.ac.in/courses/108105057
2. https://developer.arm.com/

Course Title: REAL TIME OPERATING SYSTEMS	**Course Code: R24ECEH302**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Real Time Operating Systems, you need a strong foundation in several key areas of basic operating systems, computer architecture, programming in C/C++, data structures, algorithms, and embedded systems.	

Course Objectives

1. Understand the fundamentals, characteristics, and constraints of real-time systems, and their integration with IoT and AI.
2. Learn fault detection and fault tolerance techniques used in safety-critical and real-time applications.
3. Explore the features of Real-Time Operating Systems (RTOS), task management, and synchronization issues and solutions.
4. Study real-time task scheduling strategies, algorithms like RMA, and performance evaluation metrics.
5. Gain knowledge of commercial RTOS platforms and real-time communication mechanisms in networked environments

Course Outcomes

At the end of the course, students will be able to

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	BT Level
CO1: Understand the fundamental concepts, classifications, and timing constraints of real-time systems.	2	2	-	-	-	-	-	-	-	-	L2
CO2: Analyze and apply fault tolerance mechanisms and safety requirements in real-time embedded systems.	3	3	3	4	3	-	-	-	2	-	L4
CO3: Demonstrate knowledge of RTOS features, task synchronization, and multitasking with real-world RTOS applications.	2	2	3	2	3	3	-	-	2	2	L3
CO4: Compare and evaluate various real-time scheduling algorithms and perform throughput/latency analysis.	3	3	3	4	3	3	-	-	2	2	L4
CO5: Explore the use of commercial RTOS platforms and real-time communication protocols in embedded systems.	2	2	3	2	3	2	2	2	3	-	L3

SYLLABUS

Unit I: Introduction to Real Time Systems

Overview of real-time systems, characteristics and applications, classification of real-time tasks: hard, soft, and firm. Timing constraints: delay, deadline, and duration constraints with their modeling. Discussion on safety, reliability, and fault tolerance techniques. Introduction to integrated real-time systems using IoT and AI. **COs- CO1**

Unit II: Fault Tolerance in Real-Time Systems

Concepts of safety-critical systems and reliability measures, types of faults and fault detection methods, techniques for fault tolerance including redundancy, fail-safe mechanisms, and real-time fault-tolerant application examples. **COs- CO2**

Unit III: Real Time Operating Systems

Basics of operating systems with RTOS features, task/process/thread concepts, multitasking and multiprocessing, task synchronization issues like racing and deadlock, and synchronization methods including busy wait, sleep & wakeup. RTOS selection criteria and case studies of commonly used RTOS like FreeRTOS, VxWorks, etc. **COs- CO3**

Unit IV: Real-Time Scheduling Algorithms

Task scheduling strategies: non-preemptive (FCFS, LCFS, SJF, Priority-Based) and preemptive (SRT, RR). Rate Monotonic Algorithm (RMA), latency and throughput analysis. Includes real-time scheduling case studies and performance metrics. **COs- CO4**

Unit V: Commercial RTOS and Real-Time Communication

Overview of Unix, Windows, and POSIX as RTOS. Real-time communication basics, communication in LAN and packet-switched networks. Discussion on µC/OS-II and VxWorks with their role in real-time applications and embedded system design. **COs- CO5**

Textbook (s)

1. Rajib Mall, Real-time Systems Theory and Practice, 1st edition, Pearson Publication, 2008
2. Shibu .K.V, Introduction to Embedded Systems, 1st Ed, Tata McGraw Hill Education Private Limited, 2009.

Reference (s)

1. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.
2. C.M. Krishna and K.G. Shin, Real-Time Systems, TMH, 2009.

E-Resources:

1. https://nptel.ac.in/courses/106105172
2. https://www.freertos.org/

Course Title: ADVANCED MICROCONTROLLERS	**Course Code: R24ECEH303**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Advanced Microcontrollers, you need a strong foundation in several key areas of digital electronics and microprocessor fundamentals. Familiarity with assembly language programming and embedded systems concepts is essential.	

Course Objectives

1. Understand the architecture and features of PIC microcontrollers and their interfacing techniques.
2. Learn the instruction set and programming model of PIC18F microcontrollers, including IDE-based software development.
3. Explore the architecture, features, and applications of ARM processor families such as ARM7TDMI and ARM9TDMI.
4. Study the ARM instruction sets, assembly programming, and architectural design issues.
5. Understand ARM system development concepts including memory management, interrupt handling, and embedded OS applications.

Course Outcomes

At the end of the course, students will be able to

COs	PO1	PO2	PO3	PO4	PO5	PO9	PO11	BT Level
CO1: Understand the fundamental architecture and features of PIC microcontrollers including the PIC18 family, its interrupts, timers, and interfacing techniques.	2	2	-	-	2	-	2	L2
CO2: Develop basic embedded programs for PIC microcontrollers using the PIC18F instruction set and understand software design using an IDE.	2	-	3	-	3	2	2	L3
CO3: Understand the core features, architecture, and interfacing techniques of ARM processors including ARM7TDMI and ARM9TDMI families.	2	2	-	-	2	-	2	L2
CO4: Apply the ARM instruction sets and optimize ARM assembly code, while addressing architectural design issues and support for system development.	2	2	3	-	3	-	2	L3
CO5: Analyze ARM system development aspects such as exceptions, interrupts, memory protection, and management, and evaluate embedded OS applications like ABS and elevator control systems.	3	3	3	2	3	-	3	L4

SYLLABUS

Unit I

PIC Microcontrollers

RISC vs CISC, Harvard and Von Neumann architecture, introduction to PIC microcontrollers, PIC18F family microcontroller architecture, support devices, microchip PIC family of devices, PIC18 interrupts, PIC18 timers and interfacing. **COs- CO1**

Unit II

PIC Microcontrollers Programming

PIC18F programming model, Instruction set: data copy, arithmetic, branching, bit manipulation. Stack and subroutine, Integrated Development Environment (IDE), application programs and software design. **COs- CO2**

Unit III

ARM Processors Architecture

Introduction to ARM processors cores, registers, Current Program Status Register, pipeline, exception, interrupt, interrupt vector table, core extensions, architecture revision, ARM processor families, ARM 7TDMI and ARM9TDMI processors, interfacing ARM 7TDMI and ARM9TDMI processors to other devices. Applications of ARM 7TDMI and ARM9TDMI processors.

COs- CO3

Unit IV

ARM Processor Architecture and Instruction Set

ARM Instruction Set, Thumb Instruction Set, Writing and Optimizing ARM Assembly Code, Design Issues in ARM Architecture, Architectural Support for System Development. **COs- CO4**

Unit V

ARM System Development and Embedded Operating System

Optimized Primitives for ARM, Exception and Interrupt Handling in ARM, Caches and Memory Protection Units, Memory Management Units in ARM, Embedded Operating System Usage in ARM Systems, Antilock braking system, Elevator control system. **COs- CO5**

Text Book (s):

1. Ramesh Gaonkar, Fundamentals of Microcontrollers and Applications in Embedded Systems, Penram International Publishing (India)Pvt. Ltd.,2007, 1st ed.
2. Andrew N Sloss, Dominic Symes and Chris Wright, ARM systems developer's guide, Elsevier, 2004.

Reference Book (s):

1. lucio Bi Jasio, PIC microcontrollers, Newnes Publishers.
2. Trevor Martin, The insider's guide of the Philips ARM7 based microcontrollers, Hitex (UK).

E-Resources:

1. https://developer.arm.com/
2. https://www.coursera.org/learn/embedded-systems

Course Title: EMBEDDED LINUX	**Course Code: R24ECEH404**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Embedded LINUX, you need a strong foundation in several key areas of Linux commands, embedded systems, and C programming.	

Course Objectives

1. To expose the students to the fundamentals of Linux Operating system, its basic commands and shell programming
2. To teach the history of embedded Linux, various distributions and basics of GNU Cross Platform Tool Chain.
3. To study on different Host-Target setup, debug and various memory device, file systems and performance tuning .
4. To introduce the concept of configuring kernel using the cross-platform tool chain.
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

Course Outcomes

At the end of the course, students will be able to

COs	PO1	PO2	PO3	PO5	PO9	PO11	BT Level
CO1: To use Linux desktop and GNU toolchain with Eclipse IDE.	2	-	2	3	-	2	L3
CO2: Cross compile Linux kernel and port it to target board.	3	2	3	3	-	2	L3
CO3: Add applications and write customized application for the Linux kernel in the target board.	3	2	3	3	-	2	L3
CO4: Students will study about distributions and cross-platform toolchain.	2	2	-	2	-	2	L2
CO5: Improved employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.	2	-	-	2	2	3	L2

SYLLABUS

UNIT I FUNDAMENTALS OF LINUX

Basic Linux System Concepts: Working with Files and Directories - Introduction to Linux File system - Working with Partitions and File systems - Understanding Linux Permissions; Using Command Line Tools: Executing Commands from the Command Line - Getting to a Shell - Popular Command-Line Commands - Working with the Bash Shell. **COs- CO1**

UNIT II VARIOUS DISTRIBUTIONS AND CROSS PLATFORM TOOL CHAIN

Introduction - History of Embedded Linux - Embedded Linux versus Desktop Linux - Commercial Embedded Linux Distribution - Choosing a distribution - Embedded Linux Distributions - Architecture of Embedded Linux - Linux Kernel Architecture - Porting Roadmap - GNU Cross Platform Toolchain **COs- CO2**

UNIT III HOST-TARGET SETUP AND OVERALL ARCHITECTURE

Real Life Embedded Linux Systems - Design and Implementation Methodology - Types of Host/Target Development Setups - Types of Host/Target Debug Setups - Generic Architecture of an Embedded Linux System - System Startup - Types of Boot Configurations - System Memory Layout - Processor Architectures - Buses and Interfaces - I/O – Storage **COs- CO3**

UNIT IV KERNEL CONFIGURATION

A Practical Project Workspace - GNU Cross-Platform Development Toolchain - C Library Alternatives - Other Programming Languages - Eclipse: An Integrated Development Environment - Terminal Emulators - Selecting a Kernel - Configuring the Kernel - Compiling the Kernel - Installing the Kernel - Basic Root Filesystem Structure - Libraries - Kernel Modules and Kernel Images - Device Files - Main System Applications - System Initialization **COs- CO4**

UNIT V LINUX DRIVERS

Introduction in to basics on Linux drivers, introduction to GNU cross platform Toolchain- Case study on programming one serial driver for developing application using Linux Driver. **COs- CO5**

TEXTBOOK/S:

1. Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, and Philippe Gerum, ‘Building Embedded Linux Systems 2nd Edition’, SPD -O’Reilly Publications, 2008
2. P. Raghavan, Amol Lad, Sriram Neelakandan, Embedded Linux System Design & Development, Auerbach Publications, 2012
3. William von Hagen, ‘Ubuntu Linux Bible 3rd Edition’, Wiley Publishing Inc., 2010.

REFERENCES:

1. Jonathan Corbet, Alessandro Rubini & Greg Kroah-Hartman, ‘Linux Device Drivers 3rd Edition’, SPD -O’Reilly Publications, 2011
2. Robert Love, ”Linux System Programming, SPD -O’Reilly Publications, 2010

E-Resources:

1. **https://www.coursera.org/learn/intro-embedded-linux**
2. **https://bootlin.com/training/**

Dr. E. Govinda, HOD
BoS Chairman, Dept of ECE

STREAM-3. ADVANCED COMMUNICATION SYSTEMS

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECAH201	II-II	Modern Communication systems	3	0	0	3
2	R24ECAH302	III-I	RF and Microwave design	3	0	0	3
3	R24ECAH303	III-II	mm Wave Technology	3	0	0	3
4	R24ECAH404	IV-I	GPS and Navigation system	3	0	0	3
5	R24ECAH405	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
6	R24ECAH406	---	NPTEL/MOOC Course-II (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	**12**	**0**	**0**	**18**

Course Title: Modern Communication Systems	**Course Code: R24ECAH201**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Modern Communication Systems, you need a strong foundation in several key areas of analog and digital communication principles, signal processing, and electromagnetic wave propagation.	

Course Objectives:

1. To understand digital modulation and coding techniques used in digital communication systems.
2. To learn the basics of stochastic processes and their applications in communication.
3. To study optimal receiver design for signals affected by noise and evaluate performance.
4. To explore Software Defined Radio (SDR) architecture and cognitive radio concepts.
5. To analyze MIMO systems with focus on architecture, modeling, and channel capacity.

Course Outcomes:

At the end of the course, students will be able to

COs	PO1	PO2	PO3	PO4	PO5	PO11	BT Level
CO1: Comprehend various digital modulation techniques.	2	2	–	–	–	–	L2
CO2: Explain the concept of Multicarrier Modulation.	2	2	–	–	–	–	L2
CO3: Analyze errors in system using optimum receivers and detectors.	3	3	3	–	–	–	L4
CO4: Give an introduction to the theory of stochastic processes.	2	2	–	–	–	–	L2
CO5: Contribute in the areas of software defined radio and cognitive radio, and understand MIMO systems and channel modelling.	3	2	3	2	2	3	L3

SYLLABUS

Unit 1. Digital Communication Systems

Introduction to communications systems, digital communication systems, review of digital modulation techniques, PCM, BPSK, QPSK, GMSK, Delta Modulation, Adaptive Delta Modulation, Sigma Delta Modulation, Basic principles of orthogonality, Single vs Multicarrier Systems, OFDM block diagram and its Explanations, Shannon- Fano Coding, Huffman Coding, Hamming Coding.

COs- CO1

Unit 2. Stochastic Process

Introduction, Mathematical definition of a stochastic process, Mean-Square Stochastic Integrals, Mean-Square Stochastic Differential Equations, Markov process, Poisson process, Ergodic Process.

COs- CO2

Unit 3. Optimum Receivers

Optimum receivers for signals corrupted by additive white gaussian noise, Correlation demodulator, Optimum detector. ML sequence detector, Probability of error for binary modulation techniques.

COs- CO3

Unit 4. Software Defined Radio

Need for software radio, general structure for transceiver for SDR, third generation SDR system architecture, trends in SDR, cognitive radio, spectrum sensing in cognitive radio. **COs- CO4**

Unit 5. MIMO Systems

Introduction, space diversity and systems based on space diversity, MIMO based system architecture, MIMO channel modeling, MIMO channel measurement, MIMO channel capacity. **COs- CO5**

Text Books:

1. U. Dalal, "Wireless Communication", Oxford University Press, fifth impression 2012.
2. H. Stark and J. Woods, "Probability, Statistics, and Random Processes for Engineers", 4th Edition, Pearson, 4e, 2012.
3. Taub and Schilling, "Principles of Communication Systems", 4e, Mc Graw Hills Education India 2014.

Reference books and other resources:

1. John G. Proakis, "Digital Communication", 5e, Mc Graw Hills Education, 2014.
2. W. Tomasi, "Advanced Communication Systems", Pearson Education.
3. S. Haykin "Digital Communication Systems", Wiley, 2013.
4. R. Bose, "Information Theory, Coding and Cryptography", Mc Graw Hills Education, 2008.
5. Related IEEE/IEE/ Science Direct publications.

E-Resources:

1. https://ocw.mit.edu/
2. https://nptel.ac.in/courses/117/104/117104099/

Course Title: RF and MICROWAVE DESIGN	**Course Code: R24ECAH302**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in RF and Microwave Design, you need a strong foundation in several key areas of electromagnetic theory, transmission lines, circuit theory, and basic electronics.	

Course Objectives:

1. To introduce fundamental concepts and applications of RF and microwave systems and circuits.
2. To understand RF behavior, impedance matching techniques, and circuit modeling.
3. To enable the use of Smith Chart for solving impedance matching and circuit problems.
4. To design small and large signal RF/microwave amplifiers including multistage configurations.
5. To analyze and design RF/microwave oscillators based on oscillation principles and tuning networks.

Course Outcomes:

At the end of the course, students will be able to

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**BT Level**
CO1: Understand the Radio frequency design concept and impart knowledge on various types of communication system architecture.	2	2	-	-	2	-	-	2	2	-	2	L2
CO2: Analyze various parameters of RF circuits within a communication system.	3	3	3	2	3	-	2	2	3	3	3	L3
CO3: Develop an insight to make use of several high-frequency RF design techniques.	2	2	3	-	2	-	2	-	3	2	3	L3
CO4: Utilize the various RF circuit design concepts in designing the RF Amplifier.	3	3	3	2	3	2	2	2	3	3	3	L3
CO5: Utilize the various RF circuit design concepts in designing the RF Oscillator.	3	3	3	2	3	2	2	2	3	3	3	L3

SYLLABUS

UNIT I

RF AND MICROWAVE CONCEPTS AND APPLICATIONS: Introduction, Reasons for using RF/Microwaves, RF/Microwave applications, Radio frequency waves, RF and Microwave circuit design, The unchanging fundamentals versus the ever-evolving structure, General active circuit block diagrams.
COs- CO1

UNIT II

RF ELECTRONICS CONCEPTS: Introduction, RF/Microwaves versus DC or low AC signals, EM spectrum, Wave length and frequency, Circuit representation of two port RF/microwave networks. Basics of RF component, Resonant circuits, Analysis of a simple circuit in phasor domain, Impedance transformers, RF impedance matching, Three element matching. **COs- CO2**

UNIT III

SMITH CHART AND ITS APPLICATIONS: Introduction, A valuable graphical aid the smith chart, Derivation of smith chart, Description of two types of smith charts, Smith charts circular scales, Smith charts radial scales, The normalized impedance-admittance (ZY) smith chart introduction, Applications of the smith chart - Distributed circuit applications, Lumped element circuit applications. **COs- CO3**

UNIT-IV

RF AND MICROWAVE AMPLIFIERS SMALL AND LARGE SIGNAL DESIGN:
Introduction, Types of amplifiers, small signal amplifiers, Design of different types of amplifiers, Multistage small signal amplifier design.
Introduction, High-power amplifiers, large signal amplifier design, Microwave power combining/dividing techniques, Signal distortion due to inter modulation products, Multistage amplifiers, large signal design. **COs- CO4**

UNIT V

RF AND MICROWAVE OSCILLATOR DESIGN: Introduction, Oscillator versus amplifier design, Oscillation conditions, Design of transistor oscillators, Generator-tuning networks.

COs-CO5

TEXT BOOKS:

1. Mathew M. Radmanesh , “Radio Frequency and Microwave Electronics”, Person Education Inc., New Delhi
2. Pozar, D.M., “Microwave and RF Design of Wireless Systems”, John Wiley & Sons, 2001.

REFERENCE BOOKS:

1.Joseph Helszain, “Microwave Engineering, Active and Non-reciprocal Circuits”, McGraw Hill International Edition, 1992

e-Resources:

1. https://nptel.ac.in/courses/108103141
2. https://www.microwaves101.com/

Course Title: mm WAVE TECHNOLOGY	Course Code: **R24ECAH303**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Random Variables and Stochastic Processes, you need a strong foundation in several key areas of Electromagnetic Theory, Analog & Digital Communication, and Microwave Engineering.	

Course Objectives:

1. To introduce mmWave technology, its implementation challenges, material properties, and emerging applications.
2. To understand propagation effects and channel modeling specific to mmWave frequencies.
3. To explore antenna designs and array configurations suitable for mmWave communication.
4. To examine high-speed baseband circuits including ADCs and DACs for mmWave systems.
5. To analyze physical layer design, algorithms, and networking challenges in mmWave communication.

Course Outcomes:

At the end of the course, students will be able to

COs	PO1	PO2	PO4	PO5	PO7	PO8	PO9	PO10	PSO1	BT LEVEL
CO1: Explain the fundamental concepts of Mm Wave Wireless Communication	2							2		L2
CO2: Analyze channel effects in Mm Wave and understand design considerations	3	3	2							L4
CO3: Exposed to goals and challenges of emerging Mm Wave applications	2	2			1					L2
CO4: Analyze challenges and applications of Mm Waves in research	3	3	2	2	1					L4
CO5: Review literature and report ethically on Mm Wave Wireless Communication						2	2	3		L5

SYLLABUS

UNIT-I
INTRODUCTION

A Preview of mm Wave Implementation Challenges, material properties at millimeter wave

frequencies, guiding structures, Emerging Applications of mm Wave Communications, mm Wave Standardization. **COs-CO1**

UNIT-II

RADIO WAVE PROPAGATION FOR mmWAVE

Large-Scale Propagation Channel Effects, Small Scale Channel Effects, Spatial Characterization of Multipath and Beam Combining, Angle Spread and Multipath Angle of Arrival, Antenna Polarization, Outdoor and Indoor Channel Models. **COs-CO2**

UNIT-III

ANTENNAS AND ARRAY FOR mm WAVE APPLICATIONS

Fundamentals of On-Chip and In-Package **mm** Wave Antennas, Fundamentals of On-Chip and In-Package mm Wave Antennas, In Package Antennas, Antenna Topologies for mm Wave Communications, Techniques to Improve Gain of On-Chip Antennas, Adaptive Antenna Arrays Implementations for mm Wave Communications, Characterization of On-Chip Antenna Performance. **COs-CO3**

UNIT-IV

MULTI-GBPS DIGITAL BASEBAND CIRCUITS

Review of Sampling and Conversion for ADCs and DACs, Device Mismatches: An Inhibitor to ADCs and DACs, Goals and Challenges in ADC Design, Encoders, Trends and Architectures for mm Wave Wireless ADCs, Digital to Analog Converters. **COs-CO4**

UNIT-V

mm WAVE PHYSICAL LAYER DESIGN AND ALGORITHMS

Practical Transceivers, High-Throughput PHYs, PHYs for Low Complexity, High Efficiency, Future PHY Considerations, Challenges when Networking mm Wave Devices. **COs-CO5**

TEXTBOOKS:

1. Theodore S. Rappaport, Robert W. Heath Jr., Robert C. Daniels, James N. Murdock, Millimeter Wave Wireless Communications, Prentice Hall, 2014.

REFERENCE BOOKS:

1. Prakash Bhartia, and Inder Bahl, mm Wave Engineering and Applications, Wiley Interscience

e-Resources:

1. **https://nptel.ac.in/courses/108105179**
2. **https://www.edx.org/course/the-path-to-5g**

Course Title: GPS AND NAVIGATION SYSTEMS	**Course Code: R24ECAH404**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in GPS and Navigation Systems, you need a strong foundation in several key areas of Electronics & Communication, Engineering Mathematics, and Fundamentals of Satellite Communication.	

COURSE OBJECTIVES

1. To describe the fundamental principle and architecture of the Global Positioning System.
2. To understand GPS signal structure, including PRN codes, navigation data, signal generation.
3. To understand coordinate systems, GPS orbits, and analyze user position determination techniques.
4. To interpret GPS data formats and evaluate parameters essential for navigation and observation data.
5. To explore the design, features, and applications of Global Navigation Satellite Systems, including Galileo, GLONASS, and IRNSS.

COURSE OUTCOMES

At the end of the course, the student will be able to:

COs	PO1	PO2	PO4	PO5	PO7	PO10	PSO1	BT Level
CO1: Describe the working principle & configuration of GPS.	2					2		L2
CO2: Explain GPS signal structure and its components for functionality.	2					2		L2
CO3: Apply coordinate systems and GPS principles to determine user position.	2	2		3				L3
CO4: Analyze GPS data formats and evaluate errors to improve GPS user position accuracy	3	3	2	2				L5
CO5: Compare the architectures, features, and applications of different GNSS systems	2	2			1	2		L4

SYLLABUS

UNIT-I

Introduction to GPS: The History of GPS, Development of NAVSTAR GPS, GPS working principle-Trilateration, Determining the receiver position in 2D and 3D, GPS Configuration -Space segment, Control segment, User segment. **COs- CO1**

UNIT-II

GPS Signal Structure: GPS Signals- Pseudorandom noise (PRN) code, C/A code, P code, Navigation data, GPS Signal Generation, Selective Availability (SA), Anti Spoofing (AS).

COs- CO2

UNIT-III

Coordinate Systems: Geoid, Ellipsoid, Geo dietic coordinate system, Conventional Terrestrial Reference System (CTRS), world geodetic system 1984 (WGS 84) GPS orbits and satellite position determination: GPS orbital parameters, Kepler Laws, GPS time, Basic Equations for Finding User Position, Pseudo Range Measurement in Receiver, Least squares method. **COs- CO3**

UNIT-IV

GPS Data Formats: Description of Receiver Independent Exchange format (RINEX) – Observation data and navigation message data parameters GPS Errors: GPS error sources – clock error, ionospheric error, tropospheric error, multipath, satellite geometry. **COs- CO4**

UNIT-V

Global Navigation Satellite Systems: Constellation of Galileo, Advantages of Galileo signal structure over GPS, Galileo Signal Components, GLONASS Constellation, GLONASS Components Comparison of 3 GNSS (GPS, GALILEO, GLONASS) in terms of constellation and services provided, Introduction to IRNSS-NaVIC, Applications of IRNSS. **COs- CO5**

TEXT BOOKS

1. Global Navigation Satellite Systems - G S RAO, McGraw-Hill Publications, New Delhi, 2010.
2. Introduction to GPS: The Global Positioning System- Ahmed El-Rabbany, Artech House mobile communications series, ISBN 1-58053-183-1.
3. Understanding GPS/GNSS: principles and applications-Elliott D. Kaplan, Christopher J.Hegarty, Second Edition, ARTECH HOUSE, ISBN-10: 1-58053-894- 0, 2017.

REFERENCE BOOKS

1. GPS – Theory and Practice - B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, Springer Wien, New York (2001).
2. Fundamentals of GP S receivers – A software approach - James Ba – Yen Tsui, John Wiley & Sons (2001).
3. The Global Positioning System: A Shared National Asset: Recommendations for Technical Improvements and Enhancements, National Academies Press, print ISBN: 9780309052832 ebook ISBN: 9780585054537.

e-Resources:

1. **https://nptel.ac.in/courses/105107157**
2. **https://nptel.ac.in/courses/105107194**

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BoS Chairman, Dept of ECE

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Guidelines for B.Tech Minors in Engineering Regulations-R24

(Effective for the students admitted into I year from the Academic Year 2024-2025 onwards)

1) Introduction

Looking to global scenario and as per NEP-2020, Engineering students should have knowledge of subjects from other branches and some advanced subjects of their respective branch in which they are perusing the degree. To complement the same, Institute has decided to take an initiative from Academic Year 2024-2025 (R24 Regulations) by introducing Minors to the students enrolled in B.Tech Program. This gives a provision to the students to pursue Minors other than the discipline in which student got admitted. An aspiring student can choose the courses and laboratories in any other discipline and can get a Minor Degree in the chosen specialization in addition to regular B.Tech Degree. This way undergraduate are not restricted to learn about courses only in the discipline they get admitted to, but can choose courses of their interest to later on take up a career path of their liking. The students taking up a minor course will get additional credits. A student has to acquire **18 more credits**, **in addition to 160 credits** required, for the award of the minor by fulfilling at least three credits must be earned from NPTEL / SWAYAM MOOC Course and the remaining 15 **credits by doing FIVE Theory** / Integrated courses of 03 credits each (or) **Four Theory courses of 03 credits each along with 2 Laboratory Courses of each 1.5 Credits** either through MOOCS / Regular. The department concerned will determine the required courses for award of minor. The subjects in minor programme would be a combination of mostly core and some electives.

2) Objectives

The objectives of initiating the B.Tech (Minors) degree certification are:

a) To diversify the knowledge of the undergraduates.
b) To make the undergraduates more employable.
c) To have more educational and professional skills after the completion of his UG courses.
d) To give a scope to specialize students in other streams of engineering in addition to the ones they are currently pursuing.

3) Applicability and Enrolment

a) To all B.Tech (Regular and Lateral Entry) students admitted in Engineering & Technology
b) There shall be no limit on the number of programs offered under Minor. The minor programs in emerging technologies are based on expertise in the respective departments and may also be offered in collaboration with the relevant industries/ agencies.
c) If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned HoD in consultation with BoS.
d) For applicability of minor, both regular B.Tech and minor courses shall be successfully completed.
e) Transfer of credits from a particular minor to regular B.Tech or another major degree and vice-versa shall not be permitted

4) Entry level

a) The B.Tech students (both Regular and Lateral Entry) pursuing a major degree programme can register for minor at their choice in any other department offering minor from IV semester onwards.
b) Students registering for minor shall select the subjects from other branches. For example, if a student pursuing major degree in Electrical & Electronics Engineering shall select the subjects specified for minor in Computer Science and Engineering and he/she will get major degree of Electrical & Electronics Engineering with minor of Computer Science and Engineering.
c) Student pursuing major degree in any engineering branch is eligible to register for minor in any other engineering branch. However, students pursuing major degree in a particular Engineering are not allowed to register for minor in the same engineering branch.
d) Separate CGPA shall be shown on semester and final transcripts of regular B.Tech and minor.
e) Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for minor.
f) Minor shall not be awarded at any circumstances without completing the regular major
g) B.Tech programme in which a student got admitted
h) If a student is detained due to lack of attendance, he/ she shall not be permitted to register the courses of minor
i) Students completed their degree shall not be permitted to register for minor.

5) Structure of Minor in B. Tech

a) The student shall earn additional 18 Credits for award of minor from other branch/department / discipline registered for major degree.
b) Students can complete minor courses either in the college or in online from platforms like NPTEL/SWAYAM etc.
c) The overall attendance in each semester of regular B. Tech courses and minor courses shall be computed separately
d) Student having less than 65% attendance in minor courses shall not be permitted for appearing "Minor course(s) end semester examinations".
e) A student detained due to lack of attendance in a regular B. Tech programme shall not be permitted to continue minor programme.
f) The teaching, examinations (internal and external) and evaluation procedure of minor courses offered in offline is similar to regular B. Tech courses
g) The students may choose theory or practical courses to fulfill the minimum credit requirement.
h) The students may be allowed to take maximum of two subjects per semester pertaining to their minor
i) Students shall not be permitted to register for minor degree after completion of VI semester.
j) The students are permitted to opt for only a single minor course in his/her entire tenure of B. Tech (Engineering)
k) The students registered for B. Tech (Honors) shall not be permitted to register for minor
l) The student is not permitted to take the electives courses from the parent department to fulfill the minimum

6) Credits requirement

a) A Student will be eligible to get minor along with major degree engineering, if he/she completes an additional 18 credits. These may be acquired either in offline or online like NPTEL/SWAYAM etc.,
b) Additional credits shall also be acquired through NPTEL Courses, which shall be domain specific, with a minimum duration of 8 / 12 / 16 weeks (2/3/4 credits) as recommended by the Board of studies.
c) Students shall produce a certificate issued by the NPTEL/SWAYAM etc., conducting agency as a proof of credit attainment

d) The colleges offering minor courses shall be ready to teach the courses in offline at their college in the concerned departments. Curriculum and the syllabus of the courses shall be approved by the Board of Studies

e) After successful completion of all major and minor courses with specified CGPA the University will award both major and minors

7) Procedure to Apply for Minors degree

a) The department offering the minor will announce specialization and courses before the start of the session.

b) The interested students shall apply through the HoD of his/her parent department.

c) The concerned department will announce the list of the selected students for the minor.

d) The whole process should be completed within one week before the start of every session.

e) Selected students shall be permitted to register the courses for minor.

8) To Join in Minors Program

a) Each department offering the minor will submit the final list of selected students to the principal.

b) The selected students shall submit a joining letter to the principal through the concerned HoD offering the minor. The student shall inform same to the HoD of his/her parent department.

c) Both parent department and department offering minor shall maintain the record of student pursing the minor

d) With the approval of Principal and suggestion of advisor, students can choose courses from the approved list and shall register the courses within a week as per the conditions laid down in the structure for the minor.

e) Each department shall communicate the minor courses registered by the students to the time table drafting committee and accordingly time table will be drafting. Time table drafting committee shall see that no clash in time tables.

9) Procedure for Monitoring the Progress of the Scheme

The students enrolled in the minor courses will be monitored continuously at par with the prevailing practices and examination standards. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

10) Allocation of seats for Minors degree

a) The university /institute/ colleges will notify the number of the seats for minor in the concerned department well in advance before the start of the semester
b) Total number of seats offered for a minor programme shall be a maximum of 60 (based on merit).
c) The list of the electives for minor will be offered from the list of running majors in the concerned subjects.
d) There is no fee for registration of subjects for minor degree programme offered in off line at the respective colleges.

11) Examinations

a) The examination for the minor courses offered in offline shall be conducted along with regular B. Tech programme.
b) The examinations (internal and external) and evaluation procedure of minor courses offered in offline is similar to regular B. Tech courses.
c) A separate transcript shall be issued for the minor subjects passed in each semester
d) It may be noted that both major and minor courses (from IV Semester to VII Semester) are to be completed in 4 Years for Regular students and 3 Years for lateral entry admitted students.
e) Examination Fees: Examination Fees will be as per the institute norms
f) For awarding the class, CGPA obtained in Minor Degree only will be considered.
g) For awarding the Minor, obtained credits only will be considered.

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College offering B.Tech Minors Degree in the following Streams, and the student can take any one of Stream to get B.Tech Minors by satisfying eligibility criteria.

S.No	STREAM	Offered By	Minors (For Students)
1	Digital Electronics in Modern Applications	ECE	CSE/CSE(AIML)/CSE(DS)/MECH
2	IoT based Embedded system Design	ECE	CSE/CSE(AIML)/CSE(DS)/MECH

STREAM-1: DIGITAL ELECTRONICS IN MODERN APPLICATIONS

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECDEM201	II-II	Fundamentals of Digital Electronics	3	0	0	3
	R24ECDEM202	II-II	Digital Electronics Lab	0	0	3	1.5
2	R24ECDEM301	III-I	Fundamentals of Signal Processing	3	0	0	3
3	R24ECDEM302	III-II	Fundamentals of VLSI Design	3	0	0	3
	R24ECDEM303	III-II	VLSI Design Lab	0	0	3	1.5
4	R24ECDEM401	IV-I	Digital Design with Verilog	3	0	0	3
5	R24ECDEM001	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	12	0	06	18

STREAM-2: IoT BASED EMBEDDED SYSTEM DESIGN

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECIEM201	II-II	Digital Electronics	3	0	0	3
	R24ECIEM202	II-II	Digital Electronics Lab	0	0	3	1.5
2	R24ECIEM301	III-I	Microprocessor and its applications	3	0	0	3
3	R24ECIEM302	III-II	Microcontroller and its interfacing	3	0	3	3
	R24ECIEM303	III-II	Microcontroller and interfacing Lab	0	0	3	1.5
4	R24ECIEM401	IV-I	Introduction to IoT and Embedded systems	3	0	0	3
5	R24ECIEM001	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	12	0	06	18

STREAM-1: DIGITAL ELECTRONICS IN MODERN APPLICATIONS

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECCDEM201	II-II	Fundamentals of Digital Electronics	3	0	0	3
	R24ECDEM202	II-II	Digital Electronics Lab	0	0	3	1.5
2	R24ECDEM301	III-I	Fundamentals of Signal Processing	3	0	0	3
3	R24ECDEM302	III-II	Fundamentals of VLSI Design	3	0	0	3
	R24ECDEM303	III-II	VLSI Design Lab	0	0	3	1.5
4	R24ECDEM401	IV-I	Digital Design with Verilog	3	0	0	3
5	R24ECDEM001	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	12	0	06	18

Course Title: FUNDAMENTALS OF DIGITAL ELECTRONICS	**Course Code: R24ECDEM201**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Fundamentals of Digital Electronics, you need a strong foundation in several key areas of number systems, Boolean algebra, and elementary electrical circuit concepts.	

Course Objectives:

1. To introduce the fundamental concepts of number systems, binary codes, and logic gates.
2. To enable students to simplify Boolean expressions and design basic arithmetic circuits.
3. To develop the ability to design and analyse basic combinational logic circuits.
4. To provide knowledge on the working and design of basic sequential circuits including flip-flops and counters.
5. To introduce finite state machines and highlight the importance of timing and hazards in sequential logic circuits.

Course Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	BT Level
CO1: Understand number systems, binary codes, and basic logic gates.	3	2	–	–	–	–	L1, L2
CO2: Simplify Boolean expressions and design simple arithmetic logic circuits.	3	3	3	–	–	–	L3, L4
CO3: Design and analyse basic combinational circuits like encoders, decoders, and multiplexers.	3	3	3	2	–	–	L3, L4
CO4: Explain the operation of flip-flops and design simple counters and shift registers.	3	3	3	2	–	–	L2, L3
CO5: Develop state diagrams and design sequence detectors while identifying hazards in circuits.	3	3	3	2	1	–	L3, L4

UNIT I: Number Systems and Logic Gates

Number systems (binary, decimal, hexadecimal), binary codes (BCD, Gray), basic Boolean algebra, logic gates (AND, OR, NOT, NAND, NOR, XOR), SOP and POS forms. **COs-CO1**

UNIT II: Boolean Simplification and Arithmetic Circuits

Boolean expression simplification using laws and Karnaugh maps (up to 4 variables), design of basic arithmetic circuits: half adder, full adder, half subtractor, full subtractor. **COs-CO2**

UNIT III: Combinational Logic Circuits

Basic combinational circuits: encoder, decoder, multiplexer, demultiplexer; simple implementation of logic functions using decoders and multiplexers. **COs-CO3**

UNIT IV: Sequential Logic Circuits

Introduction to sequential circuits, latches and flip-flops (RS, JK, D, T), basics of counters (ripple and synchronous), basics of shift registers. **COs-CO4**

UNIT V: Finite State Machines and Timing Issues

Concept of finite state machines, simple state diagrams and tables, basic sequence detector design, brief idea of hazards. **COs-CO5**

Text Books:

1. Switching and finite automata theory: ZviKohavi, Niraj K. Jha, Cambridge University Press, 3rd Edition, 2009.
2. Digital Design by Morris Mano, Prentice Hall India, 5th Edition.

Reference Books:

1. Digital Principles and Applications by Leach, Malvina, Saha, Mc-Graw Hill, 8th Edition, 2014.
2. Switching Theory and Logic Design by A. Anand Kumar, PHI learning, 3rd edition.
3. Introduction to Switching Theory and Logic Design – Fredriac J Hill, Gerald R Peterson, 3rdEdition, John Willey and Sons Inc,

e-Resources

1. https://nptel.ac.in/courses/108106177
2. https://nptel.ac.in/courses/117108040
3. https://nptel.ac.in/courses/106105185
4. https://nptel.ac.in/courses/117104128

Course Title: DIGITAL ELECTRONICS LAB	**Course Code: R24ECDEM202**
Teaching Scheme (L:T:P): 0:0:3	**Credits:** 1.5
Type of Course: Practical's	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Digital Electronics Lab, you need a strong foundation in several key areas of electrical circuits, number systems, Boolean algebra, and fundamental logic gates.	

Course Objectives

1. To Verify the truth tables of logic gates
2. To Design and verify the operation of combinational circuits.
3. To Design and verify the operation of sequential circuits
4. To Verify the operation of Johnson/ring counter and different types shift register
5. To Verify the operation of RAM and ALU

Course Outcomes:

At the end of the course the student will be able to

Course Outcome (CO)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**BT LEVEL**
CO1: Distinguish logic gates for design of digital circuits	3	2	2	1	1		L4
CO2: Design different types of Combinational logic circuits	3	3	3	2	1		L6
CO3: Analyze the operation of flip-flops	3	2	2	1	1		L4
CO4: Apply knowledge of flip-flops in designing of Registers and Counters & Analysis the operation of RAM and ALU	3	2	3	2	1		L3,L4

List of Experiments:

1. Realization of Logic Gates **COs: CO1**
2. 3 to 8 Decoder- 74138 **COs: CO2**
3. 8*1 Multiplexer-74151 and 2*1 De-multiplexer-74155 **COs: CO2**
4. 4-Bit Comparator-7485. **COs: CO2**
5. D Flip-Flop- 7474 **COs: CO3**
6. Decade Counter- 7490 **COs: CO4**
7. 4 Bit Counter-7493 **COs: CO4**
8. Shift Register-7495 **COs: CO4**
9. Universal shift register-74194/195 **COs: CO4**
10. Ram (16*4)-74189 (read and write operations) **COs: CO4**
11. ALU **COs: CO4**

Equipment Required:

1. Power supply
2. Integrated Circuits
3. Trainer Kits

Course Title: FUNDAMENTALS OF SIGNAL PROCESSING	**Course Code: R24ECDEM301**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Fundamentals of Signal Processing, you need a strong foundation in several key areas of number systems, Boolean algebra, and elementary electrical circuit concepts.	

Course Objectives:

1. To introduce the fundamental concepts of continuous and discrete-time signals and systems.
2. To explain the use of Fourier series and Fourier transforms for signal analysis.
3. To describe the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) techniques.
4. To teach the design of IIR digital filters using analog filter approximations.
5. To impart knowledge on FIR filter design using windowing methods and compare with IIR filters.

Course Outcomes:

Course Outcome (CO)	**PO1**	**PO2**	**PO3**	**PO4**	**PSO1**	**BT Level**
CO1: Understand the terminology of signals and systems.	3	2	–	–	–	L2
CO2: Demonstrate Fourier tools through the analogy between vectors and signals.	3	3	2	–	–	L3
CO3: Apply the Fourier transform for signal processing.	3	3	2	2	–	L3
CO4: Analyze the design and implementation of IIR filters.	3	3	3	2	–	L4
CO5: Analyze the design and implementation of FIR filters.	3	3	3	2	–	L4

SYLLABUS

UNIT-I

Introduction: Definition of Signals and Systems, Continuous time and discrete time signals, Classification of Signals, Basic operations on signals. Continuous time and Discrete time systems, Basic system properties, Basic Continuous time and discrete time signals, Analogy between vectors and signals, Signal approximation using orthogonal functions. **COs- CO1**

UNIT-II

Fourier Series and Fourier Transform: Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric and Exponential Fourier series, Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, standard signals and periodic signals, properties of Fourier transforms. **COs- CO2**

UNIT-III

Discrete Fourier Transform

Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution. **COs- CO3**

Fast Fourier Transform

Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

UNIT-IV
IIR Filters
Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by bilinear transformation method. **COs- CO4**

UNIT-V
FIR Filters
Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using windowing methods (Rectangular, Triangular, Raised Cosine, Hanning, Hamming, Blackman), Comparison of IIR & FIR filters. **COs- CO5**

Text Books:

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, *Signals and Systems*, 2nd Edition, PHI, 2009.

2. John G.Proakis, Dimitris G.Manolakis, *Digital Signal Processing, Principles, Algorithms and Applications,* 4th Edition, Pearson Education PHI, 2013.

References:

1. S.K.Mitra, *Digital Signal Processing – A practical approach* , 2nd Edition, Pearson Education, New Delhi, 2004.

2. M.H.Hayes, *Digital signal processing:* Schaum's Outlines , 2nd Edition,Tata Mc-Graw Hill, 2009.

3. Robert J.Schilling, Sandra L.Harris, *Fundamentals of Digital Signal Processing using Matlab* , 2nd Edition,Thomson, 2010.

e-Resources

1. https://nptel.ac.in/courses/108101174
2. https://nptel.ac.in/courses/108105055

Course Title: FUNDAMENTALS OF VLSI DESIGN	**Course Code:** R24ECDEM302
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Fundamentals of VLSI Design, you need a strong foundation in several key areas of digital logic design, electronic circuits, basic semiconductor physics, and MOSFET operation.	

Course Objectives

1. To introduce the fundamentals of VLSI design and IC fabrication technology.
2. To understand the electrical properties and scaling limitations of MOS circuits.
3. To study the basic analog IC building blocks and amplifier configurations.
4. To analyse and design CMOS combinational and sequential circuits.
5. To explore FPGA architectures and recent advances in VLSI technologies.

Course Outcomes:

By the end of the course student should be able to

CO No. & Statement	PO1	PO2	PO3	PO4	PO5	PSO1	BT Level
CO1: Understand the fundamentals of VLSI design and CMOS fabrication techniques.	2	–	–	–	–		2
CO2: Analyse the electrical properties and performance aspects of MOS circuits.	2	2	–	–	–		2
CO3: Design and simulate analog IC building blocks such as amplifiers and current sources.	3	3	3	–	–		3
CO4: Design CMOS combinational and sequential logic circuits and evaluate timing parameters.	3	3	3	3	–		3
CO5: Explore FPGA architectures and modern transistor technologies used in advanced VLSI design.	2	–	3	–	2		2

SYLLABUS

UNIT I: Introduction and Basic Electrical Properties of MOS Circuits

VLSI design flow, Introduction to IC technology, CMOS fabrication process, MOS transistor characteristics, CMOS inverter, Bi-CMOS inverter, Layout design, Stick diagrams, and Design rules.

COs-CO1

UNIT II: Basic Circuit Concepts and Scaling of MOS Circuits

Sheet resistance, Area capacitance, Inverter delay, Propagation delay, Wiring capacitance, Scaling models, Device parameter scaling, and Limitations of scaling. **COs-CO2**

UNIT III: Basic Building Blocks of Analog IC Design

MOSFET regions of operation, Transistor modelling, Biasing techniques, Common-source amplifier, Common-drain amplifier, Common-gate amplifier, and Current sources. **COs-CO3**

UNIT IV: CMOS Combinational and Sequential Logic Circuit Design

Complementary CMOS logic, Pass-transistor logic, Dynamic logic principles, Latch vs Register, Master-slave register design, Setup and hold time, and Clocked CMOS registers. **COs-CO4**

UNIT V: FPGA Design and Introduction to Advanced Technologies

FPGA design flow, Basic FPGA architecture, FPGA technologies and families, Short channel effects, High-k dielectrics, Metal gate, and TFET. **COs-CO5**

TEXTBOOKS:

1. Essentials of VLSI Circuits and Systems – Kamran Eshraghian, Douglas and A.Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.

2. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 2003

3. Digital Integrated Circuits, Jan M.Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd edition, 2016.

REFERENCES:

1. “Introduction to VLSI Circuits and Systems”, John P.Uyemura, John Wiley&Sons, reprint 2009.

2. Integrated Nano electronics: Nano scale CMOS, Post-CMOS and Allied Nano technologies Vinod Kumar Khanna, Springer India, 1stedition, 2016.

3. Fin-FETs and other multi-gate transistors, Colinge JP, Editor NewYork, Springer, 2008.

e-Resources

1. https://nptel.ac.in/courses/117101058
2. https://nptel.ac.in/courses/117103125
3. https://nptel.ac.in/courses/108106191
4. https://nptel.ac.in/courses/106103016

Course Title: VLSI DESIGN LAB	**Course Code: R24ECDEM303**
Teaching Scheme (L:T:P): 0:0:3	**Credits:** 1.5
Type of Course: Practical's	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in VLSI Design Lab, you need a strong foundation in several key areas of digital logic design, electronic circuits, basic semiconductor physics, and MOSFET operation.	

Course Objectives:

1. To familiarize students with the design and simulation of digital circuits using HDL (Verilog/VHDL).
2. To enable implementation of logic functions and sequential circuits on FPGA using industry-standard tools.
3. To introduce CMOS-based schematic and layout-level design of basic digital components.
4. To train students in verifying functionality and analysing parasitic using back-end EDA tools.
5. To bridge theoretical digital logic concepts with practical hardware and silicon implementation.

Course outcomes:

CO Code & Statement	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO9**	**PSO1**	**BT Level**
CO1: Design and implement basic combinational and sequential digital circuits using HDL.	3	3	2	–	3	2	–	L3
CO2: Develop synthesizable models using behavioral, dataflow, and structural modeling styles.	3	2	2	–	3	–	–	L3
CO3: Demonstrate usage of EDA tools to simulate an implement designs on FPGA platforms.	3	2	3	2	3	–	–	L3
CO4: Construct CMOS schematic and layout designs for basic digital blocks and validate digital layouts for functionality and parasitic effects using back-end simulation tools.	3	3	3	2	3	–	–	L4

List of Experiments

PART (A): FPGA Level Implementation (Any Seven Experiments)

Note 1: The students need to develop Verilog /VHDL Source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary Synthesizer

Note 2: All the experiments need to be implemented on the latest FPGA/CPLD Hardware in the Laboratory

1. Realization of Logic gates

Design and Implementation of the following:

2. 4-bit ripple carry and carry look ahead adder using behavioural, dataflow and structural modelling
3. a) 16:1 mux through 4:1 mux

   b) 3:8 decoder realization through 2:4 decoder
4. 8:3 encoder
5. 8-bit parity generator and checker

6. Flip-Flops
7. 8-bit synchronous up-down counter
8. 4-bit sequence detector through Mealy and Moore state machines.

EDA Tools/Hardware Required:

1. EDA Tool that supports FPGA programming including Xilinx Vivado /Altera (Intel)/Cypress/Equivalent Industry standard tool along with corresponding FPGA hardware.
2. Desktop computer with appropriate Operating System that supports the EDA tools.

PART (B): Back-end Level Design and Implementation (Any Five Experiments) Note: The students need to design the following experiments at schematic level using CMOS logic and verify the functionality. Further students need to draw the corresponding layout and verify the functionality including parasites. Available state of the art technology libraries can be used while simulating the designs using Industry standard EDA Tools.

Design and Implementation of the following

1a. Universal Gates 1b. An Inverter

2. Full Adder
3. Full Subtractor
4. Decoder
5. D-Flip-flop

EDA Tools/Hardware Required:

1. Mentor Graphics Software / Cadence/Synopsys/Tanner or Equivalent Industry Standard/CAD Tool.
2. Desktop computer with appropriate Operating System that supports the EDA tools.

Course Title: DIGITAL DESIGN WITH VERILOG	**Course Code:** R24ECDEM401
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Digital Design with Verilog, you need a strong foundation in several key areas of electrical circuits, number systems, Boolean algebra, and fundamental logic gates, Digital electronics, fundamentals of VLSI Design.	

Course Objectives:

1. This course teaches designing digital circuits, behaviour and RTL modelling of digital circuits using Verilog HDL,
2. verifying these Models and synthesizing RTL models to standard cell libraries and FPGAs.
3. Students aim practical experience by designing, modelling, implementing and verifying several digital circuits.
4. This course aims to provide students with the understanding of the different technologies related to HDLs, construct, compile and execute Verilog HDL programs using provided.

Course Outcomes:

CO Code & Statement	PO1	PO2	PO3	PO4	PO5	PO11	BT Level
CO1: Explain the basic concepts of Verilog HDL and its syntax, conventions, and module-level design hierarchy.	3	2	–	–	–	–	L2
CO2: Develop logic circuits using gate-level and dataflow modeling styles with delays and primitives.	3	2	3	2	3	–	L3
CO3: Implement behavioral models of combinational and sequential logic using various Verilog constructs.	3	2	3	2	3	–	L3
CO4: Illustrate switch-level modeling of logic circuits using CMOS primitives and bidirectional gates.	3	2	2	2	2	–	L2
CO5: Use system tasks, functions, compiler directives, and user-defined primitives to enhance Verilog design.	3	2	3	2	3		L3

SYLLABUS

UNIT - I: Introduction to Verilog HDL:

Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Programming Language Interface, Module. Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Data Types, Scalars and Vectors, Operators. **COs-CO1**

UNIT - II: Gate Level Modelling:

Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Gate Delay, Strengths and Contention Resolution, Net Types. Modelling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous, Assignments, Assignment to Vector, Operators. **COs-CO2**

UNIT - III: Behavioural Modelling:

Introduction, Operations and Assignments, 'Initial' Construct, always construct, Assignments with Delays, 'Wait 'Construct, Design at Behavioural Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, 'If' and 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, sequential and Parallel Blocks. **COs-CO3**

UNIT - IV: Switch Level Modelling:

Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, instantiation with strengths and delays, Switch level modelling for NAND, NOR and XOR. **COs-CO4**

UNIT - V:

System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters, System Tasks and Functions, User Defined Primitives, Compiler directives. **COs-CO5**

TEXT BOOKS:

1. T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley 2009.
2. Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education, 2009.

REFERENCE BOOKS:

1. Fundamentals of Digital Logic with Verilog Design - Stephen Brown,Zvonkoc Vranesic, TMH, 2nd Edition.
2. Zainalabdien Navabi, Verliog Digital System Design, TMH, 2nd Edition.
3. Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA - Sunggu Lee, Cengage Learning, 2012.

e-Resources

1. https://nptel.ac.in/courses/106103358
2. https://nptel.ac.in/courses/108103179

Dr. E. Govinda, HOD

BoS Chairman, Dept of ECE

STREAM-2: IoT BASED EMBEDDED SYSTEM DESIGN

S.No	Subject Code	Year of Study	Subject	L	T	P	C
1	R24ECIEM201	II-II	Digital Electronics	3	0	0	3
	R24ECIEM202	II-II	Digital Electronics Lab	0	0	3	1.5
2	R24ECIEM301	III-I	Microprocessor and its applications	3	0	0	3
3	R24ECIEM302	III-II	Microcontroller and its interfacing	3	0	3	3
	R24ECIEM303	III-II	Microcontroller and interfacing Lab	0	0	3	1.5
4	R24ECIEM401	IV-I	Introduction to IoT and Embedded systems	3	0	0	3
5	R24ECIEM001	---	NPTEL/MOOC Course-I (12 Weeks course/ excluding the above subjects)	0	0	0	3
			Total	15	0	0	18

Course Title: DIGITAL ELECTRONICS	**Course Code:** R24ECIEM201
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Digital Electronics, you need a strong foundation in several key areas of electrical circuits, number systems, Boolean algebra, and fundamental logic gates.	

Course Objectives

1. Understand the fundamentals of number systems, logic gates, and Boolean algebra for digital circuit design.
2. Analyze and simplify combinational logic circuits using Karnaugh maps and Boolean expressions.
3. Design and implement various combinational circuits like adders, multiplexers, decoders, and comparators.
4. Understand the operation of flip-flops and design sequential circuits like counters and shift registers.
5. Explore memory devices, programmable logic devices, and the basics of digital system design.

Course Outcomes:

By the end of the course, the student will be able to:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PSO1	BT LEVEL
CO1: Perform conversions between different number systems and codes and apply Boolean algebra to minimize the given logic expressions.	2	2	–	–	–		L3
CO2: Minimize Boolean expressions using K-Map (up to four variables) and QM method (up to five variables).	2	2	–	–	–		L4
CO3: Design and analyze combinational logic circuits.	2	2	3	2	2		L6
CO4: Design and analyze sequential logic circuits.	2	2	3	2	2		L6
CO5: Analyze characteristics of logic families and compare their performance in terms of performance metrics.	2	2	2	2	–		L4

UNIT – I

NUMBER SYSTEMS

Number representation, Conversion of bases, Binary Arithmetic, Representation of Negative numbers, Binary codes: weighted and non-weighted BOOLEAN ALGEBRA: Basic definitions, Axiomatic Definitions, Theorems and properties, Boolean Functions, Canonical and standard forms. **COs-CO1**

UNIT – II

LOGIC MINIMIZATION

The K-Map Method: Two variable map, Three variable map, four variable map Prime Implicants, Don't care conditions, NAND and NOR implementation, Quine-Mccluskey (QM) (upto five variables) Technique. **COs-CO2**

UNIT – III

COMBINATIONAL LOGIC DESIGN

Combinational circuits, Analysis Procedure, Design Procedure, Code Converters (BCD to XS3(XS3 to BCD)), Gray to Binary (Binary to Gray), Binary Adder-Subtractor, Decimal adder, Binary Multiplier, Magnitude comparator, Decoders, Encoders, Multiplexers. De-Multiplexer, Hazards. **COs-CO3**

UNIT – IV

SEQUENTIAL LOGIC DESIGN

Introduction to Latch and Flip flop, clocked S-R, JK, D, T flip flops. Excitation table of Flipflo Flip flop conversion, Clocked flip flop design, Edge triggered flip flop, applications of flipflop Registers, Applications of Shift registers, universal shift register, Ripple counters, Synchronou counters, counter with unused states, Ring counters, Johnson counter. **COs-CO4**

UNIT – V

LOGIC FAMILIES

Introduction, Characteristics of Digital ICs, Resistor Transistor Logic (RTL), Diode Transistor Logi (DTL), Transistor Transistor Logic (TTL), Emitter Coupled Logic (ECL), CMOS Logic, Interfacin CMOS and TTL. **COs-CO5**

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, “Digital Design”, 4th Edition, Pearson Publishers, 2001.
2. R.P Jain, “Modern Digital Electronics”, 3rd Edition, TMH, 2003.

REFERENCE BOOKS:

1. William I. Fletcher, “An Engineering Approach to Digital Design”, PHI, 1980.
2. John F. Wakerly, “Digital Design Principles and Practices”, 3rd Edition, Prentice Hall, 1999.

e-Resources

1. https://nptel.ac.in/courses/117104128
2. https://nptel.ac.in/courses/106105185

Course Title: DIGITAL ELECTRONICS LAB	**Course Code:** R24ECIEM202
Teaching Scheme (L:T:P): 0:0:3	**Credits:** 1.5
Type of Course: Practicals	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Digital Electronics Lab, you need a strong foundation in several key areas of electrical circuits, number systems, Boolean algebra, and fundamental logic gates.	

Course Objectives

6. To Verify the truth tables of logic gates
7. To Design and verify the operation of combinational circuits.
8. To Design and verify the operation of sequential circuits
9. To Verify the operation of Johnson/ring counter and different types shift register
10. To Verify the operation of RAM and ALU

Course Outcomes:

At the end of the course the student will be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PSO1	BT LEVEL
CO1: Distinguish logic gates for design of digital circuits	3	2	2	1	1		L4
CO2: Design different types of Combinational logic circuits	3	3	3	2	1		L6
CO3: Analyze the operation of flip-flops	3	2	2	1	1		L4
CO4: Apply knowledge of flip-flops in designing of Registers and Counters and Analyze the operation of RAM and ALU	3	2	3	2	1		L3, L4

List of Experiments:

1. Realization of Logic Gates **COs: CO1**
2. 3 to 8 Decoder- 74138 **COs: CO2**
3. 8*1 Multiplexer-74151 and 2*1 De-multiplexer-74155 **COs: CO2**
4. 4-Bit Comparator-7485. **COs: CO2**
5. D Flip-Flop- 7474 **COs: CO3**
6. Decade Counter- 7490 **COs: CO4**
7. 4 Bit Counter-7493 **COs: CO4**
8. Shift Register-7495 **COs: CO4**
9. Universal shift register-74194/195 **COs: CO4**
10. Ram (16*4)-74189 (read and write operations) **COs: CO4**
11. ALU **COs: CO4**

Equipment Required:

1. Power supply
2. Integrated Circuits
3. Trainer Kits

Course Title: MICROPROCESSOR AND ITS APPLICATIONS	**Course Code:** R24ECIEM301
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Microprocessor and Its Applications , you need a strong foundation in several key areas of Digital Electronics and basics of Computer Organization.	

Course Objectives:

1. To understand the architecture, functional units, and interrupt system of the 8085 microprocessor.
2. To learn the instruction set and develop assembly language programs using 8085 microprocessor.
3. To understand the architecture, memory organization, and system configuration of the 8086 microprocessors.
4. To develop assembly language programs using the 8086-instruction set and understand assembler directives.
5. To explore memory and peripheral interfacing techniques with 8086, including the use of programmable interface devices like 8255.

Course Outcomes:

At the end of the course the student will be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PSO1	BT Level
CO1: Gain comprehensive knowledge of the architecture of 8-bit 8085 Microprocessor and its interrupt structure	3	2					L2
CO2: Familiarize the instruction set of 8085 & apply them to write assembly language programs	3	3	2				L3
CO3: Able to organize the hardware involved in BIU & EU of 8086 microprocessor & analyze the minimum and maximum mode 8086 systems using timing diagrams	3	2	2				L4
CO4: Familiarize the instruction set of 8086 & apply them to write assembly language programs	3	3	2				L3
CO5: Develop applications that will provide solution to real world problems by Interfacing 8086 Microprocessor with various peripherals	3	3	3	2	2		L6

SYLLABUS

UNIT I

OVERVIEW OF 8085 ARCHITECTURE

Introduction to Microprocessors and Microcomputers, Internal Architecture and Functional Description of INTEL 8085 Microprocessor, Interrupt Structure of 8085 **COs- CO1**

UNIT II

INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING FOR 8085 Addressing modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branching instructions, Machine Control and I/O instructions, Stack and Subroutines, Assembly language Programming. **COs- CO2**

UNIT III

OVERVIEW OF 8086 ARCHITECTURE

Architecture of 8086, Register organization, Memory segmentation. Physical memory organization. signal description of 8086, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings. **COs- CO3**

UNIT IV

INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086: Addressing modes, instruction set, assembler directives (Significant), macros and operators. Simple programs involving arithmetic, logical, branch and string manipulation instructions.

COs- CO4

UNIT V

INTERFACING

Memory interfacing to 8086 (Static RAM & EPROM). Methods of parallel data transfer, 8255A Internal block diagram and system connections, 8255A operational modes and initialization, constructing and sending 8255A control words, interfacing to 8086. Interfacing Stepper motor, D/A and A/D converters **COs- CO5**

TEXT BOOKS:

1. Ramesh S. Gaonkar, Architecture Programming and Applications, 3rd Edition, Penram International Pvt. Ltd.
2. D. V. Hall, Microprocessors and Interfacing, Revised 2nd edition 2006, TMH,.
3. A.K. Ray and K.M. Bhurchand, Advanced Microprocessors and Peripherals, 2nd edition, 2006, TMH.

REFERENCE BOOKS:

1. John Uffenbeck, The 8086/8088 Family: Design, Programming And Interfacing, PHI
2. N. Senthil Kumar, M. Saravanan, and S. Jeevananthan, Microprocessors and Microcontrollers, OUP India.

e-Resources

1. https://nptel.ac.in/courses/106108100
2. https://nptel.ac.in/courses/108105102

Course Title: MICROCONTROLLERS & ITS INTERFACING	**Course Code:** R24ECIEM302
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Microcontrollers & Its Interfacing, you need a strong foundation in several key areas of digital electronics and microprocessor architecture.	

Course Objectives:

1. Understand the architecture and features of the 8051 microcontroller.
2. Develop assembly language programs using the 8051 instruction set.
3. Analyze the timer, serial communication, and interrupt functionalities of the 8051.
4. Interface the 8051 with peripherals like LCD, keyboard, ADC, DAC, and sensors.
5. Design control applications by interfacing 8051 with motors, relays, and external devices.

Course Outcomes: At the end of the course the student will be able to

COs	PO1	PO2	PO3	PO4	PO5	PSO1	BT Level
CO1: Acquire knowledge of the architecture and operation of Intel 8051 microcontroller.	3	2					L1
CO2: Develop assembly language programs for data transfer, arithmetic, logical, and branching operations using instruction set of 8051 and apply them in control applications.	3	2	2				L3
CO3: Analyze the hardware features like timers, memory, interrupts and serial communication available in 8051 Microcontroller Family of devices.	3	3		2			L4
CO4: Develop applications that will provide solution to real world problems by interfacing 8051 Microcontroller with peripherals such as ADC, DAC, keyboard, and display.	3		3		2		L6
CO5: Develop applications that will provide solution to real world problems by interfacing 8051 Microcontroller with peripherals such as Relay, PWM, DC, and Stepper motor.	3		3		2		L6

SYLLABUS

UNIT I

8051 MICROCONTROLLER: **COs: CO1**

Introduction to Microcontrollers, comparing Microprocessors and Microcontrollers, Architecture of 8051 Microcontroller, Register organization of 8051, SFRs, Pin configuration of 8051.

UNIT II

ASSEMBLY LANGUAGE PROGRAMMING OF 8051 **COs: CO2**

Addressing modes of 8051. Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions. Assembly language programming of 8051 microcontroller.

UNIT III

I/O PORT AND INTERRUPT'S PROGRAMMING **COs: CO3**

Input/Output Ports and Circuits, External Memory, Counters/Timers and modes of Timers, Serial data Input/Output, Interrupts.

UNIT IV

INTERFACING-I **COs: CO4**

LCD and Keyboard interfacing; ADC, DAC, and Sensor interfacing; Interfacing to external memory.

UNIT V

INTERFACING-II **COs: CO5**

8051 interfacing with the 8255; Motor control: Relays and optoisolators, stepper motor interfacing, DC motor interfacing and PWM.

TEXT BOOKS:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D Mc Kinlay , The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2nd Edition, Pearson Education, 2008.
2. Kenneth. J. Ayala, Dhananjay V. Gadre, The 8051 Microcontroller & Embedded Systems Using Assembly and C, 1st edition, Cengage learning, 2010

REFERENCE BOOKS:

1. Satish Shah, 8051 Microcontrollers: MCS 51 Family and Its Variants, 1/e, Oxford University Press, 2010.

e-Resources

1. https://nptel.ac.in/courses/108103157
2. https://nptel.ac.in/courses/106108100
3. https://nptel.ac.in/courses/108105102

Course Title: MICROCONTROLLERS & ITS INTERFACING LAB	**Course Code:** R24ECIEM303
Teaching Scheme (L:T:P): 0:0:3	**Credits:** 1.5
Type of Course: Practicals	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Microcontrollers & Its Interfacing lab, you need a strong foundation in several key areas of digital electronics and microprocessor architecture.	

Course Objectives:

1. Understand the basic architecture, instruction set, and programming of the 8051 microcontroller.
2. Develop assembly/C programs to perform arithmetic and logical operations.
3. Learn to interface peripheral devices such as LCD, UART, and Traffic Light Controllers.
4. Develop embedded C programs to handle interrupts, timers, and counters.
5. Apply knowledge of 8051 for solving real-time hardware interfacing problems.

Course Outcomes:

At the end of the course the student will be able to

COs	PO1	PO2	PO3	PO4	PO5	PSO1	BT Level
CO1: Understand the internal architecture and memory space of the 8051 microcontroller.	3	–	–	–	–		L2
CO2: Develop programs for arithmetic, logical operations, and data analysis on the 8051.	3	2	2	–	–		L3
CO3: Implement timer/counter and interrupt programming using the 8051 microcontroller.	2	3	2	–	–		L3
CO4: Interface the 8051 with external peripherals such as LCD, UART, and traffic light systems and Analyze I/O port control and memory addressing for real-time applications.	2	3	3	1	–		L4

List of Experiments:

1. Arithmetic operations for two 8 bit numbers **COs: CO2**
2. Finding number of 1's and number of 0's in a given 8-bit number **COs: CO2**
3. Sum of Even numbers in a given n-numbers **COs: CO2**
4. Average of n-numbers. **COs: CO2**
5. Reading and Writing on a parallel port using 8051 **COs: CO4**
6. Understanding three memory areas of 00 – FF Using 8051 external interrupts
   COs:CO1,CO3
7. Program and verify Timer/ Counter in 8051. **COs: CO3**
8. Interfacing Traffic Light Controller to 8051. **COs: CO4**
9. UART operation in 8051 **COs: CO4**
10. Interfacing LCD to 8051 **COs: CO4**

Course Title: Introduction to IoT and Embedded systems	**Course Code:** R24ECIEM401
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 3
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Introduction to IoT and Embedded systems, you need a strong foundation in several key areas of digital electronics and microprocessor and microcontrollers architecture.	

Course Objectives:

1. To understand the architecture and components of embedded systems.
2. To explore IoT evolution, architecture, and enabling technologies.
3. To learn design methodologies and develop IoT systems using Arduino and Raspberry Pi.
4. To study data analytics and supporting services for IoT applications.
5. To analyze real-world IoT applications through industrial case studies.

Course Outcomes:

At the end of the course the student will be able to

COs	PO1	PO2	PO3	PO4	PO5	PSO1	BT Level
CO1: Acquire knowledge of the embedded systems.	3	–	–	–	–		L2
CO2: Acquire knowledge of IoT.	3	–	–	–	–		L2
CO3: Design a PoC of an IoT system using Raspberry Pi/Arduino.	3	2	3	–	2		L3
CO4: Apply data analytics and use cloud offerings related to IoT.	2	3	2	1	3		L3
CO5: Analyze applications of IoT in real-time scenarios.	3	2	2	–	–		L4

UNIT I

INTRODUCTION TO EMBEDDED SYSTEMS

Embedded systems; processor embedded into system; Embedded hardware units and devices in a system; embedded software in a system; examples of embedded systems; embedded system on chip (SOC) and use of VLSI circuit design technology; complex system design and processor; Design process in embedded system; classification of embedded systems. **COs-CO1**

UNIT II

FUNDAMENTALS OF IoT

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators,

Smart Objects and Connecting Smart Objects. **COs-CO2**

UNIT III

DESIGN AND DEVELOPMENT

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming. **COs-CO3**

UNIT IV

DATA ANALYTICS AND SUPPORTING SERVICES

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG.

COs-CO4

UNIT V

CASE STUDIES/INDUSTRIAL APPLICATIONS

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control. **COs-CO5**

TEXT BOOKS:

1. Raj Kamal, Embedded systems: architecture, programming and design, Tata McGraw-Hill Education.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).
3. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

e-Resources

1. https://nptel.ac.in/courses/108105057
2. https://nptel.ac.in/courses
3. https://nptel.ac.in/courses/106105159

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