



# **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 ELECTRICAL AND ELECTRONICS ENGINEERING**

### **ACADEMIC REGULATIONS**

### **COURSE STRUCTURE AND SYLLABUS**

### **For UG-R24**

### **B.Tech – ELECTRICAL AND ELECTRONICS ENGINEERING**

*(Applicable for batches admitted from 2024-2025)*



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www.avanthienggcollege.ac.in, mail: principal@avanthienggcollege.ac.in

### 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:  $(25 \times 0.8) + (20 \times 0.2) = 24$

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:  $(25 \times 0.8) + (0 \times 0.2) = 20$

### **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 1 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 1 mark.
- (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**

<b>Assessment Method</b>	<b>Marks</b>
Continuous Internal Assessment	30
Semester End Examination	70
<b>Total</b>	<b>100</b>

- 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
<b>Total</b>	<b>100</b>

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: After 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.,

$$SGPA = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

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

$$CGPA = \frac{\sum (C_i \times S_i)}{\sum C_i}$$

Where “ $S_i$ ” is the SGPA of the  $i^{\text{th}}$  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:

<b>Class Awarded</b>	<b>CGPA Secured</b>
First Class with Distinction	$\geq 7.5$ (Without any supplementary appearance)
First Class	$\geq 6.5 < 7.5$
Second Class	$\geq 5.5 < 6.5$
Pass Class	$\geq 5.0 < 5.5$

**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:  $(CGPA - 0.75) \times 10$**

## **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

**Table: Program-B. Tech EEE (R24) Curriculum Grouping Based On Curriculum Components Semester Wise**

S.No	Course Component	I	II	III	IV	V	VI	VII	VIII	Total Credits
1	Basic Sciences Course (BS)	7	7	3	-	-	-	-	-	17
2	Engineering Science Courses (ES)	13.5	4	-	3	-	-	-	-	20.5
3	Humanity Science and Management Courses (HS)	-	3	4	4	1	1	3	-	16
4	Professional Core Courses (PC)	-	4.5	12	12	12	9	6	-	55.5
5	Program Elective Courses (PE)	-	-	-	-	3	6	3	3	15
6	Open Elective Courses / Multidisciplinary (OE)	-	-	-	-	3	3	3	3	12
7	Internships/ Project(s)	-	-	-	-	2	-	2	12	16
8	Skill Oriented Courses (SC)	-	-	2	2	1	1	1	-	07
9	Mandatory Courses (MC)	0.5	0.5	-	-	-	-	-	-	01
<b>Total</b>		<b>21</b>	<b>19</b>	<b>21</b>	<b>21</b>	<b>22</b>	<b>20</b>	<b>18</b>	<b>18</b>	<b>160</b>

**Table: Program- B. Tech EEE (R24) Category-Wise Credit Distribution Courses and % of total number of credits.**

S.No	Course Component	Code	APSCHE breakup of Credits	AICTE credits of breakup	JNTU- GV (R23)	AIET	(% of Total number of credits of the program)
1	Basic Sciences Course (BS)	BS	20	23	20	<b>17</b>	10.6%
2	Engineering Science Courses (ES)	ES	23.5	29	23.5	<b>20.5</b>	12.81%
3	Humanity Science and Management Courses (HSMC)	HS	13	16	13	<b>16</b>	10 %
4	Professional Core Courses (PC)	PC	54.5	59	54.5	<b>55.5</b>	34.6875 %
5	Program Elective Courses (PE)	PE	15	12	15	<b>15</b>	9.375 %
6	Open Elective Courses / Multidisciplinary (OE)	OE	12	09	12	<b>12</b>	7.5 %
7	Internships/ Project(s)	PJ	16	15	16	<b>16</b>	10 %
8	Skill Oriented Courses (SC)	SC	06	-	10	<b>07</b>	4.375 %
9	Mandatory Courses (MC)	MC	00	00	01	<b>01</b>	0.625 %
<b>Total</b>			<b>160</b>	<b>163</b>	<b>160</b>	<b>160</b>	<b>100%</b>



## **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

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### **Department of ELECTRICAL AND ELECTRONICS ENGINEERING**

#### **Course Structure**

#### **Program B. Tech Electrical and Electronics Engineering**

#### **Regulations-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



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### Department of ELECTRICAL AND ELECTRONICS ENGINEERING

Program: B. Tech- Electrical and Electronics 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
<b>Total</b>				<b>13</b>	<b>0</b>	<b>16</b>	<b>21</b>

Category	Courses	Credits
BS-Basic Sciences Course	3	7.0
ES-Engineering Science Course	6	13.5
MC-Mandatory Course	1	0.5
<b>Total</b>	<b>10</b>	<b>21</b>

**Department of ELECTRICAL AND ELECTRONICS ENGINEERING**

Program: B. Tech- Electrical and Electronics 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	R24EEPC01	Electrical Circuit Analysis-I	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	R24EEPC02	Electrical Circuits Lab	0	0	3	1.5
10	MC	R24MC02	NSS/NCC/Scouts Guides/Community Service	0	0	1	0.5
<b>Total</b>				<b>14</b>	<b>0</b>	<b>10</b>	<b>19</b>

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
<b>Total</b>	<b>10</b>	<b>19</b>

**Department of ELECTRICAL AND ELECTRONICS ENGINEERING**

Program: B. Tech- Electrical and Electronics 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	R24EEBS07	Complex Variables & Numerical Methods	3	0	0	3
2	HS	R24HS05	Managerial Economics and Financial Analysis	2	0	0	2
3	PC	R24EEPC03	Electromagnetic Fields(EMF)	3	0	0	3
4	PC	R24EEPC04	Electrical Circuit Analysis-II	3	0	0	3
5	PC	R24EEPC05	DC Machines & Transformers	3	0	0	3
6	PC	R24EEPC06	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	1.5
7	PC	R24EEPC07	DC Machines & Transformers Lab	0	0	3	1.5
8	HS	R24HS06	Design Thinking and Innovation	0	1	2	2
9	SEC-1	R24EESC01	Employability Skills I: Competitive coding	0	1	2	2
10	MC	R24MC04	Constitution of India	2	0	0	0
Total				16	02	10	21

Category	Courses	Credits
BS- Basic Sciences Course	1	3
HS-Humanities and Management Sciences Courses	2	4
PC-Professional Core Courses	5	12
MC-Mandatory Course	1	0
SEC- Skill Enhancement course	1	2
<b>Total</b>	<b>10</b>	<b>21</b>

## Department of ELECTRICAL AND ELECTRONICS ENGINEERING

Program: B. Tech- Electrical and Electronics 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	R24HS03	Universal Human Values-I Understanding Harmony and Ethical Human Conduct	2	0	0	2
2	ES	R24EES09	Analog Circuits	3	0	0	3
3	PC	R24EIPC08	Power Systems-I	3	0	0	3
4	PC	R24EIPC09	Induction and Synchronous Machines	3	0	0	3
5	PC	R24EIPC10	Control Systems	3	0	0	3
6	PC	R24EIPC11	Induction and Synchronous Machines Lab	0	0	3	1.5
7	PC	R24EIPC12	Control Systems Lab	0	0	3	1.5
8	HS	R24HS04	Employability Skills II Quantitative aptitude & logical reasoning	0	1	2	2
9	SEC-2	R24EESC02	Python Programming and Industry Readiness	0	1	2	2
10	MC	R24MC03	Environmental Science	2	0	0	0
<b>Total</b>				<b>16</b>	<b>02</b>	<b>10</b>	<b>21</b>
Summer internship 2 months (Mandatory) after second year (to be evaluated during III year I Semester)(community service project)							

Category	Courses	Credits
ES-Engineering Science Courses	1	3
HS-Humanities and Management Sciences Courses	2	4
PC-Professional Core Courses	5	12
SEC-Skill Enhancement Course	1	2
MC- Mandatory course	1	0
<b>Total</b>	<b>10</b>	<b>21</b>

## Department of ELECTRICAL AND ELECTRONICS ENGINEERING

Program: B. Tech- Electrical and Electronics Engineering

Regulation: R24

### III Year I Semester or SEMESTER V- Course Structure

S. No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	PC	R24EEPC13	Power Electronics	3	0	0	3
2	PC	R24EEPC14	Digital Circuits	3	0	0	3
3	PC	R24EEPC15	Power system Analysis	3	0	0	3
4	PE-1	R24EEPE01.1 R24EEPE01.2 R24EEPE01.3  R24EEPE01.4 R24EEPE01.5	1.Utilization of Electrical Energy 2.Signals and Systems 3. Soft Computing Techniques and its application in Electrical Engineering. 4.Communication systems 5.SWAYAM/ NPTEL Course recommended by the BOS	3	0	0	3
5	OE-1	R24EEOE1.1 R24EEOE1.2 R24EEOE1.3 R24EEOE1.4 R24EEOE1.5	1.Concepts of Optimization Techniques 2.Electrical Machine Design 3.Intelligent Control Systems 4. Renewable Energy Sources 5.Concepts of Power System Engineering	3	0	0	3
6	PC	R24EEPC16	Power Electronics Lab	0	0	3	1.5
7	PC	R24EEPC17	Analog and Digital Circuits Lab	0	0	3	1.5
8	SEC-3	R24EESC03	Tinkering Lab	0	0	2	1
9	Internship	R24IN01	Evaluation of community service Internship/Industry Internship (Done during II-II Summer vacation- 8 weeks)	0	0	0	2
10	MC	R24MC06	Technical Paper Writing & IPR	2	0	0	0
11	HS	R24HS07	Employability Skills III Soft Skills and verbal Ability	0	0	2	1
<b>Total</b>				<b>17</b>	<b>0</b>	<b>10</b>	<b>22</b>

Category	Courses	Credits
PC-Professional Core Courses	5	12
PE- Professional Elective	1	3
OE-Open Elective	1	3
HS-Humanities and Management Sciences Courses	1	1
Internship	1	2
SEC-Skill Enhancement Course	1	1
MC-Mandatory course	1	0
<b>Total</b>	<b>11</b>	<b>22</b>

## Department of ELECTRICAL AND ELECTRONICS ENGINEERING

Program: B. Tech- Electrical and Electronics Engineering

Regulation: R24

### III Year II Semester- Course Structure

S. No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	PC	R24EEPC18	Electrical Measurements and Instrumentation	3	0	0	3
2	PC	R24EEPC19	Microprocessors and Microcontrollers	3	0	0	3
3	PE-2	R24EEPE02.1 R24EEPE02.2 R24EEPE02.3 R24EEPE02.4 R24EEPE02.5	1.Switchgear and Protection 2. Advanced Control Systems 3. Machine Learning and Deep learning application 4.Power Systems Deregulation 5. Industrial Automation and Control	3	0	0	3
4	PE-3	R24EEPE03.1 R24EEPE03.2 R24EEPE03.3 R24EEPE03.4 R24EEPE03.5	1.Electric Drives 2.Digital Signal Processing 3.Full Stack development 4.Programmable Logic Controllers and Applications 5. Drone Technology & Applications	3	0	0	3
5	OE-2	R24EEOE2.1 R24EEOE2.2 R24EEOE2.3 R24EEOE2.4 R24EEOE2.5	1.Fundamentals of Electric Vehicles 2.Electrical Wiring Estimation and Costing 3.Fundamentals of utilization of Electrical Energy 4.Indian Electricity Act 5.Electrical Safety Management	3	0	0	3
6	PC	R24EEPC20	Electrical Measurements and Instrumentation Lab	0	0	3	1.5
7	PC	R24EEPC21	Microprocessors and Microcontrollers Lab	0	0	3	1.5
8	SEC-4	R24EESC04	IOT Applications of Electrical Engineering Lab	0	0	2	1
9	MC	R24MC08	Research Methodology	2	0	0	0
10	HS	R24HS09	Employability Skills IV Advanced aptitude & communication skills	0	0	2	1
Total				17	0	8	20
Mandatory Industry Internship of 08 weeks duration during summer vacation							

Category	Courses	Credits
PC-Professional Core Courses	4	9
PE- Professional Elective	2	6
OE-Open Elective	1	3
HS-Humanities and Management Sciences Courses	1	1
SEC-Skill Enhancement Course	1	1
MC-Mandatory course	1	0
<b>Total</b>	<b>10</b>	<b>20</b>

## Department of ELECTRICAL AND ELECTRONICS ENGINEERING

Program: B. Tech- Electrical and Electronics Engineering

**Regulation: R24**

### IV Year I Semester- Course Structure

S. No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	PC	R24EEPC22	Power System Operation and Control	3	0	0	3
2	PC	R24EEPC23	Renewable Energy systems & Smart grid	3	0	0	3
3	Management Course-II	R24HS13	Energy Management and Auditing	2	0	0	2
4	PE-4	R24EEPE04.1 R24EEPE04.2 R24EEPE04.3 R24EEPE04.4 R24EEPE04.5	1.FACTS 2. Design of PV systems 3. Embedded System Design 4.AI and its Applications to Electrical Engineering 5. SWAYAM/ NPTEL Course recommended by the BOS	3	0	0	3
5	OE-3	R24EEOE3.1 R24EEOE3.2 R24EEOE3.3 R24EEOE3.4 R24EEOE3.5	1.Battery Management Systems 2.Concepts of Smart Grid Technologies 3.Introduction to Artificial Intelligence (APSCHE) 4.Concepts of Microprocessors and Microcontrollers 5.Concepts of Internet of Things	3	0	0	3
6	SEC-5	R24EESC05	AI Applications to Power Systems Simulation Lab	0	0	2	1
7	Internship	R24IN02	Evaluation of Industry Internship (Done during III-II Summer vacation- 8 weeks)	0	0	0	2
8	MC	R24MC04	Indian Traditional Knowledge	2	0	0	0
9	HS	R24HS11	Employability Skills V Corporative Readiness for IT	0	0	2	1
<b>Total</b>				<b>16</b>	<b>02</b>	<b>08</b>	<b>18</b>

Category	Courses	Credits
PC-Professional Core Courses	2	6
PE- Professional Elective	1	3
OE-Open Elective	1	3
SEC-Skill Enhancement Course	1	1
HS-Humanities and Management Sciences Courses	2	3
MC-Mandatory Course	1	0
Internship	1	2
<b>Total</b>	<b>09</b>	<b>18</b>

**Department of ELECTRICAL AND ELECTRONICS ENGINEERING**

Program: B. Tech- Electrical and Electronics Engineering

**Regulation: R24****IV Year II Semester- Course Structure**

S. No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	PE-5	R24EEPE05.1	1.Electric Vehicles & Battery management system	3	0	0	3
		R24EEPE05.2	2.Switched Mode Power Conversion				
		R24EEPE05.3	3.Electrical Distribution System				
		R24EEPE05.4	4. Electrical Power Quality				
		R24EEPE05.5	5. Special Electrical Machines for Industrial Applications				
2	OE-4	R24EEOE4.1	1.Electrical Energy Conservation and Auditing	3	0	0	3
		R24EEOE4.2	2.Power Electronics for EV				
		R24EEOE4.3	3.Fuzzy logic and Neural Networks				
		R24EEOE4.4	4.Quantum Computing (APSCHE)				
		R24EEOE4.5	5.Solar PV Systems				
3	PR	R24PR01	Internship & Project Phase	0	0	24	12
Total				<b>06</b>	<b>0</b>	<b>24</b>	<b>18</b>

Category	Courses	Credits
PE- Professional Elective	1	3
OE-Open Elective	1	3
Internship & Project Phase	1	12
<b>Total</b>	<b>3</b>	<b>18</b>

**Note: Student need to do at least one MOOC/NPTEL Course (of 3 Credits out of 160 Credits) to meet the mandatory requirement.**

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

Course Title: <b>Linear Algebra and Calculus</b>	Course Code: <b>R24BS01</b>
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 International Ltd., 2021 (9th reprint).
5. 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](https://onlinecourses.nptel.ac.in/noc24_ma91/course)
4. [https://onlinecourses.nptel.ac.in/noc24\\_ma53/course](https://onlinecourses.nptel.ac.in/noc24_ma53/course)
5. [https://onlinecourses.nptel.ac.in/noc24\\_ma11/course](https://onlinecourses.nptel.ac.in/noc24_ma11/course)

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

Course Title: APPLIED CHEMISTRY	Course Code: <b>R24BS05</b>
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  $\Psi$  and  $\Psi^2$ , particle in one dimensional box, molecular orbital theory–bonding in homo-and hetero nuclear diatomic molecules – energy level diagrams of O<sub>2</sub> and CO, etc.  $\pi$ -molecular orbital's of butadiene and Benzene, calculation of bondorder.

**COs-CO1**

Self-Learning Topics: Energy Level Diagrams of N<sub>2</sub> & CN Molecule.

**UNIT- II: Series Modern 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 (redox titrations), concept of conductivity, conductivity cell Conductometry-conductometric titrations (acid-base titrations). Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells–Zinc-air battery, Secondary cells–lithium-ion batteries-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 polymer formation.

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-Degradable polymers-Poly Glycolic Acid (PGA), Poly Lactic Acid (PLA). **COs-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's law. 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. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010

**REFERENCE BOOKS:**

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5<sup>th</sup> Edition, Wiley Publications, Feb. 2008
3. Text book of Polymer Science, Fred W. Billmeyer Jr, 3rd Edition.

**Web References:**

1. [https://swayam.gov.in/nc\\_details/NPTEL](https://swayam.gov.in/nc_details/NPTEL)
2. [https://onlinecourses.nptel.ac.in/noc19\\_cy29](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: <b>Problem Solving &amp; Programming with C</b>	Course Code: <b>R24ES03</b>
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. 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/](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 3D drawings.
7. Understand the importance of reference planes and reference lines in orthographic projection.
8. Develop problem-solving skills in engineering drawing, including creating and interpreting drawings.

#### COURSE OUTCOMES:

CO#	Course Outcomes
CO1	Understand the basics of Engineering Graphics 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 various conditions.
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 2D orthographic 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 of a 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 Transformations using 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:**

1. <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, L and 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 INSTRUMENTATION**

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, Pearson Education, 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. Bhattacharya, 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, Prentice Hall, India, 2002.
3. R.T.Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, 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](https://www.tutorialspoint.com/basic_electronics/index.htm)
3. [https://www.tutorialspoint.com/digital\\_circuits/index.htm](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**  
**IB.TECH-I SEMESTER (Common to ECE ,EEE)**

Course Title: APPLIED CHEMISTRY LAB	Course Code: <b>R24BS06</b>
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 and 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<sub>4</sub> 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: <b>Problem Solving &amp; Programming with C Lab</b>	Course Code: <b>R24ES03</b>
Teaching Scheme (L:T:P): <b>0 0 3</b>	Credits: 1.5
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: <b>Problem Solving &amp; Programming with C lab include: Understanding programming fundamentals, Writing C programs, Applying programming techniques, Using algorithms, Using pseudocode and flowcharts</b>	

**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:

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 on 1D 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 HackerRank Solution

You are given an array of integers, marks, denoting the marks scored by students in a class.

- The alternating elements marks<sub>0</sub>, marks<sub>2</sub>, marks<sub>4</sub> and so on denote the marks of boys.
- Similarly, marks<sub>1</sub>, marks<sub>3</sub>, marks<sub>5</sub> 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 marks<sub>0</sub> is stored in the memory.

## 3. Sorting Array of Strings HackerRank 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:**

This course deals practical approach of basic concepts of electrical engineering, such as DC circuits, AC circuits and reduction techniques. It includes characteristics of electrical machines and V-I characteristics of pn junction and zener diodes. And also it covers measurement of power.

**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.

**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 of components 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**

- Half Lap joint
- Mortise and Tenon joint
- Corner Dovetail joint or Bridle joint

**2. Sheet Metal Working**

- Tapered tray
- Conical funnel
- Elbow pipe
- Brazing

**3. Fitting**

- 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](https://youtube.com/playlist?list=PLzkMouYverALpuDJ4g4TiICc6_vLcS1Ny&si=YGrVJY8uB0tHy_iQ)

**E-B 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 & Sports	Course Code: R24MC01
Teaching Scheme (L:T:P): 0:0:1	Credits: 0.5
Type of Course: Practical	
Continuous Internal Evaluation: 100	Semester End Exam: 0
Pre requisites: Mental Health Awareness, Physical Education Background	

**COURSE OVERVIEW:**

- The course on "Health and Wellness, Yoga & Sports" is designed to promote a comprehensive understanding of health, wellness, fitness, nutrition, and the significance of yoga and sports in maintaining a balanced lifestyle. It covers fundamental aspects such as dietary awareness, fitness metrics, the influence of global trends on health, and the importance of physical and mental well-being through yoga and sports activities. The course fosters hands-on learning through interactive activities, community engagement, and practical sessions.

**COURSE OBJECTIVES:**

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.  
Practicing general and specific warm up, aerobics
- ii) 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

**Evaluation Guidelines:**

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject

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

Course Title: <b>Differential Equations and Vector Calculus</b>	Course Code: <b>R24BS04</b>
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 ( $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , Polynomial in  $x$ ,  $e^{ax}V(x)$ ,  $xV(x)$ ), 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](https://onlinecourses.nptel.ac.in/noc24_ma86/course)

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

Course Title: Engineering Physics	Course Code: <b>R24BS02</b>
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. –A Textbook of Engineering Physics by M.N. Avadhanulu, P.G. Kshirsagar-S. Chand Publications, 2017.
2. –Engineering Physics by D. K. Bhattacharya and Poonam Tandon, Oxford Press (2015).
3. –Engineering Physics by R.K. Gaur and S.L. Gupta., -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 edition, 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: <b>COMMUNICATIVE ENGLISH</b>	Course Code: <b>R24HS01</b>
Teaching Scheme (L:T:P): <b>2 0 0</b>	Credits: 2
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: To excel in a <i>Communicative English</i> course, certain foundational skills and prerequisites are helpful such as Basic Grammar Knowledge, <b>Listening Skills</b> , 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)**

<b>UNIT-I</b>	<b>12 Hours</b>
<b>Lesson: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye (Short story)</b>	
<b>Listening:</b> Identifying the topic, the context and specific pieces of information By listening to short audio texts and answering a series of questions.	
<b>Speaking:</b> Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.	
<b>Reading:</b> Skimming to get the main idea of a text; scanning to look for specific pieces of information.	
<b>Writing:</b> Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.	
<b>Grammar:</b> Parts of Speech, Basic Sentence Structures-forming questions	
<b>Vocabulary:</b> Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words. <span style="float: right;"><b>COs-C01</b></span>	
Self learning topics : The Great Indian Scientists-Biography of CV Raman	
<b>UNIT-II</b>	<b>10 Hours</b>
<b>Lesson: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian and contemporary)</b>	
<b>Listening:</b> Answering a series of questions about main ideas and supporting ideas after listening to audio texts.	
<b>Speaking:</b> Discussion in pairs/small groups on specific topics followed by short structure talks.	
<b>Reading:</b> 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)	
<b>Grammar:</b> Cohesive devices-linkers, use of articles and zero article prepositions.	
<b>Vocabulary:</b> Homonyms, Homophones, Homographs. <span style="float: right;"><b>COs-C02</b></span>	
Self learning Topics : Seven Ages of Man by William Shakespeare.	
<b>UNIT-III</b>	<b>12 Hours</b>
<b>Lesson: BIOGRAPHY: Steve Jobs</b>	
<b>Listening:</b> Listening for global comprehension and summarizing what is listened to.	
<b>Speaking:</b> Discussing specific topics in pairs or small groups and reporting what is discussed	
<b>Reading:</b> Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension.	
<b>Writing:</b> Summarizing, Note-making, paraphrasing	
<b>Grammar:</b> Verbs-tenses; Subject-verb agreement; Compound words, Collocations	
<b>Vocabulary:</b> Compound words, Collocations <span style="float: right;"><b>COs-C03</b></span>	
Self learning topics: Elon Musk	
<b>UNIT-IV</b>	<b>8 Hours</b>
<b>Lesson: INSPIRATION: The Knowledge Society by APJ Abdul Kalam (Ignited minds)</b>	
<b>Listening:</b> Making predictions while listening to conversations/ transactional dialogues without video; listening with video.	
<b>Speaking:</b> Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.	
<b>Reading:</b> 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, 1<sup>st</sup>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](http://www.bbc.co.uk/learningenglish)
2. <https://dictionary.cambridge.org/grammar/british-grammar/>
3. [www.eslpod.com/index.html](http://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](https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA)

**BASIC CIVIL AND MECHANICAL ENGINEERING**  
**I B.TECH- II SEMESTER (Common to ECE, EEE & MECH)**

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: Physics, Chemistry, Mathematics, Environmental Science, Drawing	

**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:**

<b>CO#</b>	<b>Course Outcomes</b>
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 transportation engineering, 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-Stroke engines, 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 CNC machines, 3D printing 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, Basic Civil and the Mechanical Engineering, Tata Mc graw Hill publications (India) Pvt. Ltd.

**ONLINE RESOURCES:**

1. [https://www.youtube.com/playlist?list=PLyqSpQzTE6M\\_SM0Lrnzk2dJFwElh0Ebhu](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/>

**E-B BOOKS:**

1. <https://www.pdfdrive.com/basics-of-mechanical-engineering-prof-paul-d-ronney-e16452684.html>

**ELECTRICAL CIRCUIT ANALYSIS-I**  
**I B.TECH- II SEMESTER ( EEE)**

Course Title: Electrical Circuit Analysis-I	Course Code: R24EEPC01
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 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.

**COURSE OBJECTIVES:**

The objectives of this course are to

- To study the concepts of passive elements, types of sources and various network reduction techniques.
- To understand the difference between electric and magnetic circuit.
- To study the behavior of RLC networks for sinusoidal excitations.
- To understand the concepts of average value and effective value of periodic functions
- To understand the concept of resonance.
- To study the applications of network theorems for analysis of electrical networks.

**COURSE OUTCOMES:**

CO#	Course Outcomes
CO1	Apply different fundamental laws and network reduction Techniques to basic electrical networks.
CO2	Understand and apply the concept of self-inductance and mutual inductance to magnetic circuits.
CO3	Analyze single phase AC circuits under steady state for different circuit topologies (with R, L and C components).
CO4	Understand the concept of Resonance.
CO5	Evaluation of Network theorems.

**COURSE CONTENT (SYLLABUS)**

**UNIT -I: INTRODUCTION TO ELECTRICAL CIRCUITS**

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources, node and mesh analysis. Concept of Dual Networks

**COs – CO1**

Self-Learning Topics: T and [] Networks

**UNIT-II: MAGNETIC CIRCUITS**

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits,

Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.

**COs – CO2**

Self-Learning Topics Magnetic Materials

**UNIT-III: SINGLE PHASE AC CIRCUITS**

Characteristics of periodic functions, Average value, R.M.S. value, form factor, Representation of a sine function, concept of phasor, phasor diagrams. Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit.

**COs – CO3**

Self-Learning Topics: Applications of Sinusoidal Signal

**UNIT-IV: RESONANCE**

Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth.

**COs – CO4**

Self-Learning Topics: Applications of Resonance

**UNIT-V: NETWORK THEOREMS**

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.

**COs – CO5**

Self-Learning Topics: Applications of Network Theorems in Electrical Engineering

**TEXT BOOKS:**

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata McGraw Hill Education, 2005, sixth edition.
2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

**REFERENCE BOOKS:**

1. Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O. Sadiku, McGraw Hill Education (India), 2013, Fifth Edition
2. Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and
3. K. Rao, McGraw Hill Education, 2017, Fifth Edition.
4. Electric Circuits, David A. Bell, Oxford University Press, 2009, Seventh Edition.
5. Introductory Circuit Analysis, Robert L Boylestad, Pearson Publications, 2023, Fourteenth Edition.
6. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, Seventh Revised Edition.

**ONLINE RESOURCES:**

1. [https://onlinecourses.nptel.ac.in/noc23\\_ee81/preview](https://onlinecourses.nptel.ac.in/noc23_ee81/preview)
2. <https://nptel.ac.in/courses/108104139>
3. <https://nptel.ac.in/courses/108106172>
4. <https://nptel.ac.in/courses/117106108>

**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: <b>COMMUNICATIVE ENGLISH LAB</b>	Course Code: <b>R24HS02</b>
Teaching Scheme (L:T:P): <b>0 0 2</b>	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, <b>Listening Skills</b> , 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 for information, giving information, meetings, requests, exchanging dialogues in formal and informal contexts.
2. 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](http://www.esl-lab.com)
2. [www.englishmedialab.com](http://www.englishmedialab.com)
3. [www.englishinteractive.net](http://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](https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc)
4. [https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp\\_IA](https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA)

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

Course Title: Engineering Physics lab	Course Code: <b>R24BS03</b>
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: basic physics knowledge, mathematics	

**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:

1. Basic Physics Knowledge
2. Mathematics Skills
3. Measurement and Unit Conversions
4. Basic Laboratory Skills
5. Problem-Solving and Analytical Skills
6. Familiarity with Safety Practices
7. 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:**

1. Determination of radius of curvature of a given plano convex lens by Newton's method.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Determination of thickness of thin object by air wedge method
4. Determination of wavelength of Laser Source by diffraction grating.
5. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.

6. Magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method.
7. Determination of dispersive power of the prism.
8. Determination of acceleration due to gravity and radius of Gyration by using Compound pendulum.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Determination of dielectric constant using charging and discharging method.
11. Sonometer: Verification of laws of stretched string.
12. Estimation of Planck's constant using photoelectric effect.
13. Study the variation of B versus H by magnetization the magnetic material (B-H curve)
14. Determination of frequency of electrically maintained tuning fork by Melde's experiment.
15. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
16. Determination of the resistivity of semiconductor by four probe method.
17. Determination of young's modulus for the given material of wooden scale by non- uniform bending (or double cantilever) method .
18. Determination of magnetic susceptibility 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 Distributors 2023.

**ONLINE RESOURCES:**

**Web References:**

1. <https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html.prototype>  
[URL:www.vlab.co.in](http://www.vlab.co.in)

## IT Workshop

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

Course Title: <b>IT Workshop Lab</b>	Course Code: <b>R24ES04</b>
Teaching Scheme (L:T:P): <b>0 0 2</b>	Credits: 1
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: an IT workshop for engineering students: <b>Familiarity with hand tools, equipment, and machines, Computer skills.</b>	

#### **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:**

<b>CO#</b>	<b>Course Outcomes</b>
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, IITL 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– CISCO Press, 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 Tutorials

**ELECTRICAL CIRCUITS LAB**  
**I B.TECH- I SEMESTER ( EEE)**

Course Title: Electrical Circuits Lab	Course Code: R24EEPC02
Teaching Scheme (L:T:P): 0:0:3	Credits: 1.5
Type of Course: Practical	
Continuous Internal Evaluation: 30Marks	Semester End Exam: 70 Marks
Pre requisites: Understanding of Circuit Components, Breadboard connections.	

**COURSE OVERVIEW:**

- This course deals practical approach of classification of electrical elements, transformation techniques and reduction techniques of active and passive networks, it includes solution for complex networks, like Thevenin and Norton Theorems. And also includes magnetic circuits and two port networks.

**COURSE OBJECTIVES:**

To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics. It also gives practical exposure of different circuits with different conditions

**COURSE OUTCOMES:**

CO#	Course Outcomes
CO1	Apply various theorems to electrical circuits
CO2	Determination of Two port parameters of a given electric circuits. Determination of self and mutual inductances
CO3	Determine the parameters of a given coil.

**List of Experiments:**

- |  |          |
|--|----------|
| 1. Verification of Kirchhoff's circuit laws.   | COS:CO1  |
| 2. Verification of Superposition theorem.  | COS:CO1  |
| 3. Verification of Thevenin's and Norton's Theorems.                                   | COS:CO1  |
| 4. Verification of Maximum power transfer theorem.                                     | COS:CO1  |
| 5. Verification of Compensation theorem.   | COS: CO2 |
| 6. Verification of Reciprocity and Millman's Theorems.                                 | COS: CO2 |
| 7. Series and parallel resonance.  | COS: CO2 |
| 8. Determination of self, mutual inductances and coefficient of coupling               | COS: CO2 |
| 9. Determination of Impedance (Z) and Admittance (Y) Parameters for a two port network | COS: CO2 |
| 10. Determination of Transmission and Hybrid parameters                                | COS: CO2 |
| 11. Determination of Parameters of a choke coil.                                       | COS:CO1  |
| 12. Determination of cold and hot resistance of an electric lamp.                      | COS:CO1  |
| 13. Measurement of 3-phase power by two wattmeter method for unbalanced loads          | COS:CO1  |

**NOTE:** Any 10 experiments are to be conducted

**REFERENCE BOOKS:**

- Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition
- Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

**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): 0:0:1	Credits: 0.5
Type of Course: Practical	
Continuous Internal Evaluation: 100	Semester End Exam: 0
Pre requisites: Basic Social Awareness, Discipline and Responsibility, Teamwork and Communication Skills,	

**COURSE OVERVIEW:**

- This subject NSS/NCC/SCOUTS & Guides/Community Service focuses on fostering a sense of community service, environmental responsibility, and personal development among students. The curriculum encourages students to actively participate in activities that broaden their social awareness, build teamwork skills, and nurture empathy for social and environmental causes.

**COURSE OBJECTIVES:**

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:**

- Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
- Conducting orientations programs for the students –future plans-activities-releasing road map etc.
- Displaying success stories-motivational biopics- award winning movies on societal issues etc.
- 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.
- iii) Recycling and environmental pollution article writing competition.
- iv) Organising Zero-waste day.
- v) Digital Environmental awareness activity via various social media platforms.
- vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
- vii) 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.

**Evaluation Guidelines:**

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.



## 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

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### Department of ELECTRICAL AND ELECTRONICS ENGINEERING

Program: B. Tech- Electrical and Electronics 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	R24EEBS07	Complex Variables & Numerical Methods	3	0	0	3
2	HS	R24HS04	Managerial Economics and Financial Analysis	2	0	0	2
3	PC	R24EEPC03	Electromagnetic Fields(EMF)	3	0	0	3
4	PC	R24EEPC04	Electrical Circuit Analysis-II	3	0	0	3
5	PC	R24EEPC05	DC Machines & Transformers	3	0	0	3
6	PC	R24EEPC06	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	1.5
7	PC	R24EEPC07	DC Machines & Transformers Lab	0	0	3	1.5
8	HS	R24HS06	Design Thinking and Innovation	0	1	2	2
9	SEC	R24EESC01	Employability Skills I: Competitive coding	0	1	2	2
10	MC	R24MC04	Constitution of India	2	0	0	-
<b>Total</b>				<b>16</b>	<b>02</b>	<b>10</b>	<b>21</b>

Category	Courses	Credits
BS- Basic Sciences Course	1	3
HS-Humanities and Management Sciences Courses	2	4
PC-Professional Core Courses	5	12
MC-Mandatory Course	1	0
SEC- Skill Enhancement course	1	2
<b>Total</b>	<b>10</b>	<b>21</b>

**Department of ELECTRICAL AND ELECTRONICS ENGINEERING**

Program: B. Tech- Electrical and Electronics 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	R24HS03	Universal Human Values-I Understanding Harmony and Ethical Human Conduct	2	0	0	2
2	ES	R24EES09	Analog Circuits	3	0	0	3
3	PC	R24EPC08	Power Systems-I	3	0	0	3
4	PC	R24EPC09	Induction and Synchronous Machines	3	0	0	3
5	PC	R24EPC10	Control Systems	3	0	0	3
6	PC	R24EPC11	Induction and Synchronous Machines Lab	0	0	3	1.5
7	PC	R24EPC12	Control Systems Lab	0	0	3	1.5
8	HS	R24HS04	Employability Skills II Quantitative aptitude & logical reasoning	0	1	2	2
9	SEC	R24EESC02	Python Programming and Industry Readiness	0	1	2	2
10	MC	R24MC03	Environmental Science	2	0	0	-
<b>Total</b>				<b>16</b>	<b>02</b>	<b>10</b>	<b>21</b>
Summer internship 2 months (Mandatory) after second year (to be evaluated during III year I Semester)(community service project)							

Category	Courses	Credits
ES-Engineering Science Courses	1	3
HS-Humanities and Management Sciences Courses	2	4
PC-Professional Core Courses	5	12
SEC-Skill Enhancement Course	1	2
MC- Mandatory course	1	0
<b>Total</b>	<b>10</b>	<b>21</b>

**COMPLEX VARIABLES & NUMERICAL METHODS**  
**II B.TECH- I SEMESTER**

Course Title: COMPLEX VARIABLES AND STATISTICAL METHODS	Course Code: R24EEBS07
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: As a pre-requisite to this course students are required to have a reasonable mastery over multivariable calculus, differential equations and Linear algebra.	

**COURSE OBJECTIVES:**

1. To familiarize the complex variables.
2. To familiarize the students with the foundations of probability and statistical methods.
3. To equip the students to solve application problems in their disciplines.

At the end of the course student will be able to:

**COURSE OUTCOMES:**

After completing the course, the student should be able to

CO1: To obtain an analytic function for a given harmonic function using C-R equations.

CO2: Make use of the Cauchy residue theorem to evaluate certain integrals

CO3: Apply the theoretical probability distributions like Binomial, Poisson, and normal in the relevant application areas.

CO4: Analyze to test various hypotheses included in theory and types of errors for large samples.

CO5: Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real-life problems.

Course Outcomes(COs)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	1	2	1	-	-	-	-	-	2	1	L3
CO2	3	3	1	2	2	-	-	-	-	-	2	1	L3,L4
CO3	3	2	2	3	3	1	-	-	-	-	3	2	L3
CO4	2	3	2	3	3	2	-	-	-	-	3	2	L4
CO5	2	3	2	3	3	2	1	-	-	-	3	2	L4,L5

**SYLLABUS**

**UNIT- I: Functions of a complex variable and Complex integration:**

**10 hours**

Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates –Harmonic and conjugate harmonic functions – Milne –Thompson method. Complex integration: Line integral– Cauchy’s integral theorem–Cauchy’s integral formula.

**COs-CO1**

**Self- learning Topics: Evaluating contour integrals, Integration along a smooth path**

**UNIT- II: Series expansions and Residue Theorem:****10 hours**

Radius of convergence –Expansion in Taylor’s series, Maclaurin’s , series and Laurent series Types of Singularities: Isolated –Essential – Pole of order m –Residues–Residue theorem (without proof)

and evaluation of real integrals of the form  $\int_{-\infty}^{\infty} f(x) dx$ ,

**COs-CO2**

**Self- learning Topics: Approximating a function or data using a series of function is a fundamental tool for data analysis.**

**UNIT- III: Probability and Distributions:****10 hours**

Review of probability and Baye’s theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability Density function and Cumulative distribution functions – Mathematical Expectation and Variance –Binomial, Poisson, Uniform and Normal distributions.

**COs-CO3**

**Self- learning Topics: To understand risk and return on investment.**

**UNIT-IV: Sampling Theory:****10 hours**

Introduction –Population and Samples–Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions–

Introduction to t,  $\chi^2$  and F-distributions–Point and Interval estimations –Maximum error of estimate.

**COs-CO4**

**Self- learning Topics: Estimate health outcomes, behaviors and attitudes within a population.**

**UNIT- V: Tests of Hypothesis:****10 hours**

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors –Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples)–Tests on proportions.

**COs-CO5**

**Self- learning Topics: Hypothesis Testing is employed to ensure product quality and process efficiency.**

**Textbooks:**

1. **B.S.Grewal**, Higher Engineering Mathematics, Khanna Publishers, 44<sup>th</sup>Edition, 2017.
2. **Miller and Freund’s**, Probability and Statistics for Engineers, Pearson, 7<sup>th</sup>edition, 2008.

**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS****II B.TECH- I SEMESTER**

<b>Course Title: MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS</b>	<b>Course Code: R24HS04</b>
<b>Teaching Scheme (L:T:P): 2:0:0</b>	<b>Credits: 02</b>
<b>Type of Course: Lecture</b>	
<b>Continuous Internal Evaluation: 30 Marks</b>	<b>Semester End Exam: 70 Marks</b>
<b>Pre requisites:</b> 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

CO1: Define the concepts related to Managerial Economics, financial accounting and management

CO2: Understand the fundamentals of Economics: Demand, Production, cost, revenue and markets

CO3: Apply the concept of Production, cost and revenues for effective business decision

CO4: Analyze how to invest their capital and maximize returns

CO5: Evaluate the capital budgeting techniques

CO6: Develop the accounting statements and evaluate financial performance of a business entity.

Course Outcomes(COs)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	2	1	1	2	-	-	2	2	2	1	L2
CO2	3	3	2	2	2	2	-	-	1	1	2	1	L2
CO3	3	3	3	2	2	3	-	-	1	2	2	2	L3
CO4	2	3	3	3	3	3	-	-	2	3	3	2	L4
CO5	2	2	3	3	3	2	-	-	2	3	2	2	L5
CO6	3	3	3	3	3	2	-	1	2	3	3	3	L5,L6

## SYLLABUS

### UNIT - I: Managerial Economics:

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting-Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management. 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. CO6

#### 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.

#### Online Learning 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>

**ELECTROMAGNETIC FIELDS (EMF)**  
**II B.TECH- I SEMESTER**

Course Title: Electromagnetic Fields(EMF)	Course Code: R24EEPC03
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: Concepts of Differential Equations, Vector Calculus, Physics and Basic Electrical Circuits	

**COURSE OBJECTIVES:**

- To study the production of electric field and potentials due to different configurations of static charges.
- To study the properties of conductors and dielectrics, calculate the capacitance of different configurations. Understand the concept of conduction and convection current densities.
- To study the magnetic fields produced by currents in different configurations, application of Ampere's law and the Maxwell's second and third equations, magnetic force and torque through Lorentz force equation in magnetic field environment like conductors and other current loops.
- To develop the concept of self and mutual inductances and the energy stored.
- To study time varying and Maxwell's equations in different forms and Maxwell's fourth equation for the induced EMF.

**Course Outcomes:**

After completion of the course, students will be able to

- CO1:** Compute electric fields and potentials using Gauss law/ solve Laplace's or Poisson's equation for various electric charge distributions.
- CO2:** Analyze, the behavior of conductors in electric fields, electric dipole and the capacitance and energy stored in dielectrics.
- CO3:** Calculate the MFI due to different current configuration using Biot-Savart's law and Ampere's law.
- CO4:** Estimate self and mutual inductances and the energy stored in the magnetic field.
- CO5:** Understand the concepts of Faraday's laws, Displacement current, Poynting theorem and Pointing vector displacement current and Poynting vector.

Course Outcomes(COs)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	3	2	2	2	-	-	-	-	-	2	2	L3
CO2	3	3	2	2	2	-	-	-	-	-	2	2	L4
CO3	3	2	2	2	3	-	-	-	-	-	2	2	L3
CO4	3	3	2	2	3	-	-	-	-	-	2	2	L5
CO5	3	3	2	2	2	1	-	-	-	-	3	2	L2

**SYLLABUS**

<b>UNIT – I Vector Analysis:</b>	<b>14 Hours</b>
Vector Algebra : Scalars and Vectors, Unit vector, Vector addition and subtraction, Position and distance vectors, Vector multiplication, Components of a vector.	
Coordinate Systems: Rectangular, Cylindrical and Spherical coordinate systems.	
<b>Vector Calculus:</b> Differential length, Area and Volume. Del operator, Gradient of a scalar, Divergence of a vector and Divergence theorem (definition only). Curl of a vector and Stoke's theorem (definition only).	
<b>Electrostatics:</b>	
Coulomb's law and Electric field intensity (EFI) – EFI due to Continuous charge distributions (line and surface charge), Electric flux density, Work done in moving a point charge in an electrostatic field, Electric Potential- properties of potential function, Potential gradient, Gauss's law (Maxwell's first equation, ), Laplace's and Poisson's equations.	
	<b>COs-CO1</b>
<b>UNIT – II Conductors – Dielectrics and Capacitance:</b>	<b>16 Hours</b>
Behaviour of conductor in electric field, Electric dipole and dipole moment, Current density-conduction and convection current densities, Ohm's law in point form, Continuity equation , Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial and spherical capacitors, Energy stored and density in a static electric field.	
	<b>COs-CO2</b>
<b>UNIT – III Magneto statics, Ampere's Law and Force in magnetic fields:</b>	<b>14 Hours</b>
Biot- Savart's law – Magnetic flux density and Maxwell's second Equation ( $\nabla \cdot \mathbf{B} = 0$ ), Ampere's circuital law and its applications viz. MFI due to solenoid, toroidal current carrying conductor, point form of ampere's circuital law, Maxwell's Third equation( $\nabla \times \mathbf{H} = \mathbf{J}$ )	
Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors.	
	<b>COs-CO3</b>
<b>UNIT – IV Self and mutual inductance:</b>	<b>10 Hours</b>
Self and mutual inductance – determination of self-inductance of a solenoid, toroid, coaxial cable and mutual inductance between a straight long wire and a square loop wire in the same plane – Energy stored and energy density in a magnetic field.	
	<b>COs-CO3</b>
<b>UNIT – V Time Varying Fields:</b>	<b>10 Hours</b>
Faraday's laws of electromagnetic induction, Maxwell's fourth equation , integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields, Poynting theorem and Poynting vector .	
	<b>COs-CO5</b>

**Textbooks:**

1. “Principles of Electromagnetics” by Matthew N O Sadiku, S.V Kulakarni, Oxford Publications, Asian Edition, 6<sup>th</sup> edition, 2022.
2. “Engineering Electromagnetics” by William H. Hayt & John. A. Buck Mc. Graw-Hill, 9<sup>th</sup> Edition.2020.

**Reference Books:**

1. “Introduction to Electro Dynamics” by D J Griffiths, Prentice-Hall of India Pvt. Ltd,4<sup>th</sup> edition, 2020
2. “Electromagnetic Field Theory” by Yaduvir Singh, Pearson India, 1<sup>st</sup> edition, 2011.
3. “Fundamentals of Engineering Electromagnetics” by Sunil Bhooshan, Oxford University Press, 2012.
4. Schaum's Outline of Electromagnetics by Joseph A. Administer, Mahmoud Navi,14<sup>th</sup> Edition, 2014.

**Online Learning Resources:**

1. <https://archive.nptel.ac.in/courses/108/106/108106073/>
2. <https://nptel.ac.in/courses/11710306>

**ELECTRICAL CIRCUIT ANALYSIS-II****II B.TECH- I SEMESTER**

Course Title: <b>Electrical Circuit Analysis-II</b>	Course Code: <b>R24EETPC04</b>
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: Analysis of DC and Single-phase AC Circuits, Concepts of differentiation and integration.	

**COURSE OBJECTIVES:**

- To understand three phase circuits
- To analyse transients in electrical systems
- To evaluate network parameters of given electrical network
- To apply Fourier analysis to electrical systems
- To understand graph theory for circuit analysis and to understand the behaviour of filters

**COURSE OUTCOMES:**

After completion of the course, students will be able to

CO1: Analyse balanced and unbalanced three-phase systems.

CO2: Analyse the transient behaviour of electrical networks in different domains.

CO3: Estimate various Network parameters.

CO4: Apply the concept of Fourier series to electrical systems.

CO5: Analyse the filter circuit for electrical circuits.

Course Outcomes(COs)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	3	2	2	2	-	-	-	-	-	2	2	L4
CO2	3	3	2	3	2	-	-	-	-	-	2	2	L4
CO3	3	3	2	3	2	-	-	-	-	-	2	2	L5
CO4	3	2	2	2	2	-	-	-	-	-	2	2	L3
CO5	3	3	2	2	3	-	-	-	-	-	2	2	L4

**SYLLABUS****UNIT - I Analysis of three phase balanced circuits:****14 Hours**

Phase sequence, star and delta connection of sources and loads, relationship between line and phase quantities, analysis of balanced three phase circuits, measurement of active and reactive power.

**Analysis of three phase unbalanced circuits:**

Loop method, Star-Delta transformation technique, measurement of active and reactive power.

**Self-Learning Topics: Applications in Electrical Systems****COs-CO1****UNIT – II Laplace transforms:****14Hours**

Definition and Laplace transforms of standard functions (Impulse, Step, Ramp, Parabolic) – Shifting theorem – Laplace Transforms of derivatives and integrals, Inverse Laplace transforms.

**Transient Analysis:** Transient response of R-L, R-C and R-L-C circuits for D.C. and sinusoidal excitations – Initial conditions - Solution using differential equation approach and Laplace transform approach.

**COs-CO2****Self-Learning Topics: Applications of transients in Electrical systems.****UNIT - III Network Parameters:****12 Hours**

Impedance parameters, Admittance parameters, Hybrid parameters, Transmission (ABCD) parameters, conversion of Parameters from one form to other, Conditions for Reciprocity and Symmetry, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations- problems.

**COs-CO3****Self-Learning Topics: Design Networks****UNIT - IV Fourier Analysis:****10 Hours**

Trigonometric and exponential form of Fourier series, evaluation of Fourier coefficients, Symmetry in Fourier Series – Even Symmetry, Odd Symmetry, Half Wave Symmetry, Quarter Wave Symmetry, Average & RMS values of periodic waveforms, Analysis of Electric Circuits with Periodic Excitation.

**COs-CO4****Self-Learning Topics: Fourier series in mathematics****UNIT - V Filters:****10 Hours**

Classification of filters-Low pass, High pass, Band pass and Band Elimination filters, Constant-k filters - Low pass and High Pass, Design of Filters - Low pass and High pass.

**COs-CO5****Self-Learning Topics: Op-Amp Based Filters****Textbooks:**

1. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, 9<sup>th</sup> Edition McGraw-Hill, 2020
2. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N. O. Sadiku, 7<sup>th</sup> Edition, Tata McGraw-Hill, 2022

**Reference Books:**

1. Network Analysis, M. E. Van Valkenburg, 3<sup>rd</sup> Edition, PHI, 2019.
2. Network Theory, N. C. Jagan and C. Lakshminarayana, 3<sup>rd</sup> Edition, B. S. Publications, 2015.
3. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan S. Palli, 5<sup>th</sup> Edition, Tata McGraw-Hill, 2017.

4. Engineering Network Analysis and Filter Design (Including Synthesis of One Port Networks)-  
Durgesh C. Kulshreshtha Gopal G. Bhise, Prem R. Chadha ,Umesh Publications 2012.
5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, 7<sup>th</sup> Revised Edition.
6. Introduction to Basic Electronics and Circuits, Dr.Prasad Rao Rayavarapu, Mr.Varahala Dora  
,SK Research Publications 2025.

**Online Learning Resources:**

1. <https://archive.nptel.ac.in/courses/117/106/117106108/>
2. <https://archive.nptel.ac.in/courses/108/105/108105159/>
3. <https://nptel.ac.in/courses/108104139>
4. <https://nptel.ac.in/courses/108106172>
5. <https://nptel.ac.in/courses/117106108>
6. [https://onlinecourses.nptel.ac.in/noc23\\_ee81/preview](https://onlinecourses.nptel.ac.in/noc23_ee81/preview)

**DC MACHINES & TRANSFORMERS**  
**II B.TECH- I SEMESTER**

Course Title: <b>DC Machines &amp; Transformers</b>	Course Code: <b>R24EEPC05</b>
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: Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis.	

**COURSE OBJECTIVES:**

Students will get exposure to

- Understand the characteristics and applications of DC Machines.
- Develop problem solving skills about the starting, speed control and testing of DC Machines.
- Understand the concepts of efficiency and regulation of a transformer by obtaining equivalent circuit.
- Understand the performance of single-phase transformers.
- Understand the connection diagrams of three-phase transformers.

**COURSE OUTCOMES:**

After completion of the course, students will be able to

CO1: Understand the process of voltage build-up in DC generators and characteristics

CO2: Understand the process of torque production, starting and speed control of DC motors and illustrate their characteristics.

CO3: Obtain the equivalent circuit of single-phase transformer and determine its efficiency & regulation.

CO4: Analyze the performance of Single- Phase Transformers.

CO5: Analyze various configurations of three-phase transformers.

Course Outcomes(COs)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	1	1	1	-	-	-	-	-	1	2	L2
CO2	3	2	1	2	2	-	-	-	-	-	1	2	L2
CO3	3	2	2	2	2	-	-	-	-	-	2	2	L3
CO4	3	3	2	2	2	-	-	-	-	-	2	2	L4
CO5	3	2	2	2	2	-	-	-	-	-	2	2	L4

## SYLLABUS

### **UNIT – I: Principles of electromechanical energy conversion: 16 Hours**

Energy in magnetic system, field energy and mechanical force, determination of mechanical force, mechanical energy, flow of energy in electromechanical device.

#### **DC Machines**

Introduction to DC machines (Construction and principle of operation of DC machines) – EMF equation for generator –Excitation techniques – characteristics of DC generators –applications of DC Generators, Back- EMF and torque equations of DC motor- Characteristics of DC motors - Applications of DC motors – Armature reaction and commutation. COs – CO1

#### **Self-Learning Topics: Commutation**

### **UNIT – II: Starting, Speed Control and Testing of DC Machines 12 Hours**

Necessity of a starter – starting by 3-point and 4-point starters – speed control by armature voltage and field current control – Testing of DC machines, losses and efficiency – brake test, Swinburne’s test – Hopkinson’s test–Field Test. COs – CO2

#### **Self-Learning Topics: Losses and Efficiency**

### **UNIT – III: Single-phase Transformers 12 Hours**

Introduction to single-phase Transformers (Construction and principle of operation)–EMF equation – operation on no-load and on load –lagging, leading and unity power factor loads –phasor diagrams– equivalent circuit –regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – auto transformer - all day efficiency. COs–CO3

#### **Self-Learning Topics: – effect of variation of frequency and supply voltage on losses**

### **UNIT –IV: Testing of Transformers 11 Hours**

Open-Circuit and Short-Circuit tests – Sumpner’s test – separation of losses— Parallel operation with equal and unequal voltage ratios— equivalent circuit. COs–CO4

#### **Self-Learning Topics: comparison with two winding transformers**

### **UNIT – V: Three-Phase Transformers: 11 Hours**

Polyphase connections- Y/Y, Y/ $\Delta$ ,  $\Delta$ /Y,  $\Delta$ / $\Delta$ , open  $\Delta$  – Parallel operation–three winding transformers- transients in switching –off load and on load tap changers–Scott connection. COs – CO5

#### **Self-Learning Topics: transients in switching**

#### **Textbooks:**

1. Electrical Machinery by Dr. P S Bimbhra, Fully Revised edition, Khanna Publishers, New Delhi, 2021.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

#### **Reference Books:**

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition,2017.
2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2017

3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khann Publishers, 2021.
4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2013.
5. Electric Machinery by Fitzgerald, A.E., Kingsley, Jr., C.,& Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

**Online Learning Resources:**

1. [nptel.ac.in/courses/108/105/108105112](https://nptel.ac.in/courses/108/105/108105112)
2. [nptel.ac.in/courses/108/105/108105155](https://nptel.ac.in/courses/108/105/108105155)

**ELECTRICAL CIRCUIT ANALYSIS-II AND SIMULATION LAB**  
**II B.TECH- I SEMESTER**

Course Title: <b>Electrical Circuit Analysis-II And Simulation Lab</b>	Course Code: R24EEPC06
Teaching Scheme (L:T:P): 0:0:3	Credits: 1.5
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: Analysis of DC and Single-phase AC Circuits, Concepts of differentiation and integration	

**COURSE OBJECTIVES:**

- To measure three phase Active and Reactive power
- To analyse transient behaviour of circuits
- To determine 2-port network parameters
- To analyse electrical circuits using simulation tools

**COURSE OUTCOMES:**

After completion of the course, students will be able to

**CO1:** Understand the power calculations in three phase circuits.

**CO2:** Evaluate the time response of given network.

**CO3:** Evaluate two port network parameters.

**CO4:** Simulate and analyses electrical circuits using suitable software.

Course Outcomes(COs)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	-	2	2	-	-	-	-	-	-	3	L1,L2
CO2	3	3	-	3	2	-	-	-	-	-	2	3	L1, L2
CO3	3	2	-	2	2	-	-	-	-	-	-	3	L2, L3
CO4	3	2	-	3	3	-	-	-	-	-	2	3	L1,L3

**List of Experiments**

**Any 10 of the following experiments are to be conducted:**

1. Measurement of Active Power and Reactive Power for balanced loads. COs: CO1
2. Measurement of Active Power and Reactive Power for unbalanced loads. COs: CO1
3. Determination of Z and Y parameters. COs: CO3
4. Determination of ABCD and hybrid parameters COs: CO3
5. Verification of Kirchhoff's current law and voltage law using simulation tools COs: CO4
6. Verification of mesh and nodal analysis using simulation tools. COs: CO4
7. Verification of super position and maximum power transfer theorems using simulation tools. COs: CO4
8. Verification of Reciprocity and Compensation theorems using simulation tools. COs: CO4
9. Verification of Thevenin's and Norton's theorems using simulation tools COs: CO4
10. Verification of series and parallel resonance using simulation tools COs: CO4
11. Simulation and analysis of transient response of RL, RC and RLC circuits COs: CO4

12. Verification of self-inductance and mutual inductance by using simulation tools. COs: CO4
13. Modeling and analysis of Low pass and High pass filters using suitable simulation tools. COs: CO4
14. Measurement of power factor of RL, RC and RLC circuits. COs: CO1

**DC MACHINES & TRANSFORMERS LAB**  
**II B.TECH- I SEMESTER**

Course Title: <b>Dc Machines &amp; Transformers Lab</b>	Course Code: R24EEPC07
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: Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis	

**COURSE OBJECTIVES:**

The objectives of this course is

- To conduct the experiment and plot the characteristics and applications of DC machines.
- To perform the starting, speed control and testing methods of DC Machines.
- To determine/Predetermine efficiency and regulation of the transformer through equivalent circuit.

**COURSE OUTCOMES:**

After completion of the course, students will be able to

CO1: Apply theoretical concepts in analyzing the performance characteristics of DC Machines.

CO2: Determine the performance characteristics of DC machines using different testing methods

CO3: Determine the performance parameters of single-phase transformer.

Course Outcomes(COs)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2		2	2						-	3	L1, L2
CO2	3	2		3	3						2	3	L2,L3
CO3	3	2		2	2						2	3	L2, L3

**List of Experiments**

**Any 10 of the following experiments are to be conducted:**

1. Speed control of DC shunt motor by Field Current and Armature Voltage Control. COs: CO1
2. Brake test on DC shunt motor- Determination of performance curves. COs: CO2
3. Swinburne's test - Predetermination of efficiencies as DC Generator and Motor. COs: CO2
4. Hopkinson's test on DC Shunt Machines. COs: CO2
5. Load test on DC compound generator-Determination of characteristics. COs: CO2
6. Load test on DC shunt generator-Determination of characteristics. COs: CO2
7. Fields test on DC series machines-Determination of efficiency. COs: CO2

- |  |          |
|--|----------|
| 8. Brake test on DC compound motor-Determination of performance curves.          | COs: CO2 |
| 9. OC & SC tests on single phase transformer.                                    | COs: CO3 |
| 10. Sumpner's test on single phase transformer.                                  | COs: CO3 |
| 11. Scott connection of transformers.  | COs: CO3 |
| 12. Parallel operation of Single-phase Transformers.                             | COs: CO3 |
| 13. Separation of core losses of a single-phase transformer                      | COs: CO3 |
| 14. Separation of losses in DC shunt machine.                                    | COs: CO2 |
| 15. Load test on single phase transformer (calculate efficiency and regulation). | COs: CO3 |

Any 10 experiments are to be conducted

**References:**

1. Dr. P. S Bimbhra, Electrical Machinery, 7/e, Khanna Publishers,2018.
2. . I.J. Nagarath and D.P. Kothari, Electric Machines,4/e, McGraw Hill, 2010.

**Online Learning Resources:**

1. <https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html>

**DESIGN THINKING & INNOVATION**  
**II B.TECH- I SEMESTER**

<b>Course Title: DESIGN THINKING &amp; INNOVATION</b>	<b>Course Code: R24HS06</b>
<b>Teaching Scheme (L:T:P): 0:1:2</b>	<b>Credits: 02</b>
<b>Type of Course: Tutorials+Practicals</b>	
<b>Continuous Internal Evaluation: 30 Marks</b>	<b>Semester End Exam: 70 Marks</b>
<b>Pre requisites:</b> To succeed in <b>Design Thinking &amp; Innovation</b> , students should have a basic understanding of <b>problem-solving methodologies</b> and <b>critical thinking</b> . Familiarity with <b>user experience (UX)</b> principles and <b>empathy mapping</b> is essential for understanding user needs. Knowledge of <b>brainstorming techniques</b> and <b>collaborative tools</b> aids in effective ideation. Basic skills in <b>prototyping</b> and <b>rapid iteration</b> are important for testing and refining solutions. Additionally, an understanding of <b>business strategy</b> and <b>market research</b> 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

**CO1:** Define the concepts related to design thinking

**CO2:** Explain the fundamentals of Design Thinking and innovation.

**CO3:** Apply the design thinking techniques for solving problems in various sectors.

**CO4:** Analyse to work in a multidisciplinary environment.

**CO5:** Evaluate the value of creativity.

**CO6:** Formulate specific problem statements of real-time issues.

Course Outcomes(COs)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	2	1	-	-	1	1	1	1	1	-	2	1	L1, L2
CO2	2	1	1	-	1	1	1	1	2	1	2	1	L1, L2
CO3	2	2	2	1	2	2	1	2	2	2	2	2	L3
CO4	1	1	1	-	1	2	1	3	3	2	3	2	L4
CO5	1	1	1	1	2	2	2	2	2	2	3	2	L5
CO6	2	2	3	2	2	2	1	2	2	3	3	2	L3,L6

## SYLLABUS

### 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

**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.

**CO2,CO3 ,CO6**

### 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

**Activity:** Importance of modelling, how to set specifications, Explaining their own product design.

**CO3,CO4,CO6**

### 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.

**Activity:** How to market our own product, About maintenance, Reliability and plan for startup.

**CO3,CO4,CO5,CO6**

### 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

### Online Learning Resources:

<https://nptel.ac.in/courses/110/106/110106124/>

<https://nptel.ac.in/courses/109/104/109104109/>

**EMPLOYABILITY SKILLS I: COMPETITIVE CODING**  
**II B.TECH- I SEMESTER**

Course Title: <b>Employability Skills I COMPETITIVE CODING</b>	Course Code: R24EESC01
Teaching Scheme (L:T:P): 0:1:2	Credits: 2
Type of Course: Tutorial + Practical	
Continuous Internal Evaluation:	Semester End Exam:
Pre requisites: Basics of C programming , Data structures , SQL	

**Course Objective:**

1. Develop a clear understanding of C programming fundamentals and key coding concepts.
2. Gain hands-on experience with data structures, algorithms, and problem-solving techniques.
3. Achieve proficiency in SQL query writing for database interaction.
4. Prepare for online coding assessments, technical interviews, and placement processes at different MNCs.

**Course Outcomes:**

**CO1:** Demonstrate proficiency in C programming, including core concepts like functions, arrays, pointers, and control flow.

**CO2:** Apply data structures and algorithms effectively to solve complex programming problems.

**CO3:** Write and optimize SQL queries for database operations and management.

**CO4:** Gain confidence to perform well in online coding assessments and technical interviews, with practical preparation for placement processes at different MNCs.

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	-	-	-	-	-	-	-	-	-	-	L2
CO2	3	2		2	3	-	-	-	-	-	-	-	L3
CO3	2	-	-	-	3	-	-	-	-	-	-	-	L3
CO4	-	-	-	-	-	-	-	-	-	3	2	3	L5

**Part-A****Module 1: Programming Basics in C (10 Hours)**

## Topics Covered:

- Basics of C: Data types, variables, input/output, operators
- Control Flow: if-else, switch statements, nested conditions
- Loops: for, while, do-while
- Functions: Declaration, recursion, parameter passing
- Arrays & Strings: 1D and 2D arrays, string operations

- Pointers: Basics, arrays with pointers, dynamic memory allocation
- Practice Programs: Factorial, palindrome, Fibonacci, Armstrong, prime, pattern printing

### **Module 2: Data Structures & Algorithms (30 Hours)**

Subtopics:

- Arrays & Strings: Searching (Linear, Binary), Sorting (Bubble, Selection, Insertion), Anagram check, Substring search
- Linked Lists: Singly linked list operations, reversal, Floyd's cycle detection
- Stacks & Queues: Stack and Queue (array & linked list), Infix to Postfix, Evaluation
- Trees: Binary Tree, Binary Search Tree, Traversals, Mirror, Height, Leaf nodes
- Recursion & Backtracking: N-Queens, Subsets, Permutations
- Advanced Sorting: Merge Sort, Quick Sort, Binary Search Applications
- Hashing & Sets: Duplicate detection, frequency count
- Time & Space Complexity: Big O notation, complexity analysis

Practice Platforms: Hacker Rank, Leet Code, Code Studio

### **Module 3: SQL for Online Assessment & Interviews (10 Hours)**

Topics Covered:

- SQL Basics: Syntax, constraints, primary & foreign keys
- Data Operations: SELECT, INSERT, UPDATE, DELETE, WHERE
- Clauses: GROUP BY, HAVING, ORDER BY, LIMIT
- Aggregate Functions: COUNT, SUM, AVG, MIN, MAX
- Joins: INNER, LEFT, RIGHT, FULL OUTER JOIN
- Sub queries: Single row, multiple row, nested queries
- Hands-on Practice: Queries on student, employee, and product datasets
- Tools: SQLite, MySQL, Oracle Live SQL

### **Part-B**

List of Competitive Coding Experiments (Service-Based Companies Focus) (20 Hours)

#### **Basic Programming & Logic Building**

1. Factorial, Fibonacci, Palindrome, Armstrong, Prime Number Checker
2. Pattern Printing Programs (Pyramids, triangles, numbers, characters)
3. Swapping Numbers Without Temp Variable
4. GCD & LCM Calculation

#### **Array-Based Problems**

5. Find Largest, Smallest, Second Largest Element
6. Array Rotation (Left/Right)
7. Sub array with Given Sum
8. Duplicate Removal / Frequency Count
9. Prefix Sum / Running Sum Array

### **String Manipulation**

10. Palindrome Checker (String-Based)
11. Anagram Checker
12. Reverse Words in a String
13. Count Vowels, Consonants, Digits, Spaces
14. Character Frequency Map using Hashing

### **Searching & Sorting**

15. Binary Search Implementation
16. Bubble, Insertion, Selection Sort
17. Sort 0s, 1s, and 2s (Dutch National Flag Problem)
18. Merge Sort or Quick Sort (Optional)

### **Linked List (Basic Implementation)**

19. Insert, Delete, Reverse Linked List
20. Detect Loop using Floyd's Cycle Algorithm

### **Matrix Problems**

21. Spiral Traversal of a Matrix
22. Transpose of a Matrix
23. Search in a Row-wise Sorted Matrix

### **Recursion & Backtracking**

24. Tower of Hanoi
25. N-Queens Problem
26. Subset Sum Problem

### **Stacks and Queues**

27. Infix to Postfix Conversion
28. Postfix Evaluation
29. Queue Implementation using Arrays/Stacks

### **Hashing & Sets**

30. Find First Non-Repeating Character
31. Count Pairs with Given Sum
32. Intersection/Union of Two Arrays

### **SQL Integration (Optional for Project)**

33. Create a mini project that fetches or stores data using SQL (C + SQL Integration)

**Text Books:**

1. C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Edition: 2nd Edition  
Publisher: Prentice Hall, Year: 1988.
2. Data Structures and Algorithms Made Easy, Narasimha Karumanchi, Edition: 1st Edition  
Publisher: CareerMonk Publications, Year: 2011.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest,  
Clifford Stein  
Edition: 3rd Edition, Publisher: MIT Press, Year: 2009.
4. SQL For Smarties: Advanced SQL Programming, Joe Celko, Edition: 4th Edition  
Publisher: Morgan Kaufmann, Year: 2010.
5. Competitive Programming, Steven Halim, Felix Halim, Edition: 3rd Edition, Publisher:  
Springer, Year: 2013
6. Data Structures Using C, Reema Thareja, Edition: 2nd Edition, Publisher: Oxford University  
Press, Year: 2011.
7. Cracking the Coding Interview, Gayle Laakmann McDowell, Edition: 6th Edition  
Publisher: CareerCup, Year: 2015.

**E- resources:**

1. Geeks for Geeks Website: <https://www.geeksforgeeks.org>
2. Hacker Rank : Website: <https://www.hackerrank.com>
3. Code forces : Website: <https://codeforces.com>
4. Leet Code : Website: <https://leetcode.com>
5. Code Chef : Website: <https://www.codechef.com>
6. Interview Bit Website: <https://www.interviewbit.com>
7. Top Coder : Website: <https://www.topcoder.com>
8. Hacker Earth : Website: <https://www.interviewing.io>

**CONSTITUTION OF INDIA**  
**II B.TECH- I SEMESTER**

Course Title: <b>CONSTITUTION OF INDIA</b>	<b>Course Code: R24MC04</b>
<b>Teaching Scheme (L:T:P): 2:0:0</b>	<b>Credits: -</b>
<b>Type of Course: Lecture</b>	
<b>Continuous Internal Evaluation: 30 Marks</b>	<b>Semester End Exam: 70 Marks</b>
<b>Pre requisites:</b> The prerequisites for the Indian Constitution include a strong belief in democracy, the rule of law, and the importance of protecting fundamental rights.	

**Course Objectives:**

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative.

**Course Outcomes:**

After completion of the course, students will be able to:

CO1: Understand the fundamentals of the Indian Constitution

CO2: Explain the structure and functions of the Union Government

CO3: Analyze the roles of State Government and administration

CO4: Understand the framework and significance of local governance

CO5: Explain the role of Election Commission and welfare commissions

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	2	1	-	-	-	2	3	-	1	-	-	-	L2
CO2	2	2	-	-	-	3	3	1	2	-	-	-	L2
CO3	2	2	-	-	-	2	3	1	2	-	-	-	L4
CO4	2	2	-	-	-	3	3	2	2	-	-	-	L3
CO5	2	2	-	-	-	3	3	-	1	-	-	-	L2

**SYLLABUS**

**UNIT-I**

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy. **COS-CO1**

**UNIT-II**

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;  
**COS-CO2**

**UNIT-III**

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organization, Structure and Functions  
**COS-CO3**

**UNIT-IV**

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Pachayati Raj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy  
**COS-CO4**

**UNIT-V**

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission, Functions of Commissions for the welfare of SC/ST/OBC and women  
**COS-CO5**

**References:**

1. Durga Das Basu, Introduction to the Constitution of India, 12th edition Prentice – Hall of India Pvt. Ltd. New Delhi 2011.
2. Subash Kashyap, Indian Constitution, 2nd edition, National Book Trust, 2011.
3. J.A. Siwach, Dynamics of Indian Government & Politics, 2nd edition, Sterling Pub Private Ltd. 1990.
4. D.C. Gupta, Indian Government and Politics, 8th edition, Vikas Publishing House Pvt Ltd., 2015.
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication), 2015.
6. J.C. Johari, Indian Government and Politics Hans, 13th edition, Shoban Lal & Co.2012.
7. J. Raj Indian Government and Politics, 1st edition, SAGE Texts Publication, 2008.
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, 3rd edition, Lexis Nexis Publications, 2008.
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

**E-resources:**

1. [nptel.ac.in/courses/109104074/8](https://nptel.ac.in/courses/109104074/8)
2. [nptel.ac.in/courses/109104045/](https://nptel.ac.in/courses/109104045/)
3. [nptel.ac.in/courses/101104065/](https://nptel.ac.in/courses/101104065/)
4. [www.hss.iitb.ac.in/en/lecture-details](http://www.hss.iitb.ac.in/en/lecture-details)
5. [www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution](http://www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution)

**Universal Human Values-I Understanding Harmony and Ethical Human Conduct**  
**II B.TECH- II SEMESTER**

Course Title: Universal Human Values Understanding Harmony and Ethical Human Conduct	<b>Course Code: R24HS03</b>
<b>Teaching Scheme (L:T:P): 2:0:0</b>	<b>Credits: 2</b>
<b>Type of Course: Lecture</b>	
<b>Continuous Internal Evaluation: 30 Marks</b>	<b>Semester End Exam: 70 Marks</b>
<b>Pre requisites:</b> 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 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

CO1: Define terms like Natural Acceptance, Happiness, and Prosperity

CO2: Identify one's self, and one's surroundings (family, society, nature)

CO3: Apply what they have learnt to their own self in day-to-day settings

CO4: Relate human values with human relationships and society

CO5: Justify the need for universal human values and harmonious existence

CO6: Develop as socially and ecologically responsible engineers

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	1	1	-	-	-	2	3	2	2	1	2	-	L1
CO2	1	2	1	-	-	3	3	3	2	1	2	-	L2
CO3	1	2	1	1	1	3	3	3	2	2	3	1	L3
CO4	1	2	2	-	-	3	3	3	3	2	3	1	L4
CO5	2	2	2	1	1	3	3	2	2	2	3	1	L5
CO6	2	2	3	2	2	3	3	2	2	3	3	2	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, CO6

#### **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, CO6

#### **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. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, 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 – Pandit Sunderlal
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.

**Online 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%202023.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](https://onlinecourses.swayam2.ac.in/aic22_ge23/preview)

**ANALOG CIRCUITS**  
**II B.TECH- II SEMESTER**

Course Title: <b>ANALOG CIRCUITS</b>	Course Code: <b>R24EEES09</b>
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: Knowledge of electronic components and semiconductor devices, number systems, binary arithmetic, Boolean or switching algebra, and logic gates.	

**Course Objectives:**

- To acquire the basic knowledge on clippers, clampers & biasing circuits.
- To determine the h-parameters of a transistor circuit & understand the concepts of feedback amplifiers.
- To know the operation of oscillators and operational amplifier.
- To understand the applications of operational amplifier.
- To acquire the knowledge on IC 555 timer and their applications and know the operation of Analog to Digital Converters and Digital to Analog Converters.

**Course Outcomes:**

After completion of the course, students will be able to:

CO1: Analyze diode clipping and clamping circuits. Understand different types of biasing circuits of a transistor.

CO2: Use small signal modeling for transistor circuit analysis and illustrate the operation of feedback amplifiers.

CO3: Understand operation of oscillators, operational amplifiers.

CO4: Analyze the op-amp applications, comparators and wave form generators.

CO5: Use 555 timers in multi-vibrators, Schmitt Trigger and PLL applications and describe the operation of different ADC's and DAC's.

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	0	0	1	1	0	0	0	0	1	2	L2,L4
CO2	2	3	2	1	2	1	0	0	0	0	2	2	L2,L3
CO3	2	2	3	1	2	2	0	0	1	1	2	3	L2
CO4	1	1	2	3	3	2	0	0	1	1	3	3	L4
CO5	1	1	1	0	2	2	1	2	2	2	3	3	L2,L3

**SYLLABUS**

<b>Unit – 1:</b>	<b>12Hours</b>
<b>Diode clipping and clamping circuits:</b> Diode Clippers-Positive and Negative clippers, Diode Clampers - Positive and Negative Clampers. Transfer characteristics of clippers and clampers.	
<b>DC biasing of BJTs:</b> Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in $V_{BE}$ and $\beta$ for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.	
	<b>COs – CO1</b>
<b>Unit – II:</b>	<b>12Hours</b>
<b>Small Signals Modelling of BJT:</b> Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.	
<b>Feedback Amplifiers:</b> Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.	
	<b>COs – CO2</b>
<b>Unit – III:</b>	<b>12 Hours</b>
<b>Oscillator Circuits:</b> Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.	
<b>Operational Amplifiers:</b> Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.	
	<b>COs – CO3</b>
<b>Unit – IV:</b>	<b>12 Hours</b>
<b>OP-AMPS Applications:</b> Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.	
<b>Comparators and Waveform Generators:</b> Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.	
	<b>COs – CO4</b>
<b>Unit – V:</b>	<b>10 Hours</b>
<b>Timers and Phase Locked Loop:</b> Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).	
<b>Digital to Analog and Analog to Digital Converters:</b> Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.	
	<b>COs – CO5</b>

**Textbooks:**

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 4th Edition, 2015.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 5th Edition, 2018.

**Reference Books:**

1. Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021.
2. Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017.
3. Electronic Devices and Circuits – David Bell, Oxford Publications, 2010.
4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 9th Edition 2021.
5. Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Pearson,4th edition, 2021.
6. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria& Sons, 2ndEdition, 2010.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/122106025>.
2. <https://nptel.ac.in/courses/108102112>.

**POWER SYSTEMS-I**  
**II B.TECH- II SEMESTER**

Course Title: <b>Power Systems-I</b>	Course Code: <b>R24EEPC08</b>
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: Fundamentals of Basic Electrical Engineering, Electrical circuit analysis and electrical materials.	

**COURSE OBJECTIVES:**

- Understand conventional and non-conventional sources of electric power
- Analyze underground cables and economic aspects of power generation and tariff method.
- Calculate transmission line parameters.
- Analyze performance of transmission lines.
- Understand insulators, corona, and mechanical design of lines.

**Course Outcomes:**

After completion of the course, students will be able to:

CO1: Illustrate the various types of Power generation.

CO2: Explicit the grading techniques and analyse the different economic factors of power generation and tariff.

CO3: Calculate the different parameters of a transmission line

CO4: Categorize the transmission lines based on the wavelength and voltage

CO5: Analyse mechanical design calculations of transmission lines.

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	2	1	1	-	1	1	-	-	1	1	2	2	L2
CO2	2	2	2	1	1	1	-	-	1	2	2	2	L4
CO3	3	3	2	2	3	-	-	-	1	1	2	3	L3
CO4	2	2	2	1	2	1	-	-	1	1	2	2	L4
CO5	3	3	2	2	3	1	-	-	1	2	2	3	L4

**SYLLABUS****Unit I: Generation of Electric Power****12 Hours**

Conventional Sources: Hydro station, Thermal Power Plant, Nuclear Power Plant and Gas Turbine Plant – block diagram approach only, advantages and disadvantages. The need for shifting to Non-Conventional sources Non-Conventional Sources: Wind Energy and Solar Energy – block diagram

approach only, advantages and disadvantages.

## COs – CO1

### **Unit II: Underground Cables and Economic Aspects of Power Generation** **12 Hours**

**UG Cables:** Types of cables, construction of underground cables, stress in insulation of cable. Capacitance of single core cable, Grading of cables – capacitance grading and inter sheath grading. Load Curve, Load Duration and Integrated Load Duration Curves-Load Demand, Diversity, Capacity, Utilization and Plant Use Factors- Numerical Problems. Costs of Generation and their Division into Fixed, Semi-Fixed and Running Costs.

**Tariff Methods:** Desirable Characteristics of a Tariff Method- Flat Rate, Block-Rate, Two-Part, Three-Part, and Power Factor Tariff Methods. **COs – CO2**

### **Unit III: Transmission Line Parameters** **12 Hours**

Types of conductors -Description and effect on Resistance of Solid Conductors – Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Skin and Proximity effects, Numerical Problems. **COs – CO3**

### **Unit IV: Performance Of Transmission Lines:** **12 Hours**

Classification of Transmission Lines - Short, medium and long line and their model representations - Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical & Asymmetrical Networks, Numerical Problems. Mathematical Solutions to estimate regulation and efficiency of all types of lines - Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Ferranti effect, Numerical Problems. **COs – CO4**

### **UNIT V: Insulators, Corona and Mechanical Design Of Lines** **10 Hours**

Types of Insulators-String efficiency and Methods for improvement – Voltage Distribution, Calculation of string efficiency- Capacitance grading and Static shielding.

Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor - Stringing chart and sag template and its applications. **COs – CO5**

#### **Text Books:**

1. I.J. Nagarith & D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3<sup>rd</sup> Edition, 2019.
2. C.L.Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers, 6th Edition, 2018.
3. Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 3rd edition 2014.

**Reference Books:**

1. S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010
2. J.B.Gupta, Transmission and Distribution of Electrical Power, S.K.Kataria and sons, 10th Edition, 2012
3. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand, 4th Edition, 2005.
4. Handbook of Switchgear, BHEL, McGraw-Hill Education, 2007.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108102047>

**INDUCTION AND SYNCHRONOUS MACHINES**  
**II B.TECH- II SEMESTER**

Course Title: <b>Induction and Synchronous Machines</b>	Course Code: <b>R24EEPC09</b>
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: Principles of Electromechanical Energy Conversion, Electromagnetic fields and Transformers.	

**COURSE OBJECTIVES:**

Students will get exposure to understand the concepts of

- operation and performance of three phase induction motor
- performance of induction motor and their performance parameters.
- torque producing mechanism of single phase induction motor
- performance parameters of synchronous generators
- operation performance and starting methods of synchronous motors

**Course Outcomes:**

After completion of the course, students will be able to:

CO1: Explain the construction and operation of three-phase induction motor.

CO2: Analyse the performance of three-phase induction motor

CO3: Describe the working of single-phase induction motors.

CO4: Analyse the Performance of synchronous generator

CO5: Analyze the performance of synchronous motor

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	1	0	2	0	0	0	1	1	2	3	L2
CO2	3	3	2	1	3	0	0	0	1	2	2	3	L4
CO3	3	2	1	0	2	0	0	0	1	1	2	2	L2
CO4	3	3	2	1	3	0	0	0	1	2	2	3	L4
CO5	3	3	2	1	3	0	0	0	1	2	2	3	L4

**SYLLABUS****UNIT-I: Three Phase Induction Motor -I****12Hours**

Construction and principle of operation of three phase Induction motor; Power flow analysis; Torque equations; Torque - slip characteristics; No load and blocked rotor tests; equivalent circuit; performance calculation from circle diagram; Double cage rotor – Induction generator

**COs – CO1**

**UNIT-II: Three Phase Induction Motor -II****12Hours**

Need for starting — Types of starters — DOL starter; Rotor resistance starter and Autotransformer starter; Star/delta starters; Speed control — Voltage control, Frequency control; pole changing control- Rotor Resistance control; Cascaded connection-V/f control; Slip power recovery scheme; Cogging & Crawling -Braking of three phase induction motor

**COs – CO2****UNIT – III: Single Phase Motors****12 Hours**

Single phase induction motors – Double revolving field theory; Torque- Speed Characteristics and Equivalent circuit; No load and Blocked rotor test; Performance analysis; Methods of Self-starting – Shaded pole motor; Capacitor start-capacitor run motor; repulsion motor; AC series Motor. **COs – CO3**

**UNIT–IV: Synchronous Machines-I****12 Hours**

**Synchronous Generator:** Constructional Features of round rotor and salient pole machines and principal of operation: E.M.F Equation; Armature reaction - phasor diagram- load characteristics; Regulation by synchronous impedance method; M.M.F. method; Z.P.F. method; Synchronizing alternators with infinite bus bars; synchronizing power torque;

**COs – CO4****UNIT–V: Synchronous Machines-II****10 Hours**

**Parallel Operation Of Synchronous Machines:** – parallel operation and load sharing; Effect of change of excitation and mechanical power input; two reaction theory; slip test;

**Synchronous Motors:** Theory of operation – phasor diagram; Variation of current and power factor with excitation; synchronous condenser – Mathematical analysis for power developed; hunting and its suppression and Methods of starting

**COs – CO5****Text Books:**

1. Electrical Machinery, Dr. P.S. Bhimbra, Khanna Publishing, 2021, First Edition.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

**Reference Books:**

1. Electrical machines, D.P. Kothari and I.J. Nagrath, McGraw Hill Education, 2017, Fifth Edition.
2. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons, 2013.
3. Electric Machinery, A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, McGraw-Hill, 2020, Seventh edition.

**Online Learning Resources:**

1. [nptel.ac.in/courses/108/105/108105131](https://nptel.ac.in/courses/108/105/108105131)
2. <https://nptel.ac.in/courses/108106072>

**CONTROL SYSTEMS**  
**II B.TECH- II SEMESTER**

Course Title: <b>CONTROL SYSTEMS</b>	Course Code: <b>R24EEPC10</b>
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: Basic Engineering Mathematics	

**COURSE OBJECTIVES:**

1. To obtain the mathematical models of physical systems and derive transfer function.
2. To determine the time response of systems and analyse system stability.
3. To analyze system stability using frequency response methods.
4. To obtain the mathematical models of physical systems using state space approach and determine the response.

**COURSE OUTCOMES:**

After completion of the course, students will be able to:

CO1: Derive the transfer function of physical systems and determine overall transfer function using block diagram algebra and signal flow graphs

CO2: Obtain the time response of first and specifications of second order systems and determine error constants

CO3: Analyze the absolute and relative stability of LTI systems using Routh's stability criterion and root locus method. Introduction to lag, lead compensator

CO4: Analyze the stability of LTI systems using frequency response methods.

CO5: Apply state space analysis concepts to represent physical systems as state models, derive transfer function and determine the response. Understand the concepts of controllability and observability.

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	2	1	3	-	-	-	1	1	2	3	L4
CO2	3	3	2	1	3	-	-	-	1	1	2	3	L2,L3
CO3	3	3	2	2	3	-	-	-	1	1	2	3	L4
CO4	3	3	2	2	3	-	-	-	1	1	2	3	L4
CO5	3	2	2	2	3	-	-	-	1	1	2	3	L2,L3

**SYLLABUS****UNIT - I Mathematical Modelling of Control Systems:****14 Hours**

Classification of control systems - open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks- translational and rotational mechanical systems- block diagram reduction techniques -

representation by signal flow graph – reduction using Mason’s gain formula. AC Servo motor, DC servo motor. **COs – CO1**

### **Self-Learning Topics: Basics of Electrical Circuit**

**UNIT - II Time Response Analysis: 12 Hours**

Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) proportional integral derivative (PID) systems. **COs – CO2**

### **Self-Learning Topics Basic Differentiation and Integration**

**UNIT – III: Stability and Root Locus Technique: 12Hours**

The concept of stability – Routh’s stability criterion – limitations of Routh’s stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function. Introduction to Lag, lead, lag-lead compensators. **COs – CO3**

### **Self-Learning Topics: R,L,C Circuits**

**UNIT – IV: Frequency Response Analysis 12Hours**

Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram –Polar plots, Nyquist stability criterion- stability analysis using Bode plots (phase margin and gain margin). **COs – CO4**

### **Self-Learning Topics: Complex Numbers**

**UNIT – V: State Space Analysis of LTI Systems 12 Hours**

Concepts of state - state variables and state model - state space representation of transfer function: Diagonalization using linear transformation - solving the time invariant state equations State Transition Matrix and its properties- concepts of controllability and observability. **COs – CO5**

### **Self-Learning Topics: Matrices**

#### **Text Books:**

1. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India, 5th edition, 2015.
2. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 9th Edition,2014.

#### **Reference Books:**

1. Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4<sup>th</sup> Edition.
2. Control Systems Engineering by Norman S. Nise, Wiley Publications, 7th edition.
3. Control Systems by Manik Dhanesh N, Cengage publications.
4. Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition.
5. Control Systems Engineering by S.Palani, Tata Mc Graw Hill Publications.

**Online Learning Resources:**

1. <https://archive.nptel.ac.in/courses/107/106/107106081/>
2. <https://archive.nptel.ac.in/courses/108/106/108106098/>
3. <https://nptelvideos.com/video.php?id=1423&c=14>

**INDUCTION AND SYNCHRONOUS MACHINES LAB**  
**II B.TECH- II SEMESTER**

Course Title: <b>Induction and Synchronous Machines</b>	Course Code: <b>R24EEPC11</b>
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: Principles of Electromechanical Energy Conversion, Electromagnetic fields.	

**COURSE OBJECTIVES:**

The objectives of this course is

- To apply the concepts of speed control methods in 3-phase Induction Motor.
- To experimentally develop circle diagram and obtain equivalent circuit to analyse the performance of 3-phase induction motor
- To apply the concepts of power factor improvement on single phase Induction Motor
- To perform various testing methods on alternators for experimentally predetermine the regulation

**COURSE OUTCOMES:**

After completion of the course, students will be able to:

CO1: Analyse the speed control methods on 3-phase Induction Motor.

CO2: Evaluate the performance of 3-phase Induction Motor by obtaining the locus diagram and equivalent circuit of 3-phase Induction Motor.

CO3: Adapt the power factor improvement methods for single phase Induction Motor

CO4: Pre-determine the regulation of 3-phase alternator

CO5: Determine the synchronous machine reactance of 3-phase alternator

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	2	1	2	-	-	-	1	1	2	3	L4
CO2	3	3	2	2	3	-	-	-	1	1	2	3	L5
CO3	2	2	2	1	2	1	-	-	1	1	2	3	L3
CO4	3	3	2	2	3	-	-	-	1	1	2	3	L3,L4
CO5	3	2	2	2	3	-	-	-	1	1	2	3	L3

**List of Experiments**

**Any 10 experiments of the following are required to be conducted**

1. Brake test on three phase induction motor. **COs:CO1**
2. Circle diagram of three phase induction motor. **COs:CO2**

3. Speed control of three phase induction motor by V/f method. **COs:CO1**
4. Equivalent circuit of single-phase induction motor. **COs:CO3**
5. Power factor improvement of single-phase induction motor by using capacitors. **COs:CO3**
6. Load test on single phase induction motor. **COs:CO3**
7. Regulation of a three -phase alternator by synchronous impedance. **COs:CO4**
8. Regulation of a three -phase alternator by MMF method. **COs:CO4**
9. Regulation of three-phase alternator by Potier triangle method. **COs:CO4**
10. V and Inverted V curves of a three-phase synchronous motor. **COs:CO4**
11. Determination of  $X_d$ ,  $X_q$  & Regulation of a salient pole synchronous generator. **COs:CO5**
12. Determination of efficiency of three phase alternator by loading with three phase induction motor. **COs:CO5**
13. Parallel operation of three-phase alternator under no-load and load conditions. **COs:CO5**

**Online Learning Resources:**

1. <https://em-coep.vlabs.ac.in/List%20of%20experiments.html>

**CONTROL SYSTEMS LAB  
II B.TECH- II SEMESTER**

Course Title: <b>Control Systems Lab</b>	Course Code: <b>R24EEPC12</b>
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: Basic Engineering Mathematics and Fundamentals of MATLAB	

**COURSE OBJECTIVES:**

- To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, A.C. Servo motors and Synchro's.
- To understand time and frequency responses of control system with and without controllers and compensators.
- To know the different logic gates and Boolean expressions using PLC.

**COURSE OUTCOMES:**

After completion of the course, students will be able to:

CO1: Analyze the time response of system (first order and second order system).

CO2: Analyze PID controllers and compensators.

CO3: Determine the transfer function of D.C Motor

CO4: Judge the stability in time and frequency domain and Kalman's test for controllability and observability

CO5: Analyze the potentiometer and determine the state space analysis concepts to represent physical systems as state models in MATLAB.

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	2	2	2	-	-	-	1	1	2	3	L4
CO2	3	2	3	2	3	-	-	-	1	1	2	3	L4
CO3	3	2	2	1	2	-	-	-	1	1	2	3	L3
CO4	3	3	2	3	3	-	-	-	1	1	3	3	L5
CO5	3	3	3	2	3	-	-	-	1	1	3	3	L4

**List of Experiments**

**Any 10 of the following experiments are to be conducted:**

1. Analysis of First order system in time domain (For Step, Ramp Inputs) **COs:CO1**
2. Analysis of Second order system in time domain (For Step, Ramp Inputs) **COs:CO1**
3. Effect of P, PD, PI, PID Controller on a second order systems **COs:CO2**
4. Design of Lag Compensation - Magnitude and phase plot **COs:CO2**

- |   |                |
|---|----------------|
| 5. Design of Lead Compensation - Magnitude and phase plot                                   | <b>COs:CO2</b> |
| 6. Transfer function of DC Motor  | <b>COs:CO3</b> |
| 7. Stability analysis of Linear Time Invariant system using Root Locus Technique (MATLAB)   | <b>COs:CO4</b> |
| 8. Stability analysis of Linear Time Invariant system using Bode Plot Technique (MATLAB)    | <b>COs:CO4</b> |
| 9. Stability analysis of Linear Time Invariant system using Nyquist Plot Technique (MATLAB) | <b>COs:CO4</b> |
| 10. Kalman's test of Controllability and Observability using MATLAB.                        | <b>COs:CO4</b> |
| 11. Potentiometer as an error detector .  | <b>COs:CO5</b> |
| 12. State space model for classical transfer function using MATLAB.                         | <b>COs:CO5</b> |
| 13. Characteristics of AC servomotor.   | <b>COs:CO1</b> |
| 14. Characteristics of synchro transmitter and receivers.                                   | <b>COs:CO1</b> |

**QUANTITATIVE APTITUDE AND LOGICAL REASONING****II B.TECH- II SEMESTER**

Course Title: <b>Quantitative aptitude and logical reasoning</b>	Course Code: R24HS04
Teaching Scheme (L:T:P): 0:1:2	Credits:2
Type of Course: Employability skills	
Continuous Internal Evaluation:	Semester End Exam:
Pre requisites: Fundamentals of quantitative aptitude and logical reasoning	

**COURSE OBJECTIVES:**

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

**Course Outcomes:**

After completion of the course, students will be able to:

CO1: Mastery of Key Concepts – Understand number systems, percentages, time/work, profit/loss, and series completion.

CO2: Improved Problem-Solving Skills – Solve mathematical and logical problems with speed and accuracy.

CO3: Enhanced Analytical Thinking – Develop critical thinking for reasoning puzzles and real-life challenges.

CO4: Competitive Exam Preparedness – Be well-prepared for exams requiring aptitude and reasoning.

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	2	1	2	1	-	-	-	-	-	-	1	L2
CO2	3	3	2	3	1	-	-	-	-	-	-	1	L3
CO3	2	3	2	3	2	-	-	-	-	-	-	1	L4
CO4	3	2	1	2	2	-	-	-	-	-	1	2	L3

**SYLLABUS****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 3 years.

**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, Stoppage time per hour, time and distance between two moving bodies.

**Trains, Boats and Streams:** Train crossing man, same and opposite directions, Speed of boat 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, angle vs 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.

**Order and Ranking:** Find the ranking From Top/Bottom/Left/Right, Find the total number of persons/Objects.

**COs- CO3, CO4**

### Text Books:

1. R.S. Aggarwal "Quantitative Aptitude", Reviseded., S Chand publication, 2017
2. R.S. Aggarwal "Verbal-Nonverbal Reasoning", Reviseded., S Chand publication, 2017

### E- resources:

<https://www.indiabix.com/aptitude/questions-and-answers/>

[https://www.tutorialspoint.com/quantitative\\_apptitude/](https://www.tutorialspoint.com/quantitative_apptitude/)

<https://www.careerbless.com/aptitude/qa/home.php>

**PYTHON PROGRAMMING**  
**II B.TECH- II SEMESTER**

Course Title: <b>Python Programming (Skill Enhancement Course)</b>	Course Code: R24EESC02
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

CO1: Showcase adept command of Python syntax, utilizing variables, data types, control structures, functions, modules, and exception handling to engineer efficient code solutions.

CO2: Apply Python programming concepts to solve a variety of computational problems.

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.

CO4: Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas.

CO5: Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries.

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	3	3	3	3	3	-	-	-	-	-	2	1	L3
CO2	3	3	3	2	3	-	-	-	-	-	2	2	L3
CO3	3	3	3	3	3	-	-	-	-	-	2	1	L6
CO4	3	3	3	3	3	-	-	-	-	-	2	1	L3
CO5	3	3	3	3	3	-	-	-	-	-	2	2	L3

## SYLLABUS

### UNIT-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.

**Strings:** Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

**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

**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>

**ENVIRONMENTAL SCIENCE**  
**II B.TECH- II SEMESTER**

Course Title: <b>Environmental Science</b>	<b>Course Code: R24MC03</b>
<b>Teaching Scheme (L:T:P): 2:0:0</b>	<b>Credits: -</b>
<b>Type of Course:</b> Lecture	
<b>Continuous Internal Evaluation:</b> 30 Marks	<b>Semester End Exam:</b> 70 Marks
<b>Pre requisites:</b> 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

**CO1:** Understand the scope, importance, and multidisciplinary nature of environmental studies, and analyze the exploitation of natural resources

**CO2:** Describe the structure, function, and energy flow in ecosystems, and understand the importance of biodiversity and its conservation.

**CO3:** : Evaluate the causes, effects, and control measures of different types of environmental pollution, and understand the strategies for solid waste management.

**CO4:** Examine the concept of sustainable development, urban environmental issues, and the role of environmental ethics and legislation in protecting the environment.

**CO5:** Analyze the relationship between human population growth and environmental degradation, and evaluate the role of population management and health programs in sustainable development.

Course Outcomes(COS)	Mapping with POs and PSOs												DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	
CO1	2	3	1	2	2	1	-	-	-	-	2	2	L2,L4
CO2	3	2	2	3	2	1	-	-	-	-	3	1	L2,L3
CO3	3	3	2	3	3	2	-	-	-	-	2	1	L4,L5
CO4	3	2	3	3	3	2	-	-	-	-	3	2	L4,L5
CO5	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-spots 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 Bharuch for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Namibia, “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.

**POWER ELECTRONICS**  
**III B.TECH- I SEMESTER**

Course Title: POWER ELECTRONICS	Course Code: R24EEPC13
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: Electrical Circuit Analysis, Semiconductor Physics, Control Systems	

**COURSE OBJECTIVES:**

- To know the characteristics of various power semiconductor devices.
- To learn the operation of single-phase controlled converters and perform harmonic analysis of input current.
- To learn the operation of three phase-controlled converters and AC/AC converters.
- To learn the operation of different types of DC-DC converters and control techniques.
- To learn the operation of PWM inverters for voltage control and harmonic mitigation.

**COURSE OUTCOMES:**

After completion of the course, students will be able to

CO1. Illustrate the static and dynamic characteristics of SCR, Power-MOSFET and Power-IGBT.

CO2. Analyse the operation of phase-controlled rectifiers.

CO3. Analyse the operation of three-phase full-wave converters, AC Voltage Controllers and Cycloconverters.

CO4. Examine the operation and design of different types of DC-DC converters.

CO5. Analyse the operation of Square wave inverters and PWM inverters for voltage control.

Course Outcomes(COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	-	2	-	-	-	-	-	1	3	2	L2
CO2	3	3	1	2	2	-	-	-	-	-	1	3	2	L4
CO3	3	3	2	2	2	-	-	-	-	-	1	3	3	L4
CO4	3	3	3	2	3	1	-	-	-	-	2	3	3	L4
CO5	3	3	2	2	3	1	-	-	-	-	2	3	3	L4

## SYLLABUS

### UNIT – I : Power Semi-Conductor Devices

Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics – Turnon and Turn off Methods - Triggering Methods (R, RC and UJT) – Snubber circuit design. Static and Dynamic Characteristics of Power MOSFET and Power IGBT-Numerical problems. **COs-CO1**

### UNIT – II : Single-phase AC-DC Converters

Single-phase half-wave controlled rectifiers - R and RL loads with and without freewheeling diode - Single-phase fully controlled mid-point and bridge converter with R load, RL load and RLE load - Continuous and Discontinuous conduction - Effect of source inductance in Single-phase fully controlled bridge rectifier – Expression for output voltages – Single-phase Semi-Converter with R load-RL load and RLE load – Continuous and Discontinuous conduction - Dual converter and its mode of operation - Numerical Problems. **COs-CO2**

### UNIT – III : Three-phase AC-DC Converters & AC – AC Converters

Three-phase half-wave Rectifier with R and RL load - Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage - Numerical Problems. Single-phase AC-AC power control by phase control with R and RL loads - Expression for rms output voltage – Single-phase step down and step up Cycloconverter - Numerical Problems.

**COs-CO3**

### UNIT – IV: DC–DC Converters

Operation of Basic Chopper – Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple – control techniques – Introduction to PWM control -Numerical Problems. **COs-CO4**

### UNIT – V: DC–AC Converters

Introduction - Single-phase half-bridge and full-bridge inverters with R and RL loads – Phase Displacement Control – PWM with bipolar voltage switching, PWM with unipolar voltage switching - Three-phase square wave inverters - 120° conduction and 180° conduction modes of operation - Sinusoidal Pulse Width Modulation - Current Source Inverter (CSI) - Numerical Problems. **COs-CO5**

### Textbooks:

1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore M Undeland, William P Robbins, John Wiley & Sons, 2002.
2. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2<sup>nd</sup> edition, 2017.

3. Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited, India, 2009.

**Reference Books:**

1. Elements of Power Electronics–Philip T.Krein. Oxford University Press; Second edition, 2014.
2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.
4. Power Electronics: by Daniel W.Hart, Mc Graw Hill, 2011

**Online Learning Resources:**

1. <https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007>
2. <https://archive.nptel.ac.in/courses/108/101/108101126>

**DIGITAL CIRCUITS**  
**III B.TECH- I SEMESTER**

Course Title: <b>Digital Circuits</b>	Course Code: R24EEPC14
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: Knowledge of electronic components and semiconductor devices, number systems, binary arithmetic, Boolean or switching algebra and logic gates	

**COURSE OBJECTIVES:**

- To know the simplification methods of Boolean functions
- To understand the realization of arithmetic, data routing and memory logic circuits.
- To know the operation and design of various counters and registers.
- To understand the analysis and design of synchronous sequential circuits.
- To understand the basic concepts of digital integrated circuits.

**COURSE OUTCOMES:**

At the end of the course, the student will be able to,

CO1: Use the concepts of Boolean algebra, K-map, tabulation method in minimization of switching functions and able to design the arithmetic combinational circuits.

CO2: Realize different types of data routing combinational circuits and PLDs.

CO3: Apply knowledge of flip-flops in designing of registers and counters.

CO4: Analyze synchronous sequential circuits and apply different methods for the design of synchronous sequential circuits.

CO5: Understand the logic families in the form of digital integrated circuits.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	3	1	2	-	-	-	-	-	1	3	2	L3
CO2	3	2	3	1	3	-	-	-	-	-	1	3	3	L3
CO3	3	3	3	2	3	-	-	-	-	-	1	3	3	L3
CO4	3	3	3	3	3	-	-	-	-	-	2	3	3	L4
CO5	2	1	1	-	2	-	-	-	-	-	1	2	2	L2

**SYLLABUS****UNIT – I: Combinational logic circuits – I**

Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, simplification of logic functions using Boolean theorems, NAND and NOR implementations, Karnaugh maps – 3 and 4 variables, Incompletely specified functions (Don't care terms), Simplifying

Max term equations, Quine-McCluskey minimization technique, General approach to combinational logic design, Look ahead carry adder, Cascading full adders, 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder, Binary comparators.

### **UNIT – II: Combinational logic circuits – II**

Decoders, BCD decoders, 7 segment decoder, higher order decoder, multiplexer, higher order multiplexing, de-multiplexers, higher order de-multiplexing, realization of Boolean functions using decoders, multiplexers, encoders, priority encoder, Read only and Read/Write Memories, Programmable ROM, PAL, PLA-Basics structures, programming tables of PROM, PAL, PLA, realization of Boolean functions.

### **Unit – III: Sequential logic circuits**

Timing considerations of flip-flops, master-slave flip-flop, edge triggered flip-flops, characteristic equations, flip-flops with reset and clear terminals, excitation tables, conversion from one flip-flop to another flip-flop, design of asynchronous and synchronous counters, design of modulus-N counters, Johnson counter, ring counter, design of registers - buffer register, control buffer register, shift register, bi- directional shift register, universal shift register.

### **UNIT – IV: Sequential Circuit Design**

Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, Analysis of clocked sequential circuits, realization of sequence detector circuit, state reduction and assignments, design procedure.

### **UNIT – V : Digital integrated circuits**

Logic levels, propagation delay time, power dissipation, fan-out and fan-in, noise margin, logic families – RTL and DTL Circuits, TTL, Emitter-Coupled Logic, Metal-Oxide Semiconductor, Complementary MOS, CMOS Transmission Gate Circuits (Elementary approach only).

#### **Textbooks:**

1. Switching and finite automata theory Zvi. Kohavi, 3<sup>rd</sup> edition, Cambridge University Press, 2010.
2. M. Morris Mano and M. D. Ciletti, “Digital Design”, 4th Edition, Pearson Education, 2006.

#### **Reference Books:**

1. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers, 5<sup>th</sup> Edition, 1992.
2. Switching Theory and Logic Design by A. Anand Kumar, Prentice Hall India Pvt., Limited, Third Edition, 2016.

#### **Online Learning Resources:**

1. <https://nptel.ac.in/courses/117106086>.
2. <https://nptel.ac.in/courses/108105113>.

## Power Systems Analysis

### III B.TECH- I SEMESTER

<b>Course Title: Power Systems Analysis</b>	Course Code: R24EEPC15
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: Concepts of electrical circuits and power systems-I	

#### COURSE OBJECTIVES:

- To develop the impedance diagram (p.u) and formation of  $Y_{bus}$
- To learn the different load flow methods.
- To learn the  $Z_{bus}$  building algorithm.
- To learn short circuit calculation for symmetrical faults
- To learn the effect of unsymmetrical faults and their effects.
- To learn the stability of power systems and methods to improve stability.

#### COURSE OUTCOMES:

After the completion of the course the student should be able to:

CO1: Draw impedance diagram for a power system network and calculate per unit quantities.

CO2: Apply the load flow solution to a power system using different methods.

CO3: Form  $Z_{bus}$  for a power system network and analyse the effect of symmetrical faults.

CO4: Find the sequence components for power system Components and analyse its effects of unsymmetrical faults.

CO5: Analyse the stability concepts of a power system.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	1	2	-	-	-	-	-	1	3	2	L3
CO2	3	3	2	2	3	-	-	-	-	-	1	3	2	L3
CO3	3	3	2	3	3	-	-	-	-	-	2	3	2	L4
CO4	3	3	2	3	3	1	-	-	-	-	2	3	3	L4
CO5	3	3	2	2	2	1	-	-	-	-	2	3	2	L4

## SYLLABUS

### UNIT – I: Circuit Topology

Graph theory definitions – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of  $Y_{bus}$  matrix by singular transformation and direct inspection methods.

Per Unit Representation

Per Unit Quantities–Single line diagram – Impedance diagram of a power system – Numerical Problems.

### UNIT – II: Power Flow Studies

Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) – Decoupled and Fast Decoupled methods – Algorithmic approach – Numerical Problems on 3–bus system only.

### UNIT – III:

#### Z-Bus Algorithm

Formation of  $Z_{bus}$ : Algorithm for the Modification of  $Z_{bus}$  Matrix (without mutual impedance) – Numerical Problems.

#### Symmetrical Fault Analysis

Reactance's of Synchronous Machine – Three Phase Short Circuit Currents - Short circuit MVA calculations for Power Systems – Numerical Problems.

### UNIT - IV

#### Symmetrical Components

Definition of symmetrical components – symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances and Sequence networks of Synchronous generator, Transformers and Transmission line- Numerical Problems.

#### Unsymmetrical Fault analysis

Various types of faults: LG– LL– LLG and LLL on unloaded alternator-Numerical problems.

### UNIT - V

#### Power System Stability Analysis

Elementary concepts of Steady state – Dynamic and Transient Stabilities – Swing equation – Steady state stability – Equal area criterion of stability – Applications of Equal area criterion – Factors affecting transient stability – Methods to improve steady state and transient stability – Numerical problems.

**Text Books:**

1. Power System Analysis by Grainger and Stevenson - Tata McGraw Hill.2003
2. Modern Power system Analysis – by I.J.Nagrath & D .P.Kothari:
3. TataMcGraw–Hill Publishing Company - 3<sup>rd</sup> edition - 2007.

**Reference Books:**

1. Power System Analysis – by A.R.Bergen - Prentice Hall - 2<sup>nd</sup> edition - 2009.
2. Power System Analysis by HadiSaadat – Tata McGraw–Hill 3<sup>rd</sup> edition - 2010.
3. Power System Analysis by B.R.Gupta - A H Wheeler Publishing Company Limited - 1998.
4. Power System Analysis and Design by J.Duncan Glover - M.S.Sarma - T.J.Overbye – Cengage Learning publications - 5<sup>th</sup> edition - 2011.

**Online Learning Resources:**

1. <https://archive.nptel.ac.in/courses/117/105/117105140>
2. <https://archive.nptel.ac.in/courses/108/105/108105104>

**Professional Elective-I**  
**Utilization of Electrical Energy**  
**III B.TECH- I SEMESTER**

Course Title: <b>Utilization of Electrical Energy</b>	Course Code: R24EEPE01.1
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: basic knowledge of Electrical Circuits, Electrical Machines, Power Systems, and Basic Electronics.	

**Course Objectives:**

- To study the basic principles of illumination and its measurements and to design the different types lighting systems.
- To acquaint with the different types of heating and welding techniques.
- To understand the operating principles and characteristics of various motors with respect to speed, temperature and loading conditions.
- To understand the basic principles of electric traction including speed–time curves of different traction services and calculation of braking, acceleration and other related parameters.
- To introduce the concepts of various types of energy storage systems.

**Course Outcomes:**

After the completion of the course the student should be able to:

CO1: Identify various illumination methods produced by different illuminating sources.

CO2: Identify a suitable motor for electric drives and industrial applications

CO3: Identify most appropriate heating and welding techniques for suitable applications.

CO4: Distinguish various traction system and determine the tractive effort and specific energy consumption.

CO5: Validate the necessity and usage of different energy storage schemes for different applications and comparisons.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	2	2	1	-	1	2	-	-	-	-	1	2	2	L2
CO2	3	2	2	-	2	2	-	-	-	-	1	3	3	L3
CO3	3	2	2	-	2	2	-	-	-	-	1	3	3	L3
CO4	3	3	2	2	2	2	-	-	-	-	2	3	3	L4
CO5	2	2	2	-	2	3	-	-	-	-	2	3	3	L4

## SYLLABUS

### UNIT – I

#### **Illumination fundamentals**

Introduction - terms used in illumination–Laws of illumination–Polar curves–Integrating sphere–Lux meter–Sources of light.

#### **Various Illumination Methods**

Discharge lamps - MV and SV lamps – Comparison between tungsten filament lamps and fluorescent tubes– Basic principles of light control– Types and design of lighting and flood lighting–LED lighting - Energy conservation.

### UNIT – II

#### **Selection of Motors**

Choice of Motor - Type of Electric Drives - Starting And Running Characteristics – Speed Control– Temperature Rise – Applications of Electric Drives–Types of Industrial Loads–Continuous–Intermittent And Variable Loads–Load Equalization - Introduction To Energy Efficient Motors.

### UNIT – III

#### **Electric Heating**

Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating.

#### **Electric Welding**

Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding.

### UNIT – IV

#### **Electric Traction**

System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves. Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation– Adhesive weight and braking retardation adhesive weight and coefficient of adhesion-Numerical problems.

### UNIT – V

#### **Introduction to Energy Storage Systems**

Need For Energy Storage - Types of Energy Storage-Thermal - Electrical - Magnetic And Chemical Storage Systems - Comparison of Energy Storage Technologies-Applications.

#### **Text Books:**

1. Utilization of Electric Energy – by E. Openshaw Taylor - Orient Longman.
2. Art & Science of Utilization of electrical Energy – by Partab - Dhanpat Rai& Sons.
3. “Thermal energy storage systems and applications”-by Ibrahim Dincer and Mark A.Rosen. John Wiley and Sons 2002.

**Reference Books:**

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana - New Age International (P) Limited - Publishers - 1996.
2. Generation - Distribution and Utilization of electrical Energy – by C.L. Wadhwa - New Age International (P) Limited - Publishers - 1997.

**Professional Elective-I**  
**SIGNALS AND SYSTEMS**  
**III B.TECH- I SEMESTER**

Course Title: <b>Signals And Systems</b>	Course Code: R24EEPE01.2
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: Basics of Engineering Mathematics: calculus, differential equations, and complex numbers. Fundamentals of Electrical/Electronic Circuits and signal concepts.	

**COURSE OBJECTIVES:**

- This gives the basics of signals and systems required for all electrical engineering related courses.
- To understand the behavior of signal in time and frequency domain.
- To understand the characteristics of Linear Time Invariant (LTI) systems.
- Concepts of the correlation and sampling process.
- This give concepts of signals and Systems along with its analysis using different transform techniques.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Apply the knowledge of various signals and operations.

CO2: Analyze the spectral characteristics of periodic signals using Fourier Analysis.

CO3: Classify the systems based on their properties and determine the response of LSI system using convolution.

CO4: Understand the process of sampling and the effects of under sampling.

CO5: Apply Laplace and z-transforms to analyze signals and Systems (continuous & discrete).

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	-	2	-	-	-	-	-	1	2	2	L3
CO2	3	3	2	2	3	-	-	-	-	-	1	2	2	L4
CO3	3	3	3	2	3	-	-	-	-	-	1	2	2	L4
CO4	3	2	1	1	2	-	-	-	-	-	1	2	2	L2
CO5	3	3	2	2	3	-	-	-	-	-	2	2	2	L3

## **SYLLABUS**

### **UNIT – I: Introduction**

Definition of Signals and Systems - Classification of Signals - Classification of Systems - Operations on signals: time-shifting - time-scaling - amplitude-shifting - amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals – Singularity functions and related functions: impulse function - step function signum function and ramp function. Analogy between vectors and signals - orthogonal signal space - Signal approximation using orthogonal functions - Mean square error - closed or complete set of orthogonal functions - Orthogonally in complex functions. Related Problems.

### **UNIT – II: Fourier Series and Fourier Transform**

Introduction to Fourier series and Fourier Transform, representation of continuous time periodic signals properties of Fourier series - Dirichlet's conditions - Trigonometric Fourier series and Exponential Fourier series - Relation between Trigonometric and Exponential Fourier series - Complex Fourier spectrum. Deriving Fourier transform from Fourier series - Fourier transform of arbitrary signal - Fourier transform of standard signals - Fourier transform of periodic signals - properties of Fourier transforms - Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform. Related Problems.

### **UNIT – III : Analysis of Linear Systems**

Introduction - Linear system - impulse response - Response of a linear system - Linear time invariant (LTI) system - Linear time variant (LTV) system - Concept of convolution in time domain and frequency domain - Graphical representation of convolution - Transfer function of a LTI system - Related problems. Filter characteristics of linear systems. Distortion less transmission through a system - Signal bandwidth - system bandwidth - Ideal LPF - HPF and BPF characteristics – Causality and Poly Wiener criterion for physical realization - relationship between bandwidth and rise time.

### **UNIT – IV: Correlation**

Auto-correlation and cross-correlation of functions - properties of correlation function - Energy density spectrum - Parseval's theorem - Power density spectrum - Relation between Convolution and correlation - Detection of periodic signals in the presence of noise by correlation - Extraction of signal from noise by filtering.

### **Sampling Theorem**

Graphical and analytical proof for Band Limited Signals - impulse sampling - Natural and Flat top Sampling - Reconstruction of signal from its samples - effect of under sampling – Aliasing - Introduction to Band Pass sampling - Related problems.

## **UNIT - V**

### **Laplace Transforms**

Introduction - Concept of region of convergence (ROC) for Laplace transforms - constraints on ROC for various classes of signals - Properties of L.T's - Inverse Laplace transform - Relation between L.T's - and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.

### **Z-Transforms**

Concept of Z - Transform of a discrete sequence. Region of convergence in Z-Transform - constraints on ROC for various classes of signals - Inverse Z-transform - properties of Z-transforms. Distinction between Laplace - Fourier and Z transforms.

### **Text Books:**

1. Signals - Systems & Communications - B.P. Lathi - BS Publications - 2003.
2. Signals and Systems - A.V. Oppenheim - A.S. Willsky and S.H. Nawab - PHI - 2nd Edition 1997
3. Signals & Systems - Simon Haykin and Van Veen - Wiley - 2nd Edition - 2007

### **Reference Books:**

1. Principles of Linear Systems and Signals – BP Lathi - Oxford University Press - 2015
2. Signals and Systems – T K Rawat - Oxford University press - 2011.

**Professional Elective-I**  
**Soft Computing Techniques & Its application in Electrical Engineering**  
**III B.TECH- I SEMESTER**

Course Title: <b>Soft Computing Techniques &amp; Its application in Electrical Engineering</b>	Course Code: R24EEPE01.3
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: Basic knowledge of mathematics and electrical engineering.	

**COURSE OBJECTIVES:**

- To understand soft computing techniques.
- To learn Artificial Neural Networks.
- To study Fuzzy Logic systems.
- To know Genetic Algorithms.
- To apply soft computing in electrical engineering.

**COURSE OUTCOMES:**

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

- CO1: Understand soft computing concepts.  
 CO2: Apply Artificial Neural Networks.  
 CO3: Use Fuzzy Logic systems.  
 CO4: Apply Genetic Algorithms for optimization.  
 CO5: Solve electrical engineering problems using soft computing.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	-	2	-	-	-	-	-	1	2	2	L2
CO2	3	3	3	2	3	-	-	-	-	-	1	2	3	L3
CO3	3	3	3	2	3	-	-	-	-	-	1	2	3	L3
CO4	3	3	3	2	3	-	-	-	-	-	1	2	3	L3
CO5	3	3	3	2	3	1	-	-	-	-	2	3	3	L3

**SYLLABUS****UNIT – I : Introduction to Soft Computing**

Introduction to Artificial Intelligence, hard computing and soft computing, features of soft computing, applications of soft computing, basics of machine learning.

**Applications:** Smart grids, load forecasting, renewable energy systems.

## **UNIT – II: Artificial Neural Networks (ANN)**

Biological neuron and artificial neuron, neuron model, activation functions, learning rules, perceptron network, multilayer perceptron, back propagation algorithm.

**Applications:** Load prediction, fault detection, motor control.

## **UNIT – III: Fuzzy Logic Systems**

Fuzzy sets, membership functions, fuzzy operations, fuzzification, defuzzification, fuzzy inference systems, fuzzy controller design.

**Applications:** Motor speed control, voltage control, industrial automation.

## **UNIT – IV: Genetic Algorithms (GA)**

Basics of genetic algorithms, chromosome representation, selection, crossover, mutation, fitness function, optimization using GA.

**Applications:** Economic load dispatch, optimal power flow, controller tuning.

## **UNIT – V: Advanced Soft Computing Techniques**

Particle Swarm Optimization (PSO), expert systems, neuro-fuzzy systems, hybrid soft computing techniques.

**Applications:** Smart grid management, renewable energy optimization, power quality improvement.

### **Text Books**

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley.

### **Reference Books**

1. Simon Haykin, Neural Networks, Pearson Education.
2. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing, Wiley India.

### **Online Learning Resources**

1. NPTEL – Soft Computing
2. NPTEL – Neural Networks

**Professional Elective-I**  
**Communication systems**  
**III B.TECH- I SEMESTER**

Course Title: <b>Communication systems</b>	Course Code: R24EEPE01.4
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: Basics of electronic circuits and communication systems. Knowledge of mathematics and signals.	

**COURSE OBJECTIVES:**

- To provide a comprehensive understanding of the principles of analog and digital communication systems.
- To analyze the performance of modulation and demodulation techniques.
- To understand the impact of noise on communication systems and study signal-to-noise ratio (SNR).
- To explore the fundamentals of information theory and source/channel coding.
- To examine various multiplexing and multiple access techniques used in modern communication systems.

**COURSE OUTCOMES:**

After successful completion of this course, students will be able to:

CO1: Explain the fundamental concepts of communication systems and modulation techniques.

CO2: Analyze and compare analog and digital modulation schemes based on performance metrics.

CO3: Understand and apply noise analysis to communication systems.

CO4: Interpret key concepts of information theory, source and channel coding.

CO5: Demonstrate understanding of multiplexing and multiple access schemes in modern communication networks.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	1	2	-	-	-	2	-	1	2	2	L2
CO2	3	3	2	2	3	-	-	-	2	-	1	3	3	L4
CO3	3	3	2	2	3	-	-	-	2	-	1	3	2	L3
CO4	3	3	2	1	2	-	-	-	2	-	1	2	2	L2
CO5	3	2	2	1	2	-	-	-	3	-	1	2	3	L3

## SYLLABUS

### Unit I: Introduction to Communication Systems

Elements of communication systems, Types of communication: Analog and digital, Electromagnetic spectrum, signal types (deterministic, random, periodic, aperiodic), Time domain and frequency domain analysis, Amplitude Modulation (AM): Generation, demodulation, spectrum, power relations

### Unit II: Angle Modulation

Frequency Modulation (FM) and Phase Modulation (PM): Principles and mathematical representation, Generation and demodulation of FM signals, Bandwidth of FM signals (Carson's Rule), Comparison between AM and FM, Noise in AM and FM systems

### Unit III: Pulse and Digital Modulation

Sampling theorem, aliasing, Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Pulse Code Modulation (PCM) and Delta Modulation (DM), Digital modulation schemes: ASK, FSK, PSK, QPSK, Comparison of digital modulation techniques

### Unit IV: Noise and Information Theory

Noise: Internal and external noise, signal-to-noise ratio (SNR), noise figure, Information theory basics: Entropy, mutual information, Source coding: Huffman coding, Channel capacity and Shannon's theorem, Error control coding: Parity checks, CRC, Hamming codes

### Unit V: Multiplexing and Multiple Access

Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM), Code Division Multiple Access (CDMA), Orthogonal Frequency Division Multiplexing (OFDM), Spread spectrum techniques, Communication system examples: Radio, television, cellular systems, satellite communications

### Textbooks:

1. Simon Haykin, *Communication Systems*, Wiley.
2. B.P. Lathi, *Modern Digital and Analog Communication Systems*, Oxford University Press.

### Reference Books:

1. Taub and Schilling, *Principles of Communication Systems*, McGraw-Hill.
2. John G. Proakis and Masoud Salehi, *Fundamentals of Communication Systems*, Pearson.
3. Roddy and Coolen, *Electronic Communications*, Pearson Education.
4. Kennedy and Davis, *Electronic Communication Systems*, McGraw-Hill.

## POWER ELECTRONICS LAB

## III B.TECH- I SEMESTER

Course Title: Power Electronics Lab	Course Code: R24EEPC16
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: Basic knowledge of electrical circuits, semiconductor devices, and power electronics fundamentals	

**COURSE OBJECTIVES:**

- To understand the characteristics and control of power electronic devices and converters.
- To analyze the operation of AC voltage regulators, DC-DC converters, and bridge converters with different loads.
- To study the working principles of single-phase and three-phase inverters

**COURSE OUTCOMES:**

CO1: Analyze the operation and characteristics of power electronic converters and switching devices.

CO2: Examine the performance of AC-DC, AC-AC, DC-DC converters, and inverter circuits with different loads.

CO3: Differentiate the control techniques and applications of converters and inverters in power electronic systems.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	2	3	-	-	-	-	-	1	3	3	L4
CO2	3	3	3	3	3	-	-	-	-	-	2	3	3	L4
CO3	3	3	3	2	2	-	-	-	-	-	1	3	3	L4

**Any 10 of the Following Experiments are to be conducted**

1. Characteristics of SCR - Power MOSFET & Power IGBT.
2. R, RC & UJT firing circuits for SCR.
3. Single -Phase semi-converter with R & RL loads.
4. Single -Phase full-converter with R & RL loads.
5. Three- Phase full-converter with R & RL loads.
6. Single-phase dual converter in circulating current & non circulating current mode of operation for R & RL Loads.
7. Single-Phase AC Voltage Regulator with R & RL Loads.
8. Single-phase step down Cycloconverter with R & RL Loads.
9. Boost converter in Continuous Conduction Mode operation.

10. Buck converter in Continuous Conduction Mode operation.
11. Single -Phase half bridge inverter with R & RL Loads.
12. Single -Phase full bridge inverter with R & RL Loads.
13. Single - Phase Half Bridge PWM inverter.
14. Single - Phase Full Bridge PWM inverter.
15. Three-phase bridge inverter with 120° and / or 180° conduction mode

**Analog and Digital Circuits Lab****III B.TECH- I SEMESTER**

Course Title: <b>Analog and Digital Circuits Lab</b>	Course Code: R24EEPC17
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: Basic knowledge of electronic devices, analog and digital circuits, logic gates, and IC fundamentals.	

**Course Objectives:**

To impart knowledge on

- Analysis of transistor amplifiers
- Analysis of feedback amplifiers and oscillators
- Realization of digital circuits such data routing, registers and counters.

**Course Outcomes:**

At the end of the course, the student will be able to,

CO1: Analyze the operation of analog electronic circuits including clippers, clampers, biasing, amplifiers, and oscillators.

CO2: Examine the applications of linear ICs and timing circuits in electronic systems.

CO3: Demonstrate the design and operation of digital circuits such as adders, multiplexers, registers, and counters.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	3	2	3	-	-	-	-	-	1	3	3	L4
CO2	3	3	3	2	3	-	-	-	-	-	1	3	3	L4
CO3	3	3	3	2	3	-	-	-	-	-	1	3	3	L3

**Any 5 of the Following Experiments are to be conducted from each PART.**

**PART-A**

1. Analysis of clipper and clamper circuits.
2. Analysis of self-bias to a transistor.
3. Analysis of voltage series and current series feedback amplifiers.
4. Analysis of Wien Bridge oscillator and RC-phase shift oscillator.
5. Analysis of Integrator and Differentiator Circuits using IC 741.
6. Analysis of Monostable and Astable multivibrator operation using IC 555 Timer.
7. Analysis of Schmitt Trigger Circuits using IC 741 and IC 555.
8. Verify the PLL characteristics using IC 565.
9. Analysis of 8 bit A to D and D to A circuits

**PART-B**

1. Design of Full adder and Full Subtractor using logic gates.
2. Realization of parallel adder/subtractor using IC 7483.
3. Implementation of 3 to 8 line decoder using logic gates and IC 7445.
4. Implementation of 8 to 1 multiplexer using logic gates and IC 74151.
5. Verify the operation of master-slave JK flip-flop using IC7476.
6. Realization of the following shift registers using IC7495.
  - a) SISO
  - b) SIPO
  - c) PISO
  - d) PIPO
7. Implementation of Mod-10 ripple counter using flip-flops and IC 7490.
8. Implementation of Mod-8 synchronous up/down counters using flip-flops.
9. Implementation of 4 bit Ring Counter and Johnson Counter using D flip-flops/J-K flip-flops.

**Tinkering Lab**  
**III B.TECH- I SEMESTER**

Course Title: <b>Tinkering Lab</b>	Course Code: R24EESC03
Teaching Scheme (L:T:P): 0:0:2	Credits: 2
Type of Course: Practical	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: Basic knowledge of electronics, electrical circuits, and computer fundamentals.	

**COURSE OBJECTIVES:**

- To develop innovation, creativity, and problem-solving skills through hands-on activities.
- To introduce prototyping tools, components, and modern technologies for interdisciplinary project development.
- To encourage experimentation and transform ideas into working prototypes.

**Course Outcomes**

**At the end of the course, students will be able to:**

CO1: Identify and use electronic components, sensors, actuators, and prototyping tools.

CO2: Design and implement simple embedded systems and interdisciplinary prototypes.

CO3: Demonstrate teamwork and effectively communicate design and implementation ideas.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	2	2	3	-	-	-	1	-	1	3	3	L3
CO2	3	3	3	3	3	1	-	2	2	-	2	3	3	L5
CO3	-	1	1	-	1	-	-	3	3	1	1	2	2	L3

**List of Experiments**

1. Familiarization with lab tools – Breadboard, multimeter, soldering station, power supply.
2. Basic electronic circuits – Series, parallel circuits, use of resistors, capacitors, LEDs.
3. Introduction to Arduino – Writing and uploading simple sketches.
4. Sensor interfacing – Temperature, light, motion, ultrasonic sensors.
5. Actuator control – Servo motor, DC motor, relay modules.
6. Serial communication – Between Arduino and PC.
7. Simple IOT application – Sending data to cloud (e.g., using ThingSpeak or Blynk).
8. Mobile App Integration – Basic app to control devices using Bluetooth.
9. Mechanical prototyping – Introduction to 3D printing and simple CAD modeling.

### **Textbooks**

1. "Getting Started with Arduino" – Massimo Banzi and Michael Shiloh.
2. "Make: Electronics – Learning Through Discovery" – Charles Platt.
3. "Exploring Arduino" – Jeremy Blum.

### **Reference Books:**

1. "Practical Electronics for Inventors" – Paul Scherz and Simon Monk.
2. "Arduino Cookbook" – Michael Margolis and Brian Jepson.
3. "Make: Sensors" – Tero Karvinen, Kimmo Karvinen, and Ville Valtokari.
4. "Python Programming for Raspberry Pi" – Tim Cox (if Raspberry Pi is included).

**E resources:** Arduino ([www.arduino.cc](http://www.arduino.cc)), Raspberry Pi ([www.raspberrypi.org](http://www.raspberrypi.org)), Instructables ([www.instructables.com](http://www.instructables.com)), and Tinkercad.

**Employability Skills III**  
**Soft Skills and Verbal Ability**  
**III B.TECH- I SEMESTER**

Course Title: Soft Skills And Verbal Ability	Course Code: R24HS07
Teaching Scheme (L:T:P): 0:0:2	Credits: 1
Type of Course: 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:**

- Enhance proficiency in English grammar, vocabulary, and reasoning skills for recruitment exams.
- Develop effective communication skills for group discussions, resume building, and interviews.
- Equip students with techniques for reading comprehension, logical reasoning, and professional presentation.
- 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

CO1: Demonstrate strong command over English grammar, vocabulary, and reasoning skills

CO2: Effectively communicate in group discussions, create impactful resumes, and excel in interviews

CO3: Develop critical thinking and problem-solving abilities for recruitment exams

CO4: Be well prepared for career placements with enhanced professional communication and soft skills

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	2	2	1	-	1	-	-	-	3	-	2	1	1	L3
CO2	1	2	1	-	1	1	-	3	3	2	2	1	1	L3
CO3	3	3	2	2	2	-	-	1	2	1	2	1	1	L4
CO4	2	2	2	1	1	2	-	3	3	2	2	1	1	L4

**SYLLABUS****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/>.

**Technical Paper Writing & IPR**  
**III B.TECH- I SEMESTER**

Course Title: <b>Technical Paper Writing &amp; IPR</b>	<b>Course Code:</b> R24MC06
<b>Teaching Scheme (L:T:P):</b> 2:0:0	<b>Credits:</b> -
<b>Type of Course:</b> Lecture	
<b>Continuous Internal Evaluation:</b> 30 Marks	<b>Semester End Exam:</b> 70 Marks
<b>Pre requisites:</b>	

**Course Objectives**

- To develop an understanding of the structure, style, and ethics of technical and scientific writing.
- To train students in effective academic communication, including research paper, thesis, and project report writing.
- To create awareness about various forms of intellectual property and the process of securing IP rights.
- To provide foundational knowledge on patents, copyrights, trademarks, and design rights.
- To sensitize students about innovation, commercialization, and legal aspects of research.

**Course Outcomes**

**Upon successful completion of the course, students will be able to:**

CO1: Write effective technical papers and reports that conform to academic and professional standards.

CO2: Present technical information clearly and ethically in various formats (papers, posters, presentations).

CO3: Understand the process of peer review and publishing in journals/conferences.

CO4: Identify and explain different types of intellectual property and how they are protected.

CO5: Apply knowledge of IPR to protect and commercialize their innovations responsibly

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	2	2	2	1	2	-	-	-	3	2	1	1	1	L3
CO2	1	2	1	-	2	1	2	3	3	2	1	1	1	L3
CO3	1	2	1	-	1	-	2	2	2	1	1	1	1	L2
CO4	2	2	1	-	1	2	3	1	1	1	1	1	1	L2
CO5	2	3	2	1	2	3	3	2	2	2	1	1	1	L3

**SYLLABUS****Unit I: Fundamentals of Technical Writing**

Basics of technical communication, Types of technical documents: research papers, project reports, theses, Structure and components of a technical paper (Abstract, Introduction, Methods, Results, Discussion), Clarity, precision, and language usage in scientific writing, Ethics in writing: plagiarism, data falsification, multiple submissions

**Unit II: Writing for Publication**

Selection of journal/conference, understanding journal impact factor, indexing, and scope, Manuscript preparation and formatting guidelines, Submission process and peer review system, Responding to reviewers and revisions

**Unit III: Presentation and Dissemination**

Preparing abstracts, posters, and oral presentations, Tools for formatting and referencing (LaTeX, MS Word, EndNote, Mendeley, Zotero), Best practices for graphical and tabular data representation, Collaboration and authorship ethics, Copyright and open-access publishing

**Unit IV: Introduction to IPR**

Definition and need for Intellectual Property, Categories: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, Basic principles of patentability: novelty, non-obviousness, utility, National and international IPR organizations (WIPO, IPO, USPTO, EPO), IPR protection mechanisms in India

**Unit V: Patent Filing and Innovation Management**

Patent filing process in India and abroad, Patent search using free databases (Google Patents, Espacenet, WIPO), Patent drafting basics: claims, specifications, drawings, Technology transfer and commercialization of IP, Role of incubation centers and start-up policy

**Textbooks**

1. M. Ashok Kumar & R. Murugesan, *Research Methodology and IPR*, Charulatha Publications.
2. R. N. Khandare, *Research Methodology & IPR*, S. Chand Publishing.
3. Michael Alley, *The Craft of Scientific Writing*, Springer.

**Reference Books**

1. B.L. Wadehra, *Law Relating to Intellectual Property*, Universal Law Publishing Co.
2. Deborah E. Bouchoux, *Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets*, Cengage Learning.
3. Day & Gastel, *How to Write and Publish a Scientific Paper*, Cambridge University Press.
4. Robin Jeffery & Michael Wilkinson, *Publishing Research Successfully*, SAGE.
5. Government of India: *IPR Policy Documents and Patent Office Guidelines* (available on <https://ipindia.gov.in>)

**Electrical Measurements and Instrumentation**  
**III B.TECH- II SEMESTER**

Course Title: <b>Electrical Measurements and Instrumentation</b>	Course Code: R24EEPC18
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: Basics of Electrical and Electronics Engineering	

**COURSE OBJECTIVES:**

- To understand and analyze the factors that effect the various measuring units.
- To choose the appropriate meters for measuring of voltage, current, power, power factor and energy qualities and understand the concept of standardization.
- Describe the operating principle of AC & DC bridges for measurement of resistance, inductance and capacitance.
- To understand the concept of the transducer and their effectiveness in converting from one form to the other form for the ease of calculating and measuring purposes.
- To understand the operating principles of basic building blocks of digital systems, record and display units.

**Course Outcomes:**

After the completion of the course the student should be able to:

CO1: Know the construction and working of various types of analog instruments.

CO2: Describe the construction and working of wattmeter and power factor meters

CO3: Know the construction and working various bridges for the measurement resistance inductance and capacitance

CO4: Know the operational concepts of various transducers

CO5: Know the construction and operation digital meters

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	-	-	-	-	-	1	3	2	L2
CO2	3	2	1	2	2	-	-	-	-	-	1	3	2	L2
CO3	3	3	2	3	3	-	-	-	-	-	1	3	2	L2
CO4	3	2	1	2	2	-	-	-	-	-	1	3	2	L2
CO5	3	2	1	2	2	-	-	-	-	-	1	3	2	L2

## SYLLABUS

### UNIT - I : Analog Ammeter and Voltmeters

Classification – deflecting, control and damping torques – PMMC, moving iron type and electrostatic instruments – Construction – Torque equation – Range extension – Errors and compensations – advantages and disadvantages. Instrument transformers: Current Transformer and Potential Transformer – theory – Ratio and phase angle errors–Numerical Problems.

### UNIT – II: Analog Wattmeters and Power Factor Meters

Electrodynamometer type wattmeter (LPF and UPF) – Power factor meters: Dynamometer and M.I type (Single phase and Three phase) – Construction – torque equation – advantages and disadvantages. Potentiometers: Principle and operation of D.C Crompton’s potentiometer – Standardization – Applications – AC Potentiometer (Polar and coordinate types) –Standardization – Applications – Numerical Problems.

### UNIT - III : Measurements of Electrical parameters

**DC Bridges:** Method of measuring low, medium and high resistance –Wheat stone’s bridge for measuring medium resistance – Kelvin’s double bridge for measuring low resistance – Loss of charge method for measurement of high resistance – Megger – measurement of earth resistance – Numerical Problems.

**AC Bridges:** Measurement of inductance and quality factor – Maxwell’s bridge – Hay’s bridge – Anderson’s bridge. Measurement of capacitance and loss angle – Desauty’s bridge – Schering Bridge – Wien’s bridge –Numerical Problems.

### UNIT - IV :Transducers

Definition – Classification – Resistive, Inductive and Capacitive Transducer – LVDT – Strain Gauge – Thermistors – Thermocouples – Piezo electric and Photo Diode Transducers – Hall effect sensors – Numerical Problems.

### UNIT - V : Digital meters

Digital Voltmeters – Successive approximation DVM – Ramp type DVM and Integrating type DVM – Digital frequency meter – Digital multimeter – Digital tachometer – Digital Energy Meter – Q meter. CRO – measurement of phase difference and Frequency using lissajious patterns – Numerical Problems.

#### Text Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5<sup>th</sup> Edition - Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5<sup>th</sup> Edition - 2002.

**Reference Books:**

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications - 19<sup>th</sup> revised edition - 2011.
2. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3<sup>rd</sup> edition.
3. Electrical Measurements by Buckingham and Price - Prentice – Hall
4. Electrical Measurements by Forest K. Harris. John Wiley and Sons

**Online Learning Resources:**

- <https://archive.nptel.ac.in/courses/108/105/108105153>

**Microprocessors and Microcontrollers**  
**III B.TECH- II SEMESTER**

Course Title: <b>Microprocessors And Microcontrollers</b>	Course Code: R24EEPC19
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: Basic knowledge of digital electronics, computer organization, and programming fundamentals.	

**COURSE OBJECTIVES:**

- To impart knowledge of the architecture and functioning of 8086 microprocessor and 8051 microcontrollers.
- To familiarize students with assembly language programming concepts and their practical implementation.
- To understand memory interfacing and peripheral device interfacing with 8086 and 8051.
- To develop the ability to interface microcontrollers with external hardware components and sensors.
- To provide hands-on experience for designing embedded systems using 8051.

**COURSE OUTCOMES**

After completion of the course, the student will be able to

CO1: Understand the internal architecture and operations of 8086 microprocessor and write assembly language programs.

CO2: Analyze and design memory and peripheral interfacing techniques for microprocessors and microcontrollers.

CO3: Develop embedded applications using 8051 microcontroller and its instruction set.

CO4: Interface 8051 with external peripherals such as LCDs, motors, keypads, ADCs/DACs, and sensors.

CO5: Design simple embedded systems integrating sensors and actuators using the 8051 microcontrollers.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	3	2	3	-	-	-	-	-	1	3	3	L3
CO2	3	3	3	3	3	-	-	-	-	-	2	3	3	L4
CO3	3	2	3	3	3	-	-	-	-	-	1	3	3	L3
CO4	3	3	3	3	3	-	-	-	-	-	2	3	3	L4
CO5	3	3	3	3	3	1	-	-	-	-	2	3	3	L5

## SYLLABUS

### **Unit I :8086 Microprocessors and Assembly Language Programming**

Introduction to microcomputer, evolution of processors and semiconductor memories (RAM, ROM, EPROM, EEPROM), Architecture of 8086 microprocessor, register organization of 8086, Pipelining concept, Memory segmentation, Addressing Modes.

Instruction Set and Programming: Instruction set of 8086 microprocessors: Data transfer instructions, Arithmetic instructions, Logical Instructions, String instructions, Stack related instructions, Branching instructions, Assembler directives. Data transfer instructions of 8085 microprocessor,

### **Unit II :8086 Operational Modes and Memory Interfacing**

Minimum and Maximum mode operations of 8086 with timing diagrams, Procedures and macros, Stack Structure of 8086, Static RAM Interfacing, Interfacing of 8255 Programmable Peripheral Interface with 8086 microprocessors. Dynamic RAM, Direct memory access

### **Unit III :8051 Microcontroller**

Comparison between microprocessor and microcontroller, 8051 family microcontroller, RAM architecture of 8051, Integrated Development Environment (IDE), Pin description of 8051 microcontroller, Machine cycle. Addressing Modes, Instruction set of 8051: Data transfer instructions, Arithmetic instructions, Logical Instructions, Stack related instructions, Branching instructions. Programming and Applications of Timers, Interrupts, Universal Asynchronous Receiver Transmitter (UART). External memory interfacing with 8051 microcontroller, various constituents of hex file

### **Unit IV : Interfacing 8051 with Peripherals**

Interfacing 8051 with: Matrix Keypad, LCD, Seven-segment displays, L293D Motor Driver, Stepper motor, Analog-to-Digital Converter (ADC 0804) and Digital-to-Analog Converter (DAC 0808)

### **Unit V: Sensor and Relay Interfacing with 8051**

Interfacing of temperature sensor LM35 with 8051, Relay interfacing with 8051, Case studies and practical applications using 8051

#### **Text Books:**

1. Ray and Burchandi - “Advanced Microprocessors and Interfacing” - Tata McGraw–Hill - 3rd edition - 2006.
2. Kenneth J Ayala - “The 8051 Microcontroller Architecture - Programming and Applications” - Thomson Publishers - 2nd Edition.
3. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18 - -Muhammad Ali Mazidi – Rolind D.Mckinay - Danny causey -Pearson Publisher 21st Impression.

**Reference Books:**

1. Microprocessors and Interfacing - Douglas V Hall - Mc-Graw Hill - 2nd Edition.
2. R.S. Kaler - "A Text book of Microprocessors and Micro Controllers" - I.K. International Publishing House Pvt. Ltd.
3. Ajay V. Deshmukh - "Microcontrollers – Theory and Applications" - Tata McGraw-Hill Companies –2005.
4. Ajit Pal - "Microcontrollers – Principles and Applications" - PHI Learning Pvt Ltd - 2011.

**Professional Elective-II  
Switchgear and Protection  
III B.TECH- II SEMESTER**

Course Title: <b>Switchgear and Protection</b>	Course Code: R24EEPE02.1
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: Basic concepts of Electrical Machines and Power Systems.	

**COURSE OBJECTIVES:**

- To explain the working principles and applications of circuit breakers in power systems, including MCBs, oil, SF6, and vacuum breakers.
- To provide an understanding of electromagnetic protection mechanisms, particularly relays used in fault detection and system protection (overcurrent, under-voltage, directional, differential).
- To analyze protection techniques for generators and transformers, including fault protection schemes like percentage differential protection and Buchholz relays.
- To explore feeder and busbar protection methods using advanced relay systems such as distance and static relays.
- To study over-voltage protection systems including lightning arresters and neutral grounding methods to safeguard the power system.

**COURSE OUTCOMES:**

At the end of the course, student will be able to

CO1: Understand and describe the operation of circuit breakers, including their ratings, principles of arc interruption, and types.

CO2: Analyze relay-based protection systems, identifying and explaining their roles in overcurrent, undervoltage, and fault detection.

CO3: Design protection schemes for generators and transformers, addressing faults like restricted earth faults and inter-turn faults.

CO4: Implement feeder and busbar protection using advanced relays such as distance, impedance, and static relays.

CO5: Evaluate over-voltage protection strategies, including the use of lightning arresters, and understand various neutral grounding techniques.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	-	-	-	-	-	1	3	2	L2
CO2	3	3	2	3	3	-	-	-	-	-	1	3	2	L4
CO3	3	3	3	3	3	2	-	-	-	-	2	3	3	L5
CO4	3	3	3	3	3	2	-	-	-	-	2	3	3	L5
CO5	3	3	2	3	2	3	-	-	-	-	1	3	2	L4

## SYLLABUS

### UNIT – I

#### Circuit Breakers

Miniature Circuit Breaker (MCB)– Elementary principles of arc interruption– Restriking Voltage and Recovery voltages– Restriking phenomenon - RRRV– Average and Max. RRRV– Current chopping and Resistance switching– Concept of oil circuit breakers– Description and operation of Air Blast– Vacuum and SF6 circuit breakers– Circuit Breaker ratings and specifications– Concept of Auto reclosing.

### UNIT – II

#### Electromagnetic Protection

Relay connection – Balanced beam type attracted armature relay - induction disc and induction cup relays–Torque equation - Relays classification–Instantaneous– DMT and IDMT types– Applications of relays: Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays– Universal torque equation– Distance relays: Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.

### UNIT – III

#### Generator Protection

Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples.

#### Transformer Protection

Percentage differential protection– Design of CT's ratio– Buchholz relay protection–Numerical examples.

### UNIT – IV

#### Feeder and Bus bar Protection & Static Relays:

Over current Protection schemes – PSM - TMS – Numerical examples – Carrier current and three zone distance relay using impedance relays. Protection of bus bars by using Differential protection. Static relays: Introduction – Classification of Static Relays – Basic Components of Static Relays.

## **UNIT – V**

### **Protection against over voltage and grounding**

Generation of over voltages in power systems– Protection against lightning over voltages– Valve type and zinc oxide lightning arresters. Grounded and ungrounded neutral systems – Effects of ungrounded neutral on system performance – Methods of neutral grounding: Solid–resistance–Reactance–Arcing grounds and grounding Practices.

#### **Text Books:**

1. Power System Protection and Switchgear by Badri Ram and D.N Viswakarma - Tata McGraw Hill Publications - 2<sup>nd</sup> edition - 2011.
2. Power system protection- Static Relays with microprocessor applications by T.S.Madhava Rao - Tata McGraw Hill - 2<sup>nd</sup> edition.

#### **Reference Books:**

1. Fundamentals of Power System Protection by Paithankar and S.R.Bhide. - PHI - 2003.
2. Art & Science of Protective Relaying – by C R Mason - Wiley Eastern Ltd.

#### **Online Learning Resources:**

1. <https://archive.nptel.ac.in/courses/108/107/108107167>
2. <https://archive.nptel.ac.in/courses/108/105/108105167>

**Professional Elective-II**  
**Advanced Control Systems**  
**III B.TECH- II SEMESTER**

Course Title: <b>Advanced Control Systems</b>	Course Code: R24EEPE02.2
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: Basic concepts of Control Systems.	

**Course Objectives:**

- To understand the concept of controllability, observability, and their tests for continuous-time systems, as well as the principle of duality in state-space analysis.
- To understand the state-space methods to assess controllability, observability, and design state feedback controllers via pole placement.
- To know the stability of nonlinear systems using phase-plane analysis, describing functions, and Lyapunov's stability theorems.
- To Learn optimal control strategies using the calculus of variations, including constrained minimization and the minimum principle.
- To learn Optimal control and state regulator problems.

**Course Outcomes:**

At the end of the course, student will be able to

CO1: Explain controllability, observability, and the principle of duality in state-space systems.

CO2: Apply state-space methods to analyze controllability, observability, and design state feedback controllers.

CO3: Analyze the stability of nonlinear systems using phase-plane analysis and Lyapunov's stability theorems.

CO4: Examine the minimization of functional and control variable inequality constraints.

CO5: Formulate and solve the optimal regulator problems.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	2	2	-	-	-	-	-	1	2	2	L2
CO2	3	3	3	3	3	-	-	-	2	-	2	3	3	L3
CO3	3	3	3	3	3	-	-	-	-	-	2	3	2	L4
CO4	3	3	3	2	2	-	-	-	-	-	2	2	2	L4
CO5	3	3	3	3	2	-	-	-	-	-	3	2	2	L5

## SYLLABUS

### UNIT – I: Controllability - Observability and Design of Pole Placement

General concepts of controllability and observability -Tests for controllability and observability for continuous time systems - Principle of duality - Effect of state feedback on controllability and observability - Design of state feedback control through pole placement, full order and reduced order observers.

### UNIT – II : Nonlinear Systems

Introduction to nonlinear systems - Types of nonlinearities. Introduction to phase plane analysis, construction of phase trajectories-Analytical and Isocline method, Describing function - Describing functions of on-off nonlinearity, on-off nonlinearity with hysteresis, and relay with dead zone.

### UNIT – III : Stability analysis by Lyapunov Method

Stability in the sense of Lyapunov – Lyapunov’s stability and Lyapunov’s instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.

### UNIT – IV : Calculus of Variations

Minimization of functionals - functionals of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints.

### UNIT –V : Optimal Control

Necessary conditions for optimal control, Formulation of the optimal control problem, minimum time problem, minimum energy problem, minimum fuel problem, state regulator problem, output regulator problem.

#### Text Books:

1. Modern Control Engineering – by K. Ogata - Prentice Hall of India - 3rd edition - 1998.
2. Automatic Control Systems by B.C. Kuo - Prentice Hall Publication.

#### Reference Books:

1. Modern Control System Theory – by M. Gopal - New Age International Publishers - 2nd edition – 1996.
2. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.
3. Control Systems Engineering by I.J. Nagarith and M.Gopal - New Age International (P) Ltd.

#### Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/108/103/108103007>
2. <https://archive.nptel.ac.in/courses/108/107/108107115>

**Professional Elective-II**  
**Machine Learning and Deep learning application**  
**III B.TECH- II SEMESTER**

Course Title: Machine Learning and Deep learning application	Course Code: R24EEPE02.3
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 : Basic knowledge of mathematics, programming, and computer fundamentals.	

**COURSE OBJECTIVES:**

- To understand Machine Learning basics.
- To learn Deep Learning concepts.
- To study learning algorithms.
- To understand neural networks.
- To apply Machine Learning and Deep Learning in real applications.

**COURSE OUTCOMES:**

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

CO1: Understand Machine Learning concepts.

CO2: Apply Machine Learning algorithms.

CO3: Understand Deep Learning models.

CO4: Use neural networks for prediction and classification.

CO5: Apply Machine Learning and Deep Learning in engineering applications.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	2	2	-	-	-	2	-	1	3	3	L2
CO2	3	3	3	3	3	-	-	-	2	-	1	3	3	L3
CO3	3	3	2	2	2	-	-	-	2	-	1	3	3	L2
CO4	3	3	3	3	3	-	-	-	3	-	1	3	3	L3
CO5	3	3	3	3	3	2	-	-	3	2	1	3	3	L3

**SYLLABUS****UNIT – I: Introduction to Machine Learning**

Introduction to Artificial Intelligence, basics of Machine Learning, types of Machine Learning, supervised learning, unsupervised learning, data preprocessing.

**Applications:** Prediction systems, recommendation systems.

**UNIT – II: Machine Learning Algorithms**

Linear regression, logistic regression, decision trees, support vector machines, k-nearest neighbor

algorithm, classification and regression.

**Applications:** Spam detection, disease prediction.

### **UNIT – III: Unsupervised Learning**

Clustering, k-means clustering, dimensionality reduction, principal component analysis (PCA), association rules.

**Applications:** Customer analysis, data grouping.

### **UNIT – IV: Deep Learning Fundamentals**

Artificial Neural Networks, neuron model, activation functions, multilayer perceptron, back propagation algorithm, convolutional neural networks (CNN), recurrent neural networks (RNN).

**Applications:** Image recognition, speech recognition.

### **UNIT – V: Applications of Machine Learning and Deep Learning**

Applications in healthcare, robotics, smart grids, automation, cybersecurity, renewable energy systems, fault diagnosis, and pattern recognition.

**Applications:** Face recognition, smart assistants, predictive maintenance.

#### **Text Books:**

1. Tom M. Mitchell, *Machine Learning*, McGraw Hill.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, MIT Press.

#### **Reference Books:**

1. Simon Haykin, *Neural Networks and Learning Machines*, Pearson.
2. Aurélien Géron, *Hands-On Machine Learning*, O'Reilly.

#### **Online Learning Resources:**

1. NPTEL – Machine Learning
2. NPTEL – Deep Learning

**Professional Elective-II  
Power Systems Deregulation  
III B.TECH- II SEMESTER**

Course Title: <b>Power Systems Deregulation</b>	Course Code: R24EEPE02.4
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 : Basic knowledge of power systems, electrical machines, power system operation, economics, and optimization techniques is required.	

**COURSE OBJECTIVES:**

- To provide in-depth knowledge of operation of deregulated electricity market systems.
- To calculate Available Transfer Capability (ATC) using different mechanisms
- To examine typical issues in electricity markets and how these are handled world –wide in various markets.
- To learn importance effects and classification of congestion management methods.
- To know the information about various ancillary services and markets in national international scenario

**Course Outcomes:**

After the completion of the course the student should be able to:

CO1: Know the essential and operation of deregulated electricity market systems.

CO2: Learn about the different structure model.

CO3: Analyze various types of electricity market operational and control issues using new mathematical models.

CO4: Analyse LMP's wheeling transactions and congestion management.

CO5: Analyze impact of ancillary services.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	2	-	-	-	-	1	3	2	L2
CO2	3	2	1	1	1	2	-	-	-	-	1	2	2	L2
CO3	3	3	3	3	3	2	-	-	2	2	2	3	3	L4
CO4	3	3	3	3	3	3	-	-	2	2	2	3	3	L4
CO5	3	3	2	2	2	3	-	-	2	2	2	3	3	L4

**SYLLABUS****UNIT – I**

Need and conditions for deregulation. Introduction of Market structure - Market Architecture - Spot market - forward markets and settlements. Review of Concepts marginal cost of generation - least-cost operation - incremental cost of generation. Power System Operation - Power Exchange.

### **UNIT – II**

Electricity sector structures and Ownership /management - the forms of Ownership and management. Different structure model like Monopoly model - Purchasing agency model - wholesale competition model - Retail competition model - Definition of Available Transfer Capability (ATC) - computation of ATC.

### **UNIT – III**

Framework and methods for the analysis of Bilateral and pool markets - LMP based markets. Auction models and price formation - price based unit commitment - country practices.

### **UNIT – IV**

Transmission network and market power. Power wheeling transactions and marginal costing - transmission costing. Congestion management methods- market splitting - counter-trading; Effect of congestion on LMPs- country practices.

### **UNIT – V**

Ancillary Services and System Security in Deregulation. Classifications and definitions - AS management in various markets- country practices. Technical - economic - & regulatory issues involved in the deregulation of the power industry.

### **Text Books:**

1. Power System Economics: Designing markets for electricity - Steven Stoft - wiley publishers - 2002.
2. Operation of restructured power systems - K. Bhattacharya - M.H.J. Bollen and J.E. Daalder – Springer - 2012.

### **Reference Books:**

1. Power generation - operation and control - -J. Wood and B. F. Wollenberg - Wiley – 1998.
2. Market operations in electric power systems - M. Shahidehpour - H. Yaminand Z. Li – Wiley -2003.
3. Fundamentals of power system economics - S. Kirschen and G. Strbac - Wiley - 2nd edition - 2018.
4. Optimization principles: Practical Applications to the Operation and Markets of the Electric Power Industry - N. S. Rau - IEEE Press series on Power Engineering.
5. “Competition and Choice in Electricity” by Sally Hunt and Graham Shuttleworth - Wiley publishers - 1997.

**Professional Elective-II**  
**Industrial Automation and Control**  
**III B.TECH- II SEMESTER**

Course Title: <b>Industrial Automation and Control</b>	Course Code: R24EEPE02.5
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 : Basic knowledge of power systems, electrical machines, power system operation, economics, and optimization techniques is required.	

**COURSE OBJECTIVES:**

- To understand industrial automation systems.
- To learn different industrial control methods.
- To study sensors, actuators, and controllers.
- To understand PLC and SCADA systems.
- To apply automation techniques in industries.

**COURSE OUTCOMES:**

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

CO1: Understand industrial automation concepts.

CO2: Apply industrial control methods.

CO3: Understand sensors and actuators used in industries.

CO4: Use PLC and SCADA systems for automation.

CO5: Apply automation techniques in industrial applications.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	1	2	2	-	-	-	-	1	3	3	L2
CO2	3	3	3	2	3	2	-	-	-	-	1	3	3	L3
CO3	3	2	1	2	2	2	-	-	-	-	1	3	3	L2
CO4	3	3	3	3	3	2	-	-	-	-	1	3	3	L3
CO5	3	3	3	3	3	3	-	-	-	-	2	3	3	L3

**SYLLABUS****UNIT – I: Introduction to Industrial Automation**

Introduction to automation, advantages of automation, industrial control systems, types of automation, elements of automation systems, industrial processes.

**Applications:** Manufacturing industries, process industries, power plants.

### **UNIT – II: Sensors and Actuators**

Types of sensors, temperature sensors, pressure sensors, proximity sensors, flow sensors, actuators, electric actuators, hydraulic actuators, pneumatic actuators.

**Applications:** Industrial monitoring, process control.

### **UNIT – III: Programmable Logic Controllers (PLC)**

Introduction to PLC, PLC architecture, input and output modules, PLC programming basics, ladder diagrams, timers, counters, industrial applications of PLC.

**Applications:** Motor control, conveyor systems, traffic control

### **UNIT – IV: SCADA and Industrial Communication**

Introduction to SCADA, SCADA architecture, communication systems, HMI, industrial networks, basics of industrial communication protocols.

**Applications:** Power system monitoring, industrial supervision.

### **UNIT – V: Industrial Control and Automation Applications**

Control systems in industries, automation in manufacturing, robotics in industries, process automation, smart industries, safety systems, energy management systems.

**Applications:** Smart factories, robotics, industrial monitoring systems.

#### **Text Books:**

1. Krishna Kant, *Computer Based Industrial Control*, PHI.
2. Frank D. Petruzella, *Programmable Logic Controllers*, McGraw Hill.

#### **Reference Books:**

1. Curtis Johnson, *Process Control Instrumentation Technology*, Pearson.
2. S. K. Singh, *Industrial Instrumentation and Control*, McGraw Hill.

#### **Online Learning Resources:**

1. NPTEL – Industrial Automation and Control
2. NPTEL – PLC and SCADA

**Professional Elective-III**  
**Electric Drives**  
**III B.TECH- II SEMESTER**

Course Title: Electric Drives	Course Code: R24EEPE03.1
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: Electrical Circuit Analysis, Power electronics, Electrical Machines and Control Systems.	

**COURSE OBJECTIVES:**

- To learn the fundamentals of electric drive and different electric braking methods.
- To analyze the operation of three phase converter-controlled dc motors and four quadrant operation of dc motors using dual converters.
- To discuss the DC-DC converter control of dc motors.
- To understand the concept of speed control of induction motor by using AC voltage controllers, voltage source inverters and slip power recovery scheme.
- To learn the speed control mechanism of synchronous motors.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Explain the fundamentals of electric drive and different electric braking methods.

CO2: Analyze the operation of three-phase converter fed dc motors and four quadrant operations of dc motors using dual converters.

CO3: Describe the DC-DC converter fed control of dc motors in various quadrants of operation

CO4: Know the concept of speed control of induction motor by using AC voltage

controllers and voltage source inverters and differentiate the stator side control and rotor side control

CO5: Learn the concepts of speed control of synchronous motor with different methods.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	1	2	2	-	-	-	-	1	3	3	L2
CO2	3	3	3	3	3	1	-	-	-	-	2	3	3	L4
CO3	3	3	3	2	3	1	-	-	-	-	2	3	3	L3
CO4	3	3	3	3	3	1	-	-	-	-	2	3	3	L4

CO5	3	3	3	2	2	1	-	-	-	-	1	3	3	L3
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## SYLLABUS

### UNIT - I : Fundamentals of Electric Drives

Electric drive and its components– Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Load equalization– Four quadrant operation of drive (hoist control) – Braking methods: Dynamic Braking, Plugging and Regenerative Braking –Numerical problems.

### UNIT - II : Converter Fed DC Motor Drives

Single phase half and fully-controlled converter fed separately and self-excited DC motor drive for continuous and discontinuous load current, 3-phase fully-controlled converter fed separately and self-excited DC motor drive for continuous load current - Output voltage and current waveforms - Speed-torque characteristics and expressions – 3-phase Dual converter fed DC motor drives – Numerical problems.

### UNIT - III : DC–DC Converter Fed DC Motor Drives

Single quadrant, two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous Current Mode of operation - Output voltage and current waveforms – Speed-torque characteristics and expressions – Closed loop operation (qualitative treatment only) – Numerical problems.

### UNIT - IV : Control of 3-phase Induction motor Drives

Stator voltage control using 3-phase AC voltage regulators – Waveforms – Speed torque characteristics – Variable Voltage Variable Frequency control of induction motor by PWM voltage source inverter – Closed loop V/f control of induction motor drives (qualitative treatment only). Static rotor resistance control – Slip power recovery schemes – Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics– Numerical problems.

### UNIT - V : Control of Synchronous Motor Drives

Permanent Magnet Synchronous Motor (PMSM): Basic operation and advantages - Separate control of synchronous motor – self-control of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive (qualitative treatment only) — Numerical problems.

#### Text Books:

1. Fundamentals of Electric Drives – G K Dubey - Narosa Publications - 2<sup>nd</sup> edition – 2002.
2. Power Semiconductor Drives - S.B.Dewan - G.R.Slemon - A.Straughen - Wiley India - 1984.

#### Reference Books:

1. Electric Motors and Drives Fundamentals - Types and Applications - by Austin Hughes and Bill Drury - Newnes.4<sup>th</sup> edition - 2013.
2. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications - 1987.
3. Power Electronic Circuits - Devices and applications by M.H.Rashid - PHI - 3<sup>rd</sup> edition - 2009.

**Online Learning Resources:**

1. <https://archive.nptel.ac.in/courses/108/104/108104140>
2. <https://nptel.ac.in/courses/108104011>

**Professional Elective-III  
Digital Signal Processing  
III B.TECH- II SEMESTER**

Course Title: <b>Digital Signal Processing</b>	Course Code: R24EEPE03.2
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: Laplace Transforms, Z- Transforms, Fourier series and transforms.	

**Course Objectives:**

- To explore the basic concepts of digital signal processing.
- To connect the time domain signal to frequency domain signals using Fourier transform.
- To understand the basic structures of IIR systems.
- To understand and design FIR Digital filters.
- To explore the concepts of multiple sampling rates for DSP.

**Course Outcomes:**

After the completion of the course the student should be able to:

CO1: Know the concepts of Digital signal processing - frequency domain representation & z- transform.

CO2: Compute discrete Fourier transform and fast Fourier transforms for different sequences.

CO3: Design IIR filters through analog filter approximation and basic structure of IIR filters.

CO4: Design FIR filters with window techniques and basic structure of FIR filters.

CO5: Learn the concepts of Multirate Signal Processing.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	-	-	-	-	-	1	2	2	L2
CO2	3	3	3	3	3	-	-	-	-	-	1	2	2	L4
CO3	3	3	3	3	3	-	-	-	-	-	2	2	2	L5
CO4	3	3	3	3	3	-	-	-	-	-	2	2	2	L5
CO5	3	3	2	2	2	-	-	-	-	-	1	2	2	L3

**SYLLABUS****UNIT - I : Introduction to Digital Signal Processing**

Discrete time signals & sequences - Classification of Discrete time systems - stability of LTI systems – Invertability - Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms - solution of difference equations using Z-transforms - System function.

### **UNIT - II : Discrete Fourier Transforms and FFT Algorithms**

Discrete Fourier Series representation of periodic sequences -Properties of Discrete Fourier Series - Discrete Fourier transforms: Properties of DFT - linear filtering methods based on DFT - Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms - Inverse FFT.

### **UNIT - III : Design and Realizations of IIR Digital Filters**

Analog filter approximations – Butterworth and Chebyshev filters - Design of IIR Digital filters from analog filters with examples. Analog and Digital frequency transformations.

Basic structures of IIR systems – Direct-Form Structures - Transposed Structures - Cascade-Form Structures - Parallel-Form Structures Lattice and Lattice-Ladder Structures.

### **UNIT - IV : Design and Realizations of FIR Digital Filters**

Characteristics of FIR Filters with Linear Phase -Frequency Response of Linear Phase FIR Filters - Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique - Comparison of IIR & FIR filters.

Basic structures of FIR systems – Direct-Form Structure - Cascade-Form Structures Linear Phase Realizations - Lattice structures.

### **UNIT - V : Multirate Digital Signal Processing**

Decimation –Interpolation-Sampling Rate Conversion by a Rational Factor – Implementation of sampling rate converters – Applications of Multirate Signal Processing-Digital Filter Banks.

#### **Text Books:**

1. Digital Signal Processing - Principles Algorithms and Applications: John G. Proakis - Dimitris G.Manolakis - 4th Edition - Pearson Education / PHI - 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer - PHI.
3. Digital Signal Processing: A Computer based approach. Sanjit K Mitra - 4th Edition - TMH - 2014.

#### **Reference Books:**

1. Digital Signal Processing: Andreas Antoniou - TATA McGraw Hill - 2006.
2. Digital Signal Processing: MH Hayes - Schaum's Outlines - TATA Mc-Graw Hill - 2007.
3. DSP Primer - C. Britton Rorabaugh - Tata McGraw Hill - 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling - Sandra L.Harris - Thomson - 2007.
5. Digital Signal Processing – Alan V. Oppenheim - Ronald W. Schafer - PHI Ed. - 2006.
6. Digital Signal Processing – K Raja Rajeswari - 1st edition - I.K. International Publishing - House - 2014.

**Professional Elective-III  
Full Stack development  
III B.TECH- II SEMESTER**

Course Title: <b>Full Stack development</b>	Course Code: R24EEPE03.3
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: Basic knowledge of programming, HTML, CSS, JavaScript fundamentals, databases, and client-server web technologies.	

**COURSE OBJECTIVES:**

1. To implement the client side of the web application using java-script.
2. To understand Java script on the desktop using Node JS.
3. To develop a web application using Node JS and Express.
4. To implement a SPA using React.
5. To develop a full stack single page application using React ,Node JS, and a Database (MongoDB or SQL).

**COURSE OUTCOMES**

At the end of the course, students will be able to:

CO1: Implement the client side of the web application.

CO2: Deploy server side applications using NodeJS. Use express framework in web development

CO3: Implement and architect database systems. Develop a full stack single page applications

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	3	2	3	-	-	1	2	-	1	3	3	L3
CO2	3	3	3	3	3	-	-	1	2	-	2	3	3	L4
CO3	3	3	3	3	3	-	-	1	3	-	2	3	3	L5

**SYLLABUS****Experiments covering the Topics:**

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model

- Applying JavaScript-internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events

### Developing the following programs:

#### Week-1:

1. Write a HTML program, to explain the working of lists. **CO's:CO1**
2. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes. **CO's:CO1**
3. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles. **CO's:CO1**
4. To create Form validation using JavaScript. **CO's:CO1**

#### Week-2:

1. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan) **CO's:CO2**
2. Write a HTML program, to explain the working of forms by designing Registration form. **CO's:CO2**
3. Get data using Fetch API from an open-source end point and display the contents in the form of a card. **CO's:CO2**

#### Week-3:

1. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, <span> tags. **CO's:CO2**
2. Write a HTML program, to embed audio and video into HTML webpage. **CO's:CO2**
3. Write a program to apply different types (or levels of styles or style specification formats) inline, internal, external styles to HTML elements. (identify selector, property and value). **CO's:CO2**

#### Week-4:

1. Write a program to apply different types of selector forms
  - i. Simple selector (element, id, class, group, universal)
  - ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
  - iii. Pseudo-class selector
  - iv. Pseudo-element selector
  - v. Attribute selector **CO's:CO2**

#### Week-5:

1. Write a program to demonstrate the various ways you can reference a color in CSS. **CO's:CO2**
2. Write a CSS rule that places a background image half way down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down. **CO's:CO2**

3. Write a program using the following terms related to CSS fontandtext:

i. font-size ii.font-weight iii.font-style

iv.text-decoration v.text-transformation vi.text-alignment

**CO's:CO2**

4. Write a program, to explain the importance of CSS Box modelusing

i. Content ii.Border iii.Margin iv.Padding

**CO's:CO2**

#### **Week-6:**

1. Write a program to embed internal and external Java Script in a webpage. **CO's:CO3**

2. Write a program to explain the different ways for taking input & displaying output.. **CO's:CO3**

3. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not **CO's:CO3**

#### **Week-7:**

1. Write a program using document object properties and methods.

2. Write a program using window object properties and methods.

3. Write a program using array object properties and methods.

4. Write a program using math object properties and methods.

5. Write a program using string object properties and methods. **CO's:CO3**

#### **Week-8:**

1. Write a program to display week days using switch case.

2. Write a program to print1to10 numbers using for, while and do-while loops.

3. Write a program to print data in object using for-in, for-each and for-of loops Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not.

4. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's) **CO's:CO3**

#### **Week-9:**

1. Design a appropriate function should be called to display

I. Factorial of that number

II. Fibonacci series up to that number

III. Prime numbers up to that number

IV. Is it palindrome or not **CO's:CO3**

#### **Week-10:**

1. Design a HTML having a textbox and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display

I. Factorial of that number

II. Fibonacci series up to that number

III. Prime numbers up to that number

IV. Is it palindrome or not

**CO's:CO3**

**Week-11:**

1. Write a program to validate the following fields in a registration page

I. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)

II. Mobile(onlynumbersandlength10digits)

III. E-mail(shouldcontainformatlikexxxxxxx@xxxxxx.xxx). **CO's:CO3**

**Week-12:**

1. Create a form and validate the contents of the form using JavaScript. **CO's: CO3**

2. Get data using Fetch API from an open-source end point and display the contents in the form of a card.. **CO's: CO3**

3. Create a Node JS server that serves static HTML and CSS files to the user without using Express.

**CO's: CO3**

**Week-13:**

1. Create a Node JS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars. **CO's:CO3**

2. Create a Node JS server using Express that creates, reads, updates and deletes students' details and stores them in MongoDB database. The information about the user should be obtained from a HTML form. Conversion of Fahrenheit to Celsius and vice versa. **CO's:CO3**

**Week-14:**

1. Create a Node JS server that creates, reads, updates and deletes event details and stores them in a MySQL database. The information about the user should be obtained from a HTML form. **CO's:CO3**

2. Create a counter using React JS **CO's:CO3**

3. Create a To do application using ReactJS. Store the data to a JSON file using a simple Node JSserver and retrieve the information from the same during page reloads. **CO's:CO3**

**Week-15:**

1. Create a simple Signup and Login mechanism and authenticate the user using cookies. The user information can be stored in either MongoDB or MySQL and the server should be built using Node JS and Express Framework. **CO's:CO3**

2. Create and deploy a virtual machine using a virtual box that can be accessed from the host computer using SSH. Write a C program to print last n characters of a given file. **CO's:CO3**

3. Create a docker container that will deploy a Node JSping server using the Node JS image.

**CO's:CO3**

**Textbooks:**

1. JohnDean, WebProgrammingwithHTML5, CSSandJavaScript,Jones&Bartlett Learning, 2019.

**Reference Books:**

1. Programming the World WideWeb, 7thEdition, RobertWSebesta, Pearson, 2013.
2. ProMERNStack: FullStackWebAppDevelopmentwithMongo, Express, React, and Node, Vasanth Subramanian, 2nd edition, APress, O'Reilly.

**Online Learning Resources:**

1. <https://www.w3schools.com/html>
2. <https://www.w3schools.com/css>
3. <https://www.w3schools.com/js/>
4. <https://www.w3schools.com/nodejs>
5. <https://www.w3schools.com/typescript>

**Professional Elective-III**  
**Programmable Logic Controllers and Applications**  
**III B.TECH- II SEMESTER**

Course Title: <b>Programmable Logic Controllers and Applications</b>	Course Code: R24EEPE03.4
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: Basic knowledge of electrical circuits, control systems, digital electronics, and industrial automation is required.	

**Course Objectives:**

- To understand the various components of PLC systems and ladder diagrams.
- To know the programming instructions and registers in the PLC.
- To understand the use and applications of timer and counter functions.
- To familiar the data handling function and this application.
- To understand and implementation of analog operations and PID modules.

**Course Outcomes:**

After the completion of the course the student should be able to:

CO1: Illustrate I/O modules of PLC systems and ladder diagrams

CO2: Demonstrate various types registers and programming instructions.

CO3: Examine various types of PLC functions and its applications.

CO4: Assess different data handling functions and its applications.

CO5: Describe the analog operations and PID modules.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	3	2	3	1	-	-	-	-	1	3	3	L3
CO2	3	2	3	2	3	1	-	-	-	-	1	3	3	L3
CO3	3	3	3	3	3	2	-	-	-	-	2	3	3	L4
CO4	3	3	3	3	3	2	-	-	-	-	2	3	3	L4
CO5	3	3	3	3	3	1	-	-	-	-	2	3	3	L3

**SYLLABUS****UNIT – I : Introduction to PLC systems**

I/O modules and interfacing - CPU processor - programming Equipment - programming formats - construction of PLC ladder diagrams - Devices connected to I/O Modules. Digital logic gates - programming in the Boolean algebra system - conversion examples Ladder Diagrams for process control: Ladder diagrams & sequence listings - ladder diagram construction and flowchart for spray process system.

## **UNIT – II**

**PLC Programming:** Input instructions - outputs - operational procedures - programming examples using contacts and coils. Drill press operation.

**PLC Registers:** Characteristics of Registers - module addressing - holding registers - Input Registers - Output Registers.

## **UNIT – III: PLC Functions**

Timer functions & Industrial applications - counters - counter function industrial applications - Arithmetic functions - Number comparison functions - number conversion functions.

## **UNIT – IV: Data Handling functions:**

SKIP - Master control Relay - Jump - Move - FIFO - FAL - ONS - CLR & Sweep functions and their applications. Bit Pattern and changing a bit shift register - sequence functions and applications - controlling of two-axis & three axis Robots with PLC - Matrix functions.

## **UNIT – V: Analog PLC operation**

Analog modules & systems - Analog signal processing - Multi bit Data Processing - Analog output Application Examples - PID principles - position indicator with PID control - PID Modules - PID tuning - PID functions

### **Text books:**

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss - Fifth Edition - PHI
2. Programmable Logic Controllers- Programming Method and Applications –JR.Hackworth &F.D Hackworth Jr. –Pearson - 2004

### **Reference Books:**

1. Introduction to Programmable Logic Controllers- Gary A. Dunning - 3<sup>rd</sup> edition - Cengage Learning - 2005.
2. Programmable Logic Controllers –W.Bolton - 5th Edition - Elsevier publisher - 2009.

**Professional Elective-III**  
**Drone Technology & Applications**  
**III B.TECH- II SEMESTER**

Course Title: <b>Drone Technology &amp; Applications</b>	Course Code: R24EEPE03.5
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: Basic knowledge of power systems, electrical machines, power electronics, and transmission systems is required.	

**COURSE OBJECTIVES:**

- To understand the basics of drone concepts
- To learn and understand the fundamentals of design, fabrication and programming of drone.
- To impart the knowledge of a flying and operation of drone.
- To know about the various applications of drone.
- To understand the safety risks and guidelines of fly safely.

**COURSE OUTCOMES:**

Upon successful completion of the course, students should be able to:

CO1: Know about a various type of drone technology, drone fabrication and programming.

CO2: Execute the suitable operating procedures for functioning a drone.

CO3: Select appropriate sensors and actuators for Drones.

CO4: Develop a drone mechanism for specific applications.

CO5: Create the programs for various drones.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	2	2	3	1	-	-	-	-	1	3	3	L2
CO2	3	3	3	2	3	1	-	-	-	-	1	3	3	L3
CO3	3	3	3	2	3	1	-	-	-	-	1	3	3	L3
CO4	3	3	3	3	3	2	-	-	-	-	2	3	3	L5
CO5	3	3	3	3	3	1	-	-	-	-	2	3	3	L5

**SYLLABUS**

**UNIT I: Introduction To Drone Technology**

Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability.

**UNIT II: Drone Design, Fabrication and Programming**

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts - Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.

**UNIT III: Drone Flying and Operation**

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications..

**UNIT IV: Drone Commercial Applications**

Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.

**UNIT V: Future Drones and Safety**

The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms.

**Text Books**

1. Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, 2021 John Wiley & Sons, Inc.
2. Terry Kilby and Belinda Kilby, “Make:Getting Started with Drones “,Maker Media, Inc, 2016

**References**

1. John Baichtal, “Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016
2. Završnik, “Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance”, Springer, 2018.

**Electrical Measurements and Instrumentation Lab**  
**III B.TECH- II SEMESTER**

Course Title: Electrical Measurements and Instrumentation Lab	Course Code: R24EEPC20
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: Basic knowledge of electrical measurements, circuit theory, AC/DC bridges, transformers, and transducers is required.	

**COURSE OBJECTIVES:**

- To understand the working and construction of different electrical measuring instruments and transducers.
- To measure electrical parameters such as resistance, inductance, capacitance, power, and transformer errors using various methods and bridges.
- To study the testing, standardization, and calibration procedures of electrical instruments and measuring systems.

**COURSE OUTCOMES**

**CO1:** Understand the calibration, testing, and measurement techniques of electrical instruments and power measurement methods.

**CO2:** Measure electrical parameters such as resistance, inductance, capacitance, voltage, current, power, and energy using various bridges and instruments.

**CO3:** Analyze the performance of CTs, PTs, and transducers, and evaluate characteristics such as strain, frequency, and phase difference.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	-	-	-	-	-	1	3	2	L2
CO2	3	3	2	3	3	-	-	-	-	-	1	3	2	L3
CO3	3	3	2	3	3	-	-	-	-	-	2	3	3	L4

**Any 10 of the following experiments are to be conducted**

1. Calibration of dynamometer wattmeter using phantom loading

2. Measurement of resistance using Kelvin's double Bridge and Determination of its tolerance.
3. Measurement of Capacitance using Schering Bridge.
4. Measurement of Inductance using Anderson Bridge.
5. Calibration of LPF Wattmeter by direct loading.
6. Measurement of 3 phase reactive power using single wattmeter method for a balanced load.
7. Testing of C.T. using mutual inductor – Measurement of % ratio error and phase angle of given C.T. by Null deflection method.
8. P.T. testing by comparison – Vibration Galvanometer as Null detector – Measurement of percentage ratio error and phase angle error of the given P.T.
9. Determination of the characteristics of a Thermocouple.
10. Determination of the characteristics of a LVDT.
11. Determination of the characteristics for a capacitive transducer.
12. Measurement of strain for a bridge strain gauge.
13. Measurement of Choke coil parameters
14. Measurement of single-phase power using three voltmeter method.
15. Measurement of single-phase power using three ammeter method.
16. Calibration of single-phase Induction Type Energy Meter.
17. Calibration of DC ammeter and voltmeter using Crompton DC Potentiometer.
18. AC Potentiometer : Polar Form / Cartesian Form - Calibration of AC voltmeter - Parameters of choke.

**Microprocessors and Microcontrollers Lab**  
**III B.TECH- II SEMESTER**

Course Title: Microprocessors and Microcontrollers Lab	Course Code: R24EEPC21
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: Basic knowledge of microprocessors, microcontrollers, digital electronics, and assembly language programming is required..	

**COURSE OBJECTIVES**

- To understand the architecture, instruction set, and programming concepts of 8086 microprocessor and 8051 microcontroller.
- To develop assembly language programs for data transfer, arithmetic operations, and control applications.
- To interface peripheral devices such as LEDs, LCDs, keypads, and seven-segment displays with microprocessors and microcontrollers.

**COURSE OUTCOMES**

**CO1:** Understand the architecture and programming concepts of 8086 microprocessor and 8051 microcontroller.

**CO2:** Develop and execute assembly language programs and interface peripheral devices with microprocessors and microcontrollers.

**CO3:** Analyze and implement real-time applications using memory modules, ADC/DAC, sensors, and embedded interfacing techniques.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	3	2	3	-	-	-	-	-	1	3	3	L3
CO2	3	3	3	3	3	-	-	-	2	-	2	3	3	L4
CO3	3	3	3	3	3	-	-	-	2	-	2	3	3	L4

**List of Experiments:**

1. Write a data transfer program using different addressing modes in assembly language programming.

2. Perform arithmetic operations on 8 bit and 16-bit numbers in assembly language programming.
3. Data transfer program using string instruction in assembly language programming.
4. Program for data conversion in assembly language programming.
5. Implement stack operations using PUSH and POP instructions.
6. Write assembly language program using procedure.
7. Write assembly language program using macro.
8. Program to reject negative numbers from a series of bytes.
9. Interfacing 8086 with 8255 PPI to display data on LEDs.
10. Perform Arithmetic operations on 8bit numbers in assembly language programming using 8051 microcontrollers.
11. Program to toggle the LED.
12. Programming and interfacing of traffic light logic.
13. Program to generate square wave using interrupts.
14. Programming and interfacing of the key pad matrix.
15. Programming and interfacing of seven-segment display.
16. Programming and interfacing of the LCD
17. Programming and interfacing of the relay.
18. Programming and interfacing of the dc/Stepper motor.

#### **Text Books**

- 1 Douglas V. Hall, Microprocessors and Interfacing: Programming and Hardware, Tata McGraw-Hill.
- 2 Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International.
- 3 Muhammad Ali Mazidi & Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education.

#### **Reference Books:**

- 1 Kenneth Ayala, The 8051 Microcontroller, Cengage Learning.
- 2 Barry B. Brey, The Intel Microprocessors 8086/88, 80186/188, 80286, 80386, and 80486, Pearson Education.
- 3 Krishna Kant, Microprocessors and Microcontrollers: Architecture, Programming and System Design, PHI.

**IOT Applications of Electrical Engineering Lab  
III B.TECH- II SEMESTER**

Course Title :IOT Applications of Electrical Engineering Lab	Course Code: R24EESC04
Teaching Scheme (L:T:P): 0:1:2	Credits: 2
Type of Course: Tutorials+practicals	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites Concepts of Computer Organization, Computer Networks.	

**COURSE OBJECTIVES:**

- To understand the architecture and programming of Arduino and Raspberry Pi platforms.
- To interface sensors, displays, and peripheral devices with Arduino and Raspberry Pi.
- To implement wireless communication and embedded applications using Arduino and Raspberry Pi.

**COURSE OUTCOMES:**

**CO1:** Develop programs using Embedded C in Arduino IDE and Python in Raspberry Pi OS.

**CO2:** Interface sensors, displays, and peripheral devices with Arduino and Raspberry Pi for IoT applications.

**CO3:** Implement wireless communication and interconnected embedded systems using Arduino and Raspberry Pi platforms.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	3	2	3	-	-	-	2	-	1	3	3	L3
CO2	3	3	3	3	3	-	-	1	3	-	1	3	3	L4
CO3	3	3	3	3	3	-	-	2	3	-	2	3	3	L5

**Topics to be covered in Tutorials****Module–1: Programming using Arduino: (3 hrs)**

Arduino - Classification of Arduino Boards - Pin diagrams – Arduino Integrated Development Environment (IDE) – Programming using Arduino.

**Module–2: Sensors: (5 hrs)**

Working of temperature sensor, proximity sensor, IR sensor, Light sensor, ultrasonic sensor, PIR Sensor, Colour sensor, Soil Sensor, Heart Beat Sensor, Fire Alarms etc. Actuators: Stepper Motor, Servo Motor and their integration with Arduino/Raspberry Pi.

### **Module–3: Raspberry Pi: (2 hrs)**

Introduction, Classification of Raspberry Pi Series - Pin diagrams – Programming Raspberry Pi.

### **Module–4: Display: (2 hrs)**

Working of LEDs, LED, OLED display, LCDs, Seven Segment Display, Touch Screen etc. Analog Input and Digital Output Converter etc. and their integration with Arduino/Raspberry Pi.

### **Module–5: Wireless Communication Devices: (4 hrs)**

Working of Bluetooth, Wi-Fi, Radio Frequency Identification (RFID), GPRS/GSM Technology, ZigBee, etc and their integration with Arduino/Raspberry Pi. Features of Alexa.

#### **List of experiments**

#### **Any 10 of the following experiments are to be conducted:**

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. Interfacing of LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. Interfacing of Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. Interfacing of temperature sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. Interfacing of Organic Light Emitting Diode (OLED) with Arduino/Raspberry Pi
6. Interfacing of Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
7. Interfacing of Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8. Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to thing speak cloud.
9. Interfacing of 7 Segment Display with Arduino/Raspberry Pi
10. Interfacing of Joystick with Arduino/Raspberry Pi
11. Interfacing of Analog Input & Digital Output with Arduino/Raspberry Pi
12. Night Light Controlled & Monitoring System
13. Interfacing of Fire Alarm Using Arduino/Raspberry Pi
14. IR Remote Control for Home Appliances
15. A Heart Rate Monitoring System
16. Alexa based Home Automation System

**Research Methodology**  
**III B.TECH- II SEMESTER**

Course Title: <b>Research Methodology</b>	<b>Course Code: R24MC08</b>
<b>Teaching Scheme (L:T:P): 2:0:0</b>	<b>Credits: -</b>
<b>Type of Course: Lecture</b>	
<b>Continuous Internal Evaluation: 30 Marks</b>	<b>Semester End Exam: 70 Marks</b>
<b>Pre requisites:</b>	

**COURSE OBJECTIVES**

- To introduce the fundamentals of research and its methodologies.
- To equip students with the skills needed to identify research problems and design effective research strategies.
- To develop understanding of quantitative and qualitative research techniques.
- To familiarize students with literature review, citation, and plagiarism avoidance.
- To prepare students to write research proposals, reports, and academic papers.

**COURSE OUTCOMES**

**Upon successful completion of the course, students will be able to**

CO1: Formulate and define a research problem with clear objectives.

CO2: Design a research methodology suitable for different types of problems.

CO3: Apply appropriate tools for data collection, analysis, and interpretation.

CO4: Conduct a structured literature review using academic databases and tools.

CO5: Write high-quality research proposals, papers, and reports adhering to academic standards

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	3	2	1	-	2	3	2	2	1	1	L5
CO2	3	3	2	3	2	1	-	2	2	2	2	1	1	L5
CO3	3	3	2	3	3	2	-	2	3	2	2	1	1	L4
CO4	3	3	1	3	2	1	-	2	3	1	2	1	1	L4
CO5	3	3	2	3	2	1	3	2	3	3	2	1	1	L5

## SYLLABUS

### **Unit I: Introduction to Research**

Meaning and objectives of research, Types of research (Basic, Applied, Qualitative, Quantitative, Mixed methods), Research approaches and ethics, Characteristics of good research, Research process overview

### **Unit II: Research Problem & Design**

Identifying and defining a research problem, Review of literature and gap analysis, Hypothesis formulation, Research design – Exploratory, Descriptive, Experimental, Diagnostic, Variables and sampling techniques

### **Unit III: Data Collection Methods**

Primary and secondary data, Methods of data collection: surveys, interviews, observations, questionnaires, Measurement scales: Nominal, Ordinal, Interval, Ratio, Reliability and validity, Use of online tools for survey and data collection (Google Forms, etc.)

### **Unit IV: Data Analysis and Interpretation**

Descriptive statistics – mean, median, mode, standard deviation, Inferential statistics – correlation, regression, hypothesis testing, Use of software tools like Excel/SPSS/R for analysis, Data visualization: tables, charts, graphs, Interpretation of results

### **Unit V: Research Documentation and Report Writing**

Research paper structure and writing style, Plagiarism and reference management tools (Zotero, Mendeley), Citation styles – APA, IEEE, MLA, Research proposal writing, Publishing in journals, conferences, patents – overview

### **Textbooks**

1. C.R. Kothari, *Research Methodology: Methods and Techniques*, New Age International Publishers.
2. Ranjit Kumar, *Research Methodology: A Step-by-Step Guide for Beginners*, SAGE Publications.

### **Reference Books**

1. John W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, SAGE.
2. Wayne Goddard & Stuart Melville, *Research Methodology: An Introduction*.
3. Uma Sekaran, *Research Methods for Business: A Skill Building Approach*, Wiley.
4. Leedy & Ormrod, *Practical Research: Planning and Design*, Pearson.
5. Research articles from journals like IEEE, Elsevier, Springer, Taylor & Francis (for case-based teaching).

**Employability Skills III**  
**Advanced Aptitude & Communication skills**  
**III B.TECH- II SEMESTER**

Course Title: <b>Advanced Aptitude &amp; Communication skills</b>	Course Code: R24HS09
Teaching Scheme (L:T:P): 0:0:2	Credits: 1
Type of Course: Practicals	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: Basic knowledge of mathematics, logical reasoning, English communication, and computer fundamentals with an interest in employability skill development.	

**COURSE OUTCOMES (COs):**

After successful completion of this course, students will be able to:

**CO1:** Apply quantitative aptitude concepts to solve problems related to arithmetic, percentages, ratio, averages, profit and loss, interest, and data interpretation.

**CO2:** Analyze and solve logical reasoning and analytical problems involving coding-decoding, puzzles, seating arrangements, syllogisms, and data sufficiency.

**CO3:** Apply mathematical and analytical techniques to solve campus recruitment and competitive examination problems efficiently.

**CO4:** Develop professional communication skills including spoken English, workplace communication, email writing, customer interaction, and digital communication.

**CO5:** Demonstrate employability skills, presentation abilities, interpersonal communication, workplace etiquette, personality development, and interview readiness for corporate careers.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	2	2	-	-	-	2	-	1	2	2	L3
CO2	3	3	2	3	2	-	-	-	2	-	1	2	2	L4
CO3	3	3	3	2	2	-	-	-	2	-	1	2	2	L3
CO4	1	2	1	1	1	2	-	3	3	2	2	1	1	L4
CO5	1	2	1	1	1	3	2	3	3	2	2	1	1	L4

**PART – A : APTITUDE, REASONING & ANALYTICAL SKILLS**

**UNIT–1: Quantitative Aptitude & Problem Solving**

Percentages, ratio and proportion, averages, profit and loss, simple and compound interest, time and work, pipes and cisterns, time-speed-distance, boats and streams, permutations and combinations, and probability.

**Practice Activities**

Shortcut techniques, aptitude worksheets, quantitative mock tests, company-level aptitude practice, and speed calculation exercises.

**UNIT–2: Logical Reasoning & Data Interpretation**

Coding-decoding, blood relations, number series, seating arrangements, syllogisms, puzzles, statement and conclusions, logical sequences, data sufficiency, non-verbal reasoning, tables, charts, graphs, and data interpretation techniques.

**Practice Activities**

Reasoning mock tests, puzzle-solving sessions, sectional practice tests, analytical exercises, and company-specific reasoning assessments.

**UNIT–3: Basic Mathematics for Placements**

Geometry basics, triangles, circles, trigonometric ratios, heights and distances, angles, mensuration concepts, and mathematical reasoning frequently used in aptitude examinations.

**Practice Activities**

Formula applications, trigonometry exercises, mathematical problem-solving, and placement-oriented practice sessions.

**PART – B : PROFESSIONAL COMMUNICATION & EMPLOYABILITY SKILLS****UNIT–4: Professional & Corporate Communication Skills**

Sentence structure, vocabulary development, spoken English, pronunciation, fluency development, grammar correction, listening skills, workplace communication, customer handling, telephone etiquette, voice modulation, active listening, chat communication, and professional email writing.

**Practice Activities**

Speaking practice, pronunciation drills, workplace conversations, mock voice calls, email drafting, role-play activities, and communication fluency sessions.

**UNIT–5: Employability, Personality & Interview Skills**

Versant test pattern, listening comprehension, reading fluency, sentence mastery, interpersonal skills, teamwork, workplace etiquette, presentation skills, personality development, self-introduction techniques, HR interview preparation, confidence building, and professional grooming.

**Practice Activities**

Versant mock tests, mock interviews, presentation activities, teamwork exercises, self-introduction practice, placement mock drives, and workplace etiquette sessions.

### **Reference Text Books**

1. R.S. Aggarwal, *Quantitative Aptitude for Competitive Examinations*, S. Chand Publishing.
2. Meenakshi Raman and Sangeeta Sharma, *Technical Communication: Principles and Practice*, Oxford University Press.
3. Barun K. Mitra, *Personality Development and Soft Skills*, Oxford University Press.

### **Reference Books**

1. M. Tyra, *Magical Book on Quicker Maths*, BSC Publishing.
2. S.P. Bakshi, *Objective General English*, Arihant Publications.
3. Edgar Thorpe, *Test of Reasoning*, Pearson Education.

### **Web Links**

1. IndiaBix Aptitude and Reasoning
2. PrepInsta Placement Preparation
3. British Council English Learning

**Power System Operation and Control**  
**IV B.TECH- I SEMESTER**

Course Title: <b>Power System Operation and Control</b>	Course Code: R24EEPC22
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: Basic knowledge of Power Systems, Electrical Machines, Control Systems, Power Electronics, Network Analysis, and optimization techniques is required to understand economic operation and control of power systems.	

**COURSE OBJECTIVES:**

The objectives of this course is to acquire knowledge on

- Optimal dispatch of generation with and without losses.
- Optimal scheduling of hydro thermal systems.
- Optimal unit commitment problem.
- load frequency control for single and two area systems with and without controllers
- Reactive power control and compensation of transmission lines.

**COURSE OUTCOMES:**

CO1: Compute optimal scheduling of Generators.

CO2: Compute hydrothermal scheduling.

CO3: Solve unit commitment problem.

CO4: Design PID controllers in single area and two area systems.

CO5: Apply reactive power control and compensation for transmission line.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	3	3	2	2	-	-	-	-	2	3	3	L4
CO2	3	3	3	3	2	2	-	-	-	-	2	3	3	L4
CO3	3	3	3	3	2	2	-	-	-	-	2	3	3	L4
CO4	3	3	3	3	3	1	-	-	-	-	2	3	3	L5

CO5	3	3	2	3	2	3	-	-	-	-	1	3	3	L3
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## SYLLABUS

### UNIT-I: Economic Operation of Power Systems

Optimal operation of Generators in Thermal power stations, – Heat rate curve – Cost Curve – Incremental fuel and Production costs – Input–output characteristics – Optimum generation allocation with line losses neglected – Optimum generation allocation including the effect of transmission line losses – Loss Coefficients – General transmission line loss formula.

### UNIT-II: Hydrothermal Scheduling

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models – Scheduling problems – Short term hydrothermal scheduling problem.

### UNIT-III: Unit Commitment

Optimal unit commitment problem – Need for unit commitment – Constraints in unit commitment – Cost function formulation – Solution methods – Priority ordering – Dynamic programming.

### UNIT-IV: Load Frequency Control

Modeling of steam turbine - Modeling of Hydro turbine – Generator – Mathematical modeling of speed governing system – Transfer function –Necessity of keeping frequency constant –Control area – Single area power system – Block diagram representation of an isolated power system – Steady state analysis - Dynamic response of Uncontrolled case. Proportional plus Integral control of single area- Steady State Response .Tieline bias control, Block diagram development of Load Frequency Control of two area system- uncontrolled case and controlled case, Economic dispatch control.

### UNIT-V: Reactive Power Control

Overview of Reactive Power control – Reactive Power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation – Specifications of load compensator – Uncompensated and compensated transmission lines: Shunt and series compensation.

#### Text Books:

1. Electric Energy systems Theory – by O.I.Elgerd, Tata McGraw–Hill Publishing Company Ltd., Second edition.
2. Modern Power System Analysis – by I.J.Nagrath&D.P.Kothari Tata McGraw Hill Publishing Company Ltd, 2nd edition.

#### Reference Books:

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., Thompson,3rdEdition.
2. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
3. Power System Analysis by HadiSaadat – TMH Edition.
4. Power System stability & control, PrabhaKundur, TMH

**Renewable Energy systems & Smart grid**  
**IV B.TECH- I SEMESTER**

Course Title : <b>Renewable Energy systems &amp; Smart grid</b>	Course Code: R24EEPC23
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 : Basic knowledge of electrical circuits, power systems, and electrical machines.	

**COURSE OBJECTIVES:**

- To understand renewable energy systems.
- To learn different renewable energy sources.
- To study smart grid technologies.
- To understand energy management systems.
- To apply renewable energy and smart grid concepts in power systems.

**COURSE OUTCOMES:**

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

CO1: Understand renewable energy sources and systems.

CO2: Explain the operation of solar and wind energy systems.

CO3: Understand smart grid concepts and technologies.

CO4: Apply energy management and monitoring techniques.

CO5: Analyze renewable energy integration with smart grids.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO2	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO3	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO4	3	3	3	3	3	3	-	-	-	2	2	3	3	L3
CO5	3	3	3	3	3	3	-	-	-	2	2	3	3	L4

## SYLLABUS

### UNIT – I: Introduction to Renewable Energy Systems

Introduction to renewable energy, need for renewable energy, conventional and non-conventional energy sources, types of renewable energy systems, energy scenario.

**Applications:** Power generation, rural electrification, sustainable energy systems.

### UNIT – II: Solar and Wind Energy Systems

Solar radiation, solar photovoltaic systems, solar thermal systems, wind energy conversion systems, wind turbines, energy storage systems.

**Applications:** Solar power plants, wind farms, hybrid energy systems.

### UNIT – III: Other Renewable Energy Sources

Biomass energy, biogas plants, geothermal energy, tidal energy, fuel cells, small hydro power plants.

**Applications:** Distributed generation, clean energy systems.

### UNIT – IV: Smart Grid Fundamentals

Introduction to smart grid, smart grid architecture, smart meters, communication systems, distributed generation, demand side management, energy management systems.

**Applications:** Smart homes, smart cities, intelligent power systems.

### UNIT – V: Renewable Energy Integration and Smart Grid Applications

Integration of renewable energy into smart grids, grid stability, power quality, electric vehicles, microgrids, smart grid protection, future trends in smart grids.

**Applications:** Electric vehicle charging systems, smart energy management, intelligent distribution systems.

#### Text Books:

1. G. M. Masters, *Renewable and Efficient Electric Power Systems*, Wiley.
2. Stuart Borlase, *Smart Grid: Infrastructure, Technology and Solutions*, CRC Press.

#### Reference Books:

1. John Twidell and Tony Weir, *Renewable Energy Resources*, Routledge.
2. Gilbert M. Masters, *Introduction to Environmental Engineering and Science*, Pearson.

#### Online Learning Resources:

1. NPTEL – Renewable Energy Engineering
2. NPTEL – Smart Grid

**Energy Management and Auditing**  
**IV B.TECH- I SEMESTER**

Course Title : <b>Energy Management and Auditing</b>	Course Code: R24HS13
Teaching Scheme (L:T:P): 2:0:0	Credits: 2
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
<b>Pre requisites:</b> Basic knowledge of Electrical Circuits, Power Systems, Electrical Machines, Illumination Engineering, HVAC systems, and engineering economics is required to understand energy conservation and energy management techniques.	

**COURSE OBJECTIVES:**

The objectives of this course is to acquire knowledge on

- Energy efficiency, scope, conservation and technologies.
- Design energy efficient lighting systems.
- Estimation /calculate power factor of systems and propose suitable compensation techniques.
- Energy conservation in HVAC systems.
- Costing analysis and return on investment on energy efficient technologies.

**COURSE OUTCOMES:**

The student should be able to

CO1: Explain energy efficiency, conservation and various technologies.

CO2: Design energy efficient lighting systems.

CO3: Calculate power factor of systems and propose suitable compensation techniques.

CO4: Explain energy conservation in HVAC systems.

CO5: Calculate life cycle costing analysis and return on investment on energy efficient technologies.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	-	-	-	-	1	3	2	L2
CO2	3	3	3	3	3	3	-	-	-	-	2	3	3	L5
CO3	3	3	2	3	3	3	-	-	-	-	2	3	3	L3

CO4	3	2	1	2	2	3	-	-	-	-	1	3	2	L2
CO5	3	3	3	3	3	3	-	-	-	3	3	3	3	L4

## SYLLABUS

### Unit-I: Basic Principles of Energy Audit and management

Energy audit - Definitions - Concept - Types of audit - Energy index - Cost index - Pie charts - Sankey diagrams - Load profiles - Energy conservation schemes and energy saving potential - Numerical problems - Principles of energy management - Initiating, planning, controlling, promoting, monitoring, reporting - Energy manager - Qualities and functions - Language - Questionnaire - Check list for top management.

### Unit-II: Lighting

Modification of existing systems - Replacement of existing systems - Priorities: Definition of terms and units - Luminous efficiency - Polar curve - Calculation of illumination level - Illumination of inclined surface to beam Luminance or brightness - Types of lamps - Types of lighting - Electric lighting fittings (luminaries) - Flood lighting - White light LED and conducting Polymers - Energy conservation measures.

### Unit-III: Power Factor and energy instruments

Power factor - Methods of improvement - Location of capacitors - Power factor with non linear loads - Effect of harmonics on Power factor - Numerical problems. Energy Instruments - Watt-hour meter - Data loggers Thermocouples - Pyrometers - Lux meters - Tong testers - Power analyzer.

### Unit-IV: Space Heating and Ventilation

Ventilation - Air-Conditioning (HVAC) and Water Heating: Introduction - Heating of buildings - Transfer of Heat-Space heating methods - Ventilation and air-conditioning - Insulation-Cooling load - Electric water heating systems - Energy conservation methods.

### Unit-V: Economic Aspects and Analysis

Economics Analysis - Depreciation Methods - Time value of money - Rate of return - Present worth method - Replacement analysis - Life cycle costing analysis - Energy efficient motors (basic concepts). Calculation of simple payback method - Net present worth method - Power factor correction - Lighting - Applications of life cycle costing analysis - Return on investment.

### Text Books:

1. Energy management by W.R. Murphy & G. McKay Butter worth, Elsevier publications. 2012
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995

### Reference Books:

1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company
2. Ltd. New Delhi.

3. Energy management by Paul o' Callaghan, Mc-Graw Hill Book company-1st edition, 1998.
4. Energy management hand book by W.C.Turner, John wiley and sons.
5. Energy management and conservation –K V Sharma and P Venkata Seshaiiah-I K International Publishing House pvt.ltd,2011.
7. [http://www.energymanagertraining.com/download/Gazette of IndiaPartIISecI-37 25-08-2010.pdf](http://www.energymanagertraining.com/download/Gazette%20of%20IndiaPartIISecI-37%2025-08-2010.pdf)

**Professional Elective-IV**  
Flexible Alternating Current Transmission Systems  
**IV B.TECH- I SEMESTER**

Course Title: <b>Concepts of Optimization Techniques</b>	Course Code: R24EEPE04.1
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: Basic knowledge of Power Systems, Power Electronics, Control Systems, Electrical Machines, and Transmission Line Theory is required to understand FACTS controllers and power flow control techniques	

**COURSE OBJECTIVES:**

The objectives of this course is to acquire knowledge on

- Basics of power flow control in transmission lines using FACTS controllers.
- Operation and control of voltage and current source converter.
- Shunt compensation using static VAR compensators.
- Series compensation methods.
- Operation of Unified Power Flow Controller (UPFC).

**COURSE OUTCOMES :**

The students should be able to

CO1: Know the power flow control in transmission lines using facts controllers.

CO2: Explain the operation and control of voltage and current source converter

CO3: Analyze method of shunt compensation using static var compensators.

CO4: Evaluate different methods of compensation using series compensators.

CO5: Apply unified power flow controller (UPFC) on transmission systems.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	2	-	-	-	-	1	3	3	L2
CO2	3	3	3	2	3	1	-	-	-	-	1	3	3	L3

CO3	3	3	3	3	3	2	-	-	-	-	2	3	3	L4
CO4	3	3	3	3	3	2	-	-	-	-	2	3	3	L4
CO5	3	3	3	3	3	2	-	-	-	-	2	3	3	L5

## SYLLABUS

### Unit I: Introduction to FACTS Power flow in an AC System

Loading capability limits – Dynamic stability considerations – Importance of controllable parameters – Basic types of FACTS controllers – Benefits from FACTS controllers – Requirements and characteristics of high-power devices – Voltage and current rating – Losses and speed of switching – Parameter trade-off devices.

### Unit II : Voltage source and Current source converters

Concept of voltage source converter (VSC) – Single phase bridge converter – Square-wave voltage harmonics for a single-phase bridge converter – Three-phase full wave bridge converter– Three-phase current source converter – Comparison of current source converter with voltage source converter.

### Unit III : Shunt Compensators

Objectives of shunt compensation – Mid-point voltage regulation for line segmentation – End of line voltage support to prevent voltage instability – Improvement of transient stability – Power oscillation damping. Thyristor Switched Capacitor (TSC) – Thyristor Controlled Reactor (TCR). Static VAR compensator (SVC) and Static Compensator (STATCOM): The regulation and slope transfer function and dynamic performance – Transient stability enhancement and power oscillation damping– Operating point control and summary of compensation control.

### Unit IV: Series Compensators

Static series compensators: Concept of series capacitive compensation – Improvement of transient stability – Power oscillation damping – Functional requirements. Static Synchronous Series Compensator (SSSC) - GTO thyristor-controlled Series Capacitor (GSC) – Thyristor Switched Series Capacitor (TSSC) and Thyristor Controlled Series Capacitor (TCSC).

### Unit V : Combined Controllers

Schematic and basic operating principles of Unified Power Flow Controller (UPFC) -Interline Power Flow Controller (IPFC)– Application.

### Text Books:

1. “Understanding FACTS” N.G.Hingorani and L.Guygi, IEEE Press. Indian Edition is available: Standard Publications, 2001.

2. “FACTS Controllers in Power Transmission and Distribution” Padiyar.K.R, New Age Int. Publishers, 2007

**Reference Books:**

1. “Flexible ac transmission system (FACTS)” Edited by Yong Hue Song and Allan T Johns, Institution of Electrical Engineers, London.
2. Thyristor-based FACTS Controllers for Electrical Transmission Systems, by R.Mohan Mathur and Rajiv K.Varma, Wiley

**Professional Elective-IV  
Design of PV systems  
IV B.TECH- I SEMESTER**

Course Title: <b>Design of PV systems</b>	Course Code: R24EEPE04.2
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: Basic knowledge of Electrical Circuits, Power Electronics, Renewable Energy Systems, Electrical Machines, and Control Systems is required to understand solar photovoltaic systems and grid integration techniques.	

**COURSE OBJECTIVES:**

- Understand the characteristics and modeling of PV cells and their interconnection.
- Learn solar energy fundamentals, insolation estimation, and PV system sizing.
- Explore MPPT techniques and converter integration for PV systems.
- Gain knowledge on battery interfaces, charge control, and water pumping using PV.
- Understand the principles and methods for interfacing PV systems with the grid.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Analyze PV cell behavior, efficiency, and protection methods in arrays.

CO2: Estimate solar energy on different surfaces and design basic PV systems.

CO3: Apply MPPT algorithms and DC-DC converter concepts to maximize PV output.

CO4: Design battery storage systems and apply PV for thermal and pumping needs.

CO5: Implement PV grid interface using modern control techniques and topologies.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	3	3	3	-	-	-	-	1	3	3	L4
CO2	3	3	3	3	3	3	-	-	-	-	2	3	3	L5
CO3	3	3	3	3	3	2	-	-	-	-	2	3	3	L5
CO4	3	3	3	3	3	3	-	-	-	-	2	3	3	L5
CO5	3	3	3	3	3	2	-	-	-	-	2	3	3	L5

## **SYLLABUS**

### **UNIT-I : PV Cell**

Historical Perspective, PV cell characteristics and equivalent circuit, model of PV cell, cell efficiency, I-V & P-V Characteristics - effect of temperature and irradiance, fill factor. Series and parallel connection of identical and non-identical cells, protecting cell in series and parallel, interconnecting modules, solar panels and PV System.

### **UNIT-II: Energy from Sun**

Insolation and irradiance, solar geometry, insolation and energy on horizontal plate, sunrise and sunset hour angles. Incident energy estimation: energy on a tilted flat plate, energy plots in octave, atmospheric effects, airmass, Sizing PV: sizing PV applications without batteries, Batteries, battery selection, PV system design.

### **UNIT-III : Maximum Power Point tracking**

MPPT concept – DC-DC converters, MPPT algorithms- Perturb & Observe, Incremental Conductance - Case study of PV system design with MPPT algorithm.

### **UNIT-IV: PV Battery Interfaces**

Direct PV- Battery connection, charge controller, battery charger, batteries in series and parallel. Peltier Cooling: Peltier device, Peltier element, thermal aspects and Water Pumping: water pumping principle, hydraulic energy and power, total dynamic head, centrifugal pumps, reciprocating pump.

### **UNIT-V: PV Grid Interface**

Grid connection principles, PV to Grid Topologies, 3phase d-q controlled grid connection- AC to DC transformation, DC to AC transformation, complete 3 phase grid connection. SVPWM-discrete and analog implementation, application of integrated magnetics.

#### **Text Books:**

1. Chenming, H. and White, R.M., Solar Cells from B to Advanced Systems, McGraw Hill Book Co, 1983.

#### **Reference Books:**

1. Ruschenbach, HS, Solar Cell Array Design Hand Varmostrand, Reinhold, NY, 1980
2. Proceedings of IEEE Photovoltaics Specialists Conferences, Solar Energy Journal.

**Professional Elective-IV  
Embedded System Design  
IV B.TECH- I SEMESTER**

Course Title: <b>Embedded System Design</b>	Course Code: R24EEPE04.3
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: Basic knowledge of Digital Electronics, Microprocessors, Computer Organization, Programming in C, and Electronic Circuits is required to understand embedded systems and their applications.	

**COURSE OBJECTIVES:**

- To provide an overview of Design Principles of Embedded System.
- To provide clear understanding about the role of firmware.
- To understand the necessity of operating systems in correlation with hardware systems.
- To learn the methods of interfacing and synchronization for tasking.

**COURSE OUTCOMES (COS)**

CO1: Understand the basic concepts, architecture, and applications of embedded systems.

CO2: Analyze the operation and applications of various processors and microcontrollers used in embedded systems.

CO3: Develop embedded hardware and software using appropriate development tools and design methodologies.

CO4: Understand the role of microcomputers, ASICs, PLDs, memory, and interfacing techniques in embedded systems.

CO5: Analyze the concepts of RTOS, sensors, memory interfaces, and communication interfaces in embedded applications.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	3	-	-	-	1	-	1	3	3	L2
CO2	3	3	2	3	3	-	-	-	2	-	1	3	3	L4

CO3	3	3	3	3	3	-	-	2	3	-	2	3	3	L5
CO4	3	3	2	2	3	-	-	-	2	-	1	3	3	L3
CO5	3	3	3	3	3	-	-	1	3	-	2	3	3	L4

## SYLLABUS

### Unit -I Introduction to Embedded Systems:

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

### Unit -II: Typical Embedded System:

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

### Unit -III: Embedded Firmware:

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

### Unit -IV: RTOS Based Embedded System Design:

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multi processing and Multi tasking, Task Scheduling.

### Unit -V: TASK COMMUNICATION:

**Task communication:** Shared Memory, Message Passing, Remote Procedure Call and Sockets,

**Task Synchronization:** Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

### Textbooks:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

### Reference Books:

1. Embedded Systems - Raj Kamal, TMH. systems.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013.
4. An Embedded Software Primer - David E. Simon, Pearson Education.

### e-Resources:

1. <http://nptel.ac.in/courses/108102045/> NPTEL
2. Embedded Systems 1. <http://nptel.ac.in/courses/108102045/> GATE SYLLABUS

**Professional Elective-IV**  
**AI and its Applications to Electrical Engineering**  
**IV B.TECH- I SEMESTER**

Course Title: <b>AI and its Applications to Electrical Engineering</b>	Course Code: R24EEPE04.4
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: This course introduces the fundamentals of Neural Networks, Artificial Neural Networks, and Fuzzy Logic systems along with their applications in Electrical Engineering and project development.	

**COURSE OBJECTIVES:**

- To understand artificial neuron models & learning methods of ANN.
- To utilize different algorithms of ANN.
- To distinguish between classical and fuzzy sets.
- To illustrate different modules of fuzzy controller.
- To analyze applications of neural networks and fuzzy logic.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Analyse different models of artificial neuron & Use learning methods of ANN.

CO2: Evaluate different paradigms of ANN.

CO3: Classify between classical and fuzzy sets.

CO4: Illustrate different modules of Fuzzy logic controller.

CO5: Apply Neural Networks and fuzzy logic for real-time applications.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	3	3	3	-	-	-	-	-	1	2	3	L4
CO2	3	3	3	3	3	-	-	-	-	-	1	2	3	L5
CO3	3	2	1	1	2	-	-	-	-	-	1	1	2	L2

CO4	3	3	2	2	3	-	-	-	-	-	1	2	3	L3
CO5	3	3	3	3	3	2	-	-	-	1	2	3	3	L3

## SYLLABUS

### UNIT – I : Introduction

Artificial Neural Networks (ANN) – Humans and computers – Biological neural networks – ANN Terminology – Models of Artificial neuron – activation functions – typical architectures – biases and thresholds – learning strategy (supervised - unsupervised and reinforced) – Neural networks learning rules. Single layer feed forward neural networks: concept of pattern and its types - perceptron training and classification using Discrete and Continuous perceptron algorithms – linear separability- XOR function.

### UNIT – II : Multi-layer feed forward networks

Generalized delta rule – Back Propagation algorithm – Radial Basis Function (RBF) network - Kohonen's self-organizing feature maps (KSOFM) - Learning Vector Quantization (LVQ) – Bidirectional Associative Memory (BAM) – Hopfield Neural Network.

### UNIT – III : Classical Sets and Fuzzy Sets

Introduction to classical sets- properties - Operations and relations - Fuzzy sets - Operations - Properties - Fuzzy relations - Cardinalities - Membership functions.

### UNIT – IV : Fuzzy Logic Modules

Fuzzification - Membership value assignment - development of rule base and decision making system - Defuzzification to crisp sets - Defuzzification methods.

### UNIT – V : Applications

**Neural network applications:** Load flow studies - load forecasting - reactive power control.

**Fuzzy logic applications:** Economic load dispatch - speed control of DC motors - single area and two area load frequency control.

#### Text Books:

1. Introduction to Artificial Neural Systems - Jacek M. Zurada - Jaico Publishing House - 1997.
2. Neural Networks - Fuzzy logic - Genetic algorithms: synthesis and applications by Rajasekharanand Pai – PHI Publication.

#### Reference Books:

1. Artificial Neural Network – B.Yegnanarayana - PHI - 2012.
2. Fuzzy logic with Fuzzy Applications – T.J Ross – Mc Graw Hill Inc - 1997.
3. Introduction to Neural Networks using MATLAB 6.0 – S N Sivanandam - SSumathi - S N Deepa TMGH
4. Introduction to Fuzzy Logic using MATLAB – S N Sivanandam - SSumathi - S N Deepa Springer - 2007.

**AI Applications to Power Systems Simulation Lab**  
**IV B.TECH- I SEMESTER**

Course Title: <b>AI Applications to Power System Simulation Lab</b>	Course Code: R24EESC05
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: Basic knowledge of Electrical Circuit Analysis, Power Systems, Electrical Machines, Control Systems, and fundamentals of power system operation and analysis.	

**COURSE OBJECTIVES:**

- To impart the practical knowledge of functioning of various power system components and determination of various parameters and simulation of load flows, transient stability, LFC and Economic dispatch.

**COURSE OUTCOMES:**

CO1: Analyze and estimate sequence impedances of alternators, transformers, and transmission line performance in power systems.

CO2: Apply and simulate power flow analysis methods and Load Frequency Control (LFC) using PI controllers for interconnected power systems.

CO3: Analyze and simulate transient stability and overall performance of power systems under different operating conditions.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	3	3	2	-	-	-	-	1	3	3	L4
CO2	3	3	3	3	3	2	-	-	2	2	2	3	3	L5
CO3	3	3	3	3	2	2	-	-	-	-	2	3	3	L4

**Any 3–5 experiments can be conducted from each section:**

**Section I: Power Systems Lab:****1. Estimation of sequence impedances of 3-phase Transformer**

2. Estimation of sequence impedances of 3-phase Alternator by Fault Analysis
3. Estimation of sequence impedances of 3-phase Alternator by Direct method
4. Estimation of ABCD parameters on transmission line model
5. Performance of long transmission line without compensation
6. Performance of long transmission line with shunt compensation
7. Analyze the Ferranti effect on long transmission line

## **Section II: Simulation Lab**

8. Determination of Ybus using direct inspection method
9. Load flow solution of a power system network using Gauss-Seidel method
10. Load flow solution of a power system network using Newton Raphson method.
11. Formation of Zbus by building algorithm.
12. Economic load dispatch with & without losses
13. Load frequency control of a two area Power System without & with PI controller
14. Transient Stability analysis of single machine connected to an infinite bus (SMIB) using equal area criterion.

## **Section III: AI Applications in Power Systems (Additional Experiments)**

**(Any 3–5 experiments can be conducted)**

### **1. Load Forecasting using Machine Learning (AI-Based)**

- Use regression models (Linear Regression / Random Forest) to predict short-term electrical load demand.
- Compare results with traditional statistical forecasting methods.
- Dataset: historical load data (utility/grid data or Kaggle datasets).

YouTube Reference:

Load Forecasting using Machine Learning in Power Systems

### **2. Fault Detection in Transmission Lines using AI**

- Apply classification algorithms (SVM / Decision Tree / ANN) to detect fault types (LG, LL, LLG, 3-phase faults).
- Improve fault identification speed compared to conventional methods.

YouTube Reference:

Power System Fault Detection using Machine Learning

### **3. Smart Grid Energy Consumption Prediction**

- Use AI models to predict household or industrial energy usage.
- Helps in demand-side management and smart grid optimization.

YouTube Reference:

Smart Grid Load Prediction using AI and Python

### **4. Optimal Power Flow using AI Optimization Techniques**

- Use Genetic Algorithm (GA) or Particle Swarm Optimization (PSO).
- Minimize generation cost while satisfying load demand constraints.

YouTube Reference:

Optimal Power Flow using Genetic Algorithm in Power Systems

### 5. Power System Anomaly Detection using Deep Learning

- Detect abnormal voltage/current patterns using Neural Networks or LSTM.
- Useful for predictive maintenance in smart grids.

YouTube Reference:

Anomaly Detection in Smart Grid using Deep Learning

### Indian Traditional Knowledge IV B.TECH- I SEMESTER

Course Title: <b>Indian Traditional Knowledge</b>	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
<b>Pre requisites:</b> 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:

CO1: Understand the concept of Traditional knowledge and its importance

CO2: Know the need and importance of protecting traditional knowledge

CO3: Know the various enactments related to the protection of traditional knowledge

CO4: Understand the concepts of Intellectual property to protect traditional knowledge

Course	<b>Mapping with POs and PSOs</b>	<b>DOK</b>
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Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	2	2	1	1	1	3	3	1	2	1	1	1	1	L2
CO2	2	2	1	1	1	3	3	1	2	1	1	1	1	L2
CO3	2	2	1	1	1	3	3	1	2	1	1	1	1	L2
CO4	2	2	1	1	1	3	3	1	2	1	1	1	1	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.

### 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.

### 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.

### 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.

### 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

### 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/>

**Employability Skills V  
Corporate Readiness for IT  
IV B. TECH- I SEMESTER**

Course Title: <b>Corporate Readiness for IT</b>	Course Code: R24HS11
Teaching Scheme (L:T:P): 0:0:2	Credits: 1
Type of Course: Practicals	
Continuous Internal Evaluation: 30 Marks	Semester End Exam: 70 Marks
Pre requisites: Basic knowledge of computer fundamentals, logical reasoning, mathematics, and problem-solving concepts with an interest in programming and software development.	

**COURSE OBJECTIVE:**

The course is designed to provide core engineering students with essential programming, web development, database, and AI fundamentals required for campus placements and entry-level software industry roles. It focuses on improving coding ability, analytical thinking, problem-solving skills, technical knowledge, and project development through practical and placement-oriented learning.

**COURSE OUTCOMES (COS):**

After successful completion of the course, students will be able to:

CO1: Apply programming and data structure concepts to solve campus placement coding problems.

CO2: Develop responsive frontend applications using modern web technologies.

CO3: Perform database operations and use SQL queries effectively in software applications.

CO4: Use APIs, Git Hub workflows, and software development tools for application development.

CO5: Demonstrate foundational AI knowledge, project development skills, teamwork, and technical interview readiness.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	3	2	3	-	-	1	2	-	2	3	3	L3
CO2	3	2	3	2	3	-	-	1	3	-	1	3	3	L3
CO3	3	3	3	3	3	-	-	1	2	-	1	3	3	L3
CO4	3	3	3	3	3	-	-	2	3	2	1	3	3	L3

CO5	3	3	3	2	3	2	2	3	3	3	2	3	3	L3
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## SYLLABUS

### UNIT-I: ADVANCED PROGRAMMING & DSA FOUNDATIONS

Programming Fundamentals, Algorithm Design and Problem Solving, Recursion, Time and Space Complexity Analysis, Asymptotic Notations, Arrays and Array Operations, Linked Lists, Stacks and Their Applications, Queues and Variants of Queues, Basics of Hashing and Hash Tables, Introduction to Trees and Tree Traversals, Searching Techniques, Sorting Algorithms, Coding Optimization Techniques, Pattern-Based Problem Solving, and Data Structures Applications for Technical Interview and Campus Placement Assessments.

#### Hands-on Skills

- Solving coding problems
- Implementing data structures
- Complexity analysis
- Competitive coding practice

### UNIT-II: WEB DEVELOPMENT FOUNDATIONS

Introduction to Web Technologies, HTML5 Elements and Forms, CSS3 Styling, JavaScript fundamentals, DOM manipulation, responsive layouts, API concepts, and introductory React development for modern user interface creation.

#### Hands-on Skills

- Building responsive web pages
- Creating interactive UI components
- Working with forms and APIs
- Developing small frontend projects

### UNIT-III: DATABASES & SQL FUNDAMENTALS

Database Fundamentals, Relational Database Concepts, SQL Queries, CRUD Operations, Data Definition and Manipulation Commands, Joins and Subqueries, Database Connectivity Concepts, Introduction to Backend Integration, and Database Applications in Software Development.

#### Hands-on Skills

- Writing SQL queries
- Performing CRUD operations
- Connecting applications with databases
- Database practice exercises

### UNIT-IV: APIs, GIT & SOFTWARE TOOLS

REST API Fundamentals, API Requests and Responses, API Testing Basics, Git and GitHub

Workflows, Version Control Concepts, Branching and Merging, Debugging Techniques and Tools, Collaboration Practices, and Introduction to Application Deployment.

### **Hands-on Skills**

- Connecting frontend with APIs
- Git workflow management
- API testing practice
- Deploying simple applications

## **UNIT-V: AI FOUNDATIONS & PROJECT DEVELOPMENT**

Introduction to Artificial Intelligence, Datasets and Data Handling, NumPy and Pandas Basics, AI APIs and Applications, Prompt Engineering Fundamentals, Project Planning and Execution, Team Collaboration, Documentation Practices, Resume Building, Technical Interview Preparation, and Capstone Project Development.

### **Hands-on Skills**

- Working with datasets
- Using AI APIs
- Building simple AI-enabled applications
- Team collaboration and presentation

### **Text Books**

1. Reema Thareja, *Programming in C*, Oxford University Press, India.
2. Jon Duckett, *HTML & CSS: Design and Build Websites*, Wiley India Publications.
3. Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems*, Pearson India.

### **Reference Books**

1. Narasimha Karumanchi, *Data Structures and Algorithms Made Easy*, CareerMonk Publications, India.
2. Eloquent JavaScript by Marijn Haverbeke, *A Modern Introduction to Programming*, No Starch Press.
3. Sumita Arora, *Computer Science with Python*, Dhanpat Rai Publications.

### **Web Links**

1. Geeks for Geeks Programming & DSA
2. MDN Web Docs
3. W3Schools Learning Platform

**Professional Elective-V**  
**Electric Vehicles & Battery management system**  
**IV B.TECH- II SEMESTER**

Course Title: <b>Electric Vehicles &amp; Battery management system</b>	Course Code: R24EEPE05.1
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: Basic knowledge of electrical circuits, power systems, and electrical machines.	

**COURSE OBJECTIVES:**

- To understand renewable energy systems.
- To learn different renewable energy sources.
- To study smart grid technologies.
- To understand energy management systems.
- To apply renewable energy and smart grid concepts in power systems.

**COURSE OUTCOMES:**

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

CO1: Understand renewable energy sources and systems.

CO2: Explain the operation of solar and wind energy systems.

CO3: Understand smart grid concepts and technologies.

CO4: Apply energy management and monitoring techniques.

CO5: Analyze renewable energy integration with smart grids.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO2	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO3	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO4	3	3	3	3	3	3	-	-	-	2	2	3	3	L3

CO5	3	3	3	3	3	3	-	-	-	2	2	3	3	L4
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## SYLLABUS

### UNIT – I: Introduction to Renewable Energy Systems

Introduction to renewable energy, need for renewable energy, conventional and non-conventional energy sources, types of renewable energy systems, energy scenario.

**Applications:** Power generation, rural electrification, sustainable energy systems.

### UNIT – II: Solar and Wind Energy Systems

Solar radiation, solar photovoltaic systems, solar thermal systems, wind energy conversion systems, wind turbines, energy storage systems.

Applications: Solar power plants, wind farms, hybrid energy systems.

### UNIT – III: Other Renewable Energy Sources

Biomass energy, biogas plants, geothermal energy, tidal energy, fuel cells, small hydro power plants.

Applications: Distributed generation, clean energy systems

### UNIT – IV: Smart Grid Fundamentals

Introduction to smart grid, smart grid architecture, smart meters, communication systems, distributed generation, demand side management, energy management systems.

**Applications:** Smart homes, smart cities, intelligent power systems

### UNIT – V: Renewable Energy Integration and Smart Grid Applications

Integration of renewable energy into smart grids, grid stability, power quality, electric vehicles, microgrids, smart grid protection, future trends in smart grids.

**Applications:** Electric vehicle charging systems, smart energy management, intelligent distribution systems.

### Text Books

1. G. M. Masters, *Renewable and Efficient Electric Power Systems*, Wiley.
2. Stuart Borlase, *Smart Grid: Infrastructure, Technology and Solutions*, CRC Press.

### Reference Books

3. John Twidell and Tony Weir, *Renewable Energy Resources*, Routledge.
4. Gilbert M. Masters, *Introduction to Environmental Engineering and Science*, Pearson.

### Online Learning Resources

3. NPTEL – Renewable Energy Engineering
4. NPTEL – Smart Grid

**Professional Elective-V**  
**Switched Mode Power Conversion**  
**IV B.TECH- II SEMESTER**

Course Title <b>Switched Mode Power Conversion</b>	Course Code: R24EEPE05.2
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: Basic knowledge of Electrical Circuits, Power Electronics devices, Analog Electronics, Control Systems, Magnetic Circuits, and DC–DC converter fundamentals.	

**COURSE OBJECTIVES:**

- Understand the fundamentals and operating modes of various SMPS topologies including Cuk converters.
- Learn thyristor commutation methods and device selection for SMPS.
- Explore transformer-isolated converter types and their configurations.
- Study the design of magnetic components used in power converters.
- Analyze switching regulator control and the benefits of soft-switching techniques.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Explain the principles and operating modes of Cuk and related converters.

CO2: Classify and compare various commutation techniques and select suitable devices for SMPS.

CO3: Analyze transformer-isolated converter topologies like flyback, forward, and push-pull.

CO4: Design magnetic components tailored for different converter applications.

CO5: Apply small-signal modeling and evaluate performance of soft-switched converters.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	2	3	-	-	-	-	-	1	3	3	L4

CO2	3	3	2	2	3	-	-	-	-	-	1	3	3	L4
CO3	3	3	3	3	3	-	-	-	-	-	2	3	3	L4
CO4	3	3	3	3	3	-	-	-	-	-	2	3	3	L5
CO5	3	3	3	3	3	-	-	-	-	-	2	3	3	L5

## SYLLABUS

### UNIT-I

Introduction to Switch Mode Power Converters - about Switch Mode Power Conversion, SMPS requirements. Cuk converters - and their principles of operation; continuous and discontinuous modes of operation.

### UNIT-II

Thyristor Commutation Techniques - Review of Recent developments in power devices for switch mode power supplies. Selection of devices, Commutation: Load Commutation, Resonant Pulse Commutation, Complementary Commutation, Impulse Commutation, External Pulse Commutation.

### UNIT-III

Transformer-Isolated Converters Single-switch and multi-switch transformer-isolated DC-DC converters. Flyback and forward converters; transformer isolated half-bridge, full - bridge converters. Push-pull converters. Voltage fed and current-fed converters.

### UNIT-IV

Magnetic Component Design Magnetic core materials and performance; basic inductor and transformer design; practical magnetic design; design aspects to be considered for designing transformers for specific applications – flyback, push-pull converters.

### UNIT-V

Switching Regulator Control, Soft-Switched Dc-Dc Power Converters Small-signal models for switching regulators. Performance analysis and design of closed-loop system under different control methods, and operating modes. Measurement of small signal transfer functions. Soft Switched DC-DC Power Converters -Motivation. Hard-switching vs soft-switching.

### Text Books:

1. N Mohan, T M Undeland and W P Robbins, "Power Electronics: Converters, Applications and Design", Wiley, 3rd Edition, 2007
2. Abraham Pressman, Keith Billings, Taylor Morey, "Switching Power Supply Design", McGraw-Hill.3rd Edition, 2009

### Reference Books:

1. K. Kit Sum, Switch Mode Power Conversion: Basic Theory and Design 1st Edition, Kindle Edition,2017

### Web Links:

1. <https://nptel.ac.in/courses/108108036>

**Professional Elective-V  
Electrical Distribution System  
IV B.TECH- II SEMESTER**

Course Title: <b>Electrical Distribution System</b>	Course Code: R24EEPE05.3
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 Basic knowledge of Electrical Circuits, Power Systems, Electrical Machines, Transmission & Distribution systems, and Power System Protection concepts.	

**COURSE OBJECTIVES:**

- Understand the basic structure, load characteristics, and factors influencing distribution systems.
- Learn substation placement and feeder design for efficient distribution networks.
- Analyze voltage drop and power loss in various load conditions across distribution lines.
- Explore protective devices and their coordination in distribution systems.
- Study compensation techniques for power factor and voltage control in distribution networks.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to

CO1: Classify different loads and apply factors like load factor, loss factor, and coincidence factor in system planning.

CO2: Design optimal substation locations and feeder layouts for radial and loop systems.

CO3: Calculate voltage drops and power losses in distribution lines with various loading scenarios.

CO4: Select and coordinate protection devices to ensure safety and reliability of the distribution system.

CO5: Implement capacitive compensation and voltage control methods for system efficiency and economy.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02		

CO1	3	3	2	3	2	2	-	-	-	-	2	3	3	L3
CO2	3	3	3	3	3	2	-	-	-	-	2	3	3	L5
CO3	3	3	3	3	3	2	-	-	-	-	2	3	3	L4
CO4	3	3	3	3	3	2	-	-	-	-	2	3	3	L5
CO5	3	3	3	3	3	3	-	-	-	-	2	3	3	L4

## SYLLABUS

### UNIT – I : General Concepts

Introduction to distribution systems, Load modeling and characteristics – Coincidence factor – Contribution factor-loss factor – Relationship between the load factor and loss factor – Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

### UNIT – II : Substations & Distribution Feeders

Location of substations: Rating of distribution substation – Service area with ‘n’ primary feeders – Benefits and methods of optimal location of substations.

Design Considerations of distribution feeders: Radial and loop types of primary feeders – Voltage levels – Feeder loading – Basic Design practice of the secondary distribution system.

### UNIT – III : System Analysis

Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines – Uniformly distributed loads and non-uniformly distributed loads – Numerical problems - Three phase balanced primary lines.

### UNIT – IV : Protective devices and Coordination

Objectives of distribution system protection – Types of common faults and procedure for fault calculations for distribution system – Protective devices: Principle of operation of fuses – Circuit reclosures – Line sectionalizers and circuit breakers, Coordination of protective devices, General coordination procedures - Various types of coordinated operation of protective devices - Residual Current Circuit Breaker

### UNIT – V : Compensation for Power Factor Improvement and Voltage Control

Capacitive compensation for power factor control – Different types of power capacitors – shunt and series capacitors – Effect of shunt capacitors (Fixed and switched) – Power factor correction – Capacitor allocation – Economic justification – Procedure to determine the best capacitor location. Equipment for voltage control – Effect of series capacitors – Effect of AVB/AVR – Line drop compensation – Numerical problems.

**Text Book:**

1. “Electric Power Distribution system, Engineering” – by Turan Gonen, McGraw–hill Book Company.

**Reference Books:**

1. Electrical Distribution Systems by Dale R.Patrick and Stephen W.Fardo, CRC press
2. Electric Power Distribution – by A.S. Pabla, Tata McGraw–hill Publishing company, 4th edition, 1997.
3. Electrical Power Distribution Systems by V.Kamaraju, Right Publishers

**Professional Elective-V  
Electrical Power Quality  
IV B.TECH- II SEMESTER**

Course Title: <b>Electrical Power Quality</b>	Course Code: R24EEPE05.4
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: Power Systems and Power Electronics	

**COURSE OBJECTIVES:**

- Understand the fundamentals and significance of power quality in electrical power systems.
- Analyze various power quality disturbances such as voltage sag, swell, interruptions, transients, and harmonics.
- Study power quality standards, voltage regulation, and power factor improvement techniques.
- Learn the causes, effects, and mitigation methods of harmonics in power systems.
- Explore power quality monitoring methods and the use of measuring instruments for analysis and assessment.

**COURSE OUTCOMES:**

At the end of this course the student should be able to:

CO1: Differentiate between different types of power quality problems.

CO2: Explain the sources of voltage sag / swell, interruptions, transients, long duration over Voltages and harmonics in a power system and power quality standards.

CO3: Explain the principle of voltage regulation and power factor improvement methods.

CO4: Describe causes and mitigation of harmonics.

CO5: Explain the power quality monitoring concepts and the usage of measuring instruments.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	

CO1	3	2	1	2	2	2	-	-	-	-	1	3	3	L2
CO2	3	3	2	3	3	2	-	-	-	-	1	3	3	L2
CO3	3	3	2	3	3	3	-	-	-	-	2	3	3	L3
CO4	3	3	2	3	3	3	-	-	-	-	1	3	3	L2
CO5	3	3	2	3	3	2	-	-	-	-	2	3	3	L3

## SYLLABUS

### UNIT-I: INTRODUCTION

Overview of power quality – Concern about the power quality – General classes of power quality and voltage quality problems – Transients – Long–duration voltage variations – Short– duration voltage variations – Voltage unbalance – Waveform distortion – Voltage fluctuation – Power frequency variations - CBEMA and ITI Curves.

### UNIT-II: VOLTAGE IMPERFECTIONS IN POWER SYSTEMS

Power quality terms – Voltage sags – Voltage swells and interruptions – Sources of voltage sag, swell and interruptions – Nonlinear loads – IEEE and IEC standards. Source of transient over voltages – Principles of over voltage protection – Devices for over voltage protection – Utility capacitor switching transients, mathematical modeling of transients for short circuits.

### UNIT-III: VOLTAGE REGULATION AND POWER FACTOR IMPROVEMENT

Principles of regulating the voltage – Device for voltage regulation – Utility voltage regulator application – Capacitor for voltage regulation – End–user capacitor application – Regulating utility voltage with distributed resources – Flicker – Power factor penalty – Static VAR compensations for power factor improvement

### UNIT- IV: HARMONIC DISTORTION AND SOLUTIONS

Voltage distortion vs. Current distortion – Harmonics vs. Transients – Harmonic indices – Sources of harmonics – Effect of harmonic distortion – Impact of capacitors, transformers, motors and meters – Point of common coupling – Passive and active filtering – Numerical problems.

### UNIT-V: MONITORING AND INSTRUMENTATION

Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data – Application of intelligent systems – PQ monitoring standards.

#### TEXT BOOK:

1. Dugan R C, Mc Granaghan M F, Santoso S, and Beaty H W, “Electrical Power Systems Quality”, Second Edition, McGraw–Hill, 3rd edition, 2012.

#### REFERENCE BOOKS:

1. Bollen M HJ, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, First Edition, IEEE Press, 2000.

2. Kennedy B W, “Power Quality Primer”, First Edition, McGraw–Hill, 2000.
3. Arrillaga J and Watson N R, “Power System Harmonics”, Second Edition, John Wiley& Sons, 2003.
4. W. E. Kazibwe and M. H. Sendaula, “Electric Power Quality Control Techniques”, Van Nostrand Reinhold, NewYork.
5. C. Shankaran, “Power Quality” CRC Press,2001 6. Franciso C DeLaRosa, “Harmonics and Power Systems” CRC Press (Taylor & Francis)

**WEB RESOURCES:**

1. <https://nptel.ac.in/courses/108106025/>
2. <https://storage.googleapis.com/uniquecourses/course.html>

**Professional Elective-V**  
**Special Electrical Machines for Industrial Applications**  
**IV B.TECH- II SEMESTER**

Course Title: <b>Special Electrical Machines for Industrial Applications</b>	Course Code: R24EEPE05.5
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: Electrical Circuit Analysis, Electrical Machines-I, II and Power Electronics	

**COURSE OBJECTIVES**

1. To introduce the construction, principle of operation, and control techniques of special electrical machines.
2. To analyze the characteristics and performance of Switched Reluctance Motors (SRM) and Servo Motors used in industrial applications.
3. To understand the properties of permanent magnet materials and the operation of Permanent Magnet Synchronous Motors (PMSM).
4. To study the construction, working, control strategies, and applications of Brushless DC (BLDC) motors.
5. To develop knowledge on the operating principles, modes of excitation, and performance evaluation of Stepper Motors.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Estimate the sequence impedances of 3-phase Transformer and Alternators

CO2: Evaluate the performance of transmission lines

CO3: Analyse and simulate power flow methods in power systems

CO4: Analyse and simulate the performance of PI controller for load frequency control.

CO5: Analyse and simulate stability studies of power systems

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	3	3	2	-	-	-	-	1	3	3	L4
CO2	3	3	3	3	3	2	-	-	-	-	1	3	3	L4
CO3	3	3	3	3	3	2	-	-	2	2	2	3	3	L4
CO4	3	3	3	3	3	2	-	-	2	2	2	3	3	L4
CO5	3	3	3	3	3	2	-	-	2	2	2	3	3	L4

## SYLLABUS

### UNIT-I: SWITCHED RELUCTANCE MOTORS (SRM)

Switched Reluctance Motor (SRM) Constructional features, Principle of operation, Torque equation, Characteristics, Power Converter Circuits, Basic Drive – Concept, Control of SRM.

### UNIT-II: SERVOMOTORS

Servomotors, AC and DC servo motors, Constructional features, and Principle of operation, Torque production, Performance Characteristics, applications and Transfer function.

### UNIT-III: PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)

Permanent magnet materials and motors, Principle of operation, EMF and torque equation, Torque speed characteristics, Comparisons of conventional and PM synchronous motor, Transfer function of PMSM, and closed loop control scheme of PMSM.

### UNIT-IV: PERMANENT MAGNET BRUSHLESS DC (BLDC) MOTORS

Constructional features, Principle of operation, Commutation in DC motors, Difference between mechanical and electronic commutators, Types of BLDC motors, EMF and torque equation, Torque speed characteristics, Drives - concept and Control of BLDC motors.

### UNIT-V-STEPPER MOTORS

Constructional features, Principle of operation, Modes of excitation, Torque production in Variable Reluctance (VR) stepping motor, dynamic characteristics, Drive system and circuit for open loop control, closed loop control, and areas of applications.

#### Text Books:

1. E.G. Janardanan “Special Electrical Machines” PHI Learning Private Limited, Delhi First Edition reprinted in 2014. (Unit I, II, III, IV and V)
2. K. Venkataratnam “Special Electrical Machines” Universities Press (India) Private Limited, Hyderabad, First Edition reprinted in 2013.

#### Reference Books:

1. R.S.Krishnan “Switched Reluctance Motor Drives: Modeling Simulation Analysis, Design and Application” CRC press 2001.
2. R.S.Krishnan “Permanent Magnet Synchronous Motor and Brushless DC Motor Drives” Rc press First edition, 2002.
3. Kenjo, T “ Stepping Motor and their Microprocessor control”, Clarendon press Oxford, Second edition, 1989.

**Web References:**

1. <https://nptel.ac.in/courses/108102156>
2. <https://unacademy.com/course/special-electrical-machines/21AZBGE3>
3. [https://books.google.co.in/books/about/SPECIAL\\_ELECTRICAL\\_MACHINES.html?id=CttzAgAAQBAJ&redir\\_esc=y](https://books.google.co.in/books/about/SPECIAL_ELECTRICAL_MACHINES.html?id=CttzAgAAQBAJ&redir_esc=y).

**Open Elective-I**  
**Concepts of Optimization Techniques**  
**III B.TECH- I SEMESTER**

Course Title: <b>Concepts of Optimization Techniques</b>	Course Code: R24EEOE1.1
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: Fundamental knowledge of programming and electrical engineering concepts.	

**COURSE OBJECTIVES:**

- To know the importance of adopting optimization techniques in day to day life.
- To analyse the importance of various types of constraints at various stages.
- To learn more on linear & nonlinear programming concepts.
- To analyse the significance of transportation problem.
- To learn the concepts of dynamic programming.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: State and formulate the optimization problem without and with constraints, also apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints and arrive at an optimal solution.

CO2: Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.

CO3 : Formulate a mathematical model and apply non-linear programming techniques for unconstrained and constrained case studies.

CO4: Solve transportation and assignment problem by using Linear programming Simplex method.

CO5: Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	3	3	2	-	-	-	-	-	2	2	2	L5
CO2	3	3	3	3	3	-	-	-	-	-	2	2	2	L5
CO3	3	3	3	3	3	-	-	-	-	-	2	2	2	L5
CO4	3	3	3	3	3	-	-	-	-	-	2	2	2	L5
CO5	3	3	3	3	3	-	-	-	-	-	2	2	2	L5

## SYLLABUS

### UNIT – I : Introduction to Optimization Techniques

Statement of an Optimization problem – design vector – design constraints – objective function – classification of Optimization problems.

#### Classical Optimization Techniques

Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers.

### UNIT – II : Linear Programming

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

### UNIT – III : Nonlinear Programming

**Unconstrained cases** - One – dimensional minimization methods: Classification - Fibonacci method and Quadratic interpolation method - Univariate method - Powell's method.

**Constrained cases** - Characteristics of a constrained problem - Classification - Basic approach of Penalty Function method.

### UNIT – IV : Transportation Problem

Finding initial basic feasible solution by north – west corner rule - least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem.

### UNIT – V : Dynamic Programming

Dynamic programming - Multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution

**Text Books:**

1. “Engineering optimization: Theory and practice”-by S. S.Rao- New Age International (P) Limited - 3rd edition - 1998.
2. “Introductory Operations Research” by H.S. Kasene& K.D. Kumar - Springer (India) 2013.

**Reference Books:**

1. “Optimization Methods in Operations Research and systems Analysis” – by K.V. Mital and C. Mohan - New Age International (P) Limited - Publishers - 3rd edition - 1996.
2. Operations Research – by Dr. S.D.Sharma- Kedarnath - Ramnath& Co - 2012.
3. “Operations Research: An Introduction” – by H.A.Taha - PHI pvt. Ltd. - 6th edition
4. Linear Programming–by G.Hadley.

**Open Elective-I**  
**Electrical Machine Design**  
**III B.TECH- I SEMESTER**

Course Title: <b>Electrical Machine Design</b>	Course Code: R24EEOE1.2
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: Basics of Conservation of Electrical Energy	

**COURSE OBJECTIVES:**

- To introduce the fundamental principles of electrical machine design
- To Analyze and apply thermal and mechanical considerations.
- To understand the selection and role of magnetic, electric, and insulating materials
- To explore the application of Computer Aided Design (CAD)
- To develop analytical skills to formulate and solve design-oriented problems

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Analyze the design factors and modern trends in electrical machine design.

CO2: Design different types of electrical machines based on performance requirements.

CO3: Evaluate materials and cooling methods for optimized machine performance.

CO4: Apply analytical and CAD tools for efficient machine design.

CO5: Solve design-oriented numerical problems and optimize parameters under constraints

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	2	2	-	-	-	-	-	1	3	3	L4
CO2	3	3	3	3	3	-	-	-	-	-	2	3	3	L5

CO3	3	3	3	3	3	2	-	-	-	-	1	3	3	L5
CO4	3	3	2	3	3	-	-	-	2	-	2	3	3	L3
CO5	3	3	3	3	3	-	-	-	-	-	2	3	3	L4

## SYLLABUS

### UNIT–I: Fundamental Aspects of Electrical Machine Design

Design of machines - design factors - limitation in design - modern trends in electrical machine design – types of magnetic, electric and insulating materials – modes of heat dissipation – cooling of rotating machines – methods of cooling.

### UNIT–II: Design of transformers

Transformer windings – output equation – design of main dimensions – design of core - choice of flux density – determination of number of turns and length of mean term - resistance and leakage reactance – no load current calculation –cooling of transformers- calculation of number of tubes.

### UNIT–III: Design of DC Machines

Output equation –selection of specific magnetic and electric loadings - separation of D and L – estimation of number of conductors, armature slots and conduct dimensions – choice of number of poles and calculation of length of air gap – design of field systems, interpoles and brushes.

### UNIT–IV: Design of Induction motors

Output equation -main dimensions – choice of average flux density and ampere conduction for meter — design of stator slots and rotor slots- design of rotor bars end rings– design of wound rotor – design of no-load current.

### UNIT–V : Design of Synchronous Machines

Types of construction – output equation - main dimensions – short circuit ratio and its effects on the performance – design of rotor –Design of field winding – Design of turbo alternators – Rotor design temperature rise and its effects.

#### Text Books:

1. A.K.Sawhney , “A Course in Electrical Machines Design” , Dhan path Rai & Co. 6th edition 2010

#### Reference Books:

1. AE Clayton and NN Hancock, “The Performance and Design of Direct Current Machines”, CBS Publishers, 3rd edition, 2004.
2. M.G. Say, “Performance and Design of A.C. Machines”, ELBS and Pitman & Sons, 4th edition, 2013.
3. S. K. Sen, “Principles of Electrical Machine Design with computer programmes”, Oxford and IBH Company Pvt. Ltd. New Delhi, 2nd edition,2006.

4. K. M. Vishnu Murthy, “Computer Aided Design of Electrical Machines”, B.S. Publications, 1st edition 2008.

**Online Learning Resources:**

1. <https://cusp.umn.edu/electric-machine-design-videos>
2. <https://nptel.ac.in/courses/108102146>
3. <https://nptel.ac.in/courses/108/105/108105017>

**Open Elective-I  
Intelligent Control Systems  
III B.TECH- I SEMESTER**

Course Title: <b>Intelligent Control Systems</b>	Course Code: R24EEOE1.3
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: Basic knowledge of Control Systems, Electrical and Electronic Circuits, Signals and Systems, Programming, and Mathematics.	

**COURSE OBJECTIVES:**

- To introduce the fundamentals of intelligent control systems and their applications in modern engineering.
- To develop the ability to design intelligent controllers for complex, nonlinear, and uncertain systems.
- To explore various intelligent control techniques, including fuzzy logic, neural networks, genetic algorithms, and hybrid systems.
- To implement intelligent control systems using real-world applications in robotics, automation, and process control.
- To study the hybridization of different intelligent techniques to improve the performance of control systems

**COURSE OUTCOMES:**

After the completion of the course the student should be able to

CO1: Explain the fundamental principles of intelligent control systems and their components.

CO2: Develop artificial neural networks (ANNs) and apply them for control system applications.

CO3: Design and implement fuzzy logic controllers for nonlinear systems.

CO4: Apply genetic algorithms (GA) for optimization and controller tuning in intelligent control systems.

CO5: Analyze and solve complex control problems using hybrid intelligent techniques

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	2	2	-	-	-	-	-	1	2	3	L2
CO2	3	3	3	3	3	-	-	-	-	-	2	2	3	L5
CO3	3	3	3	3	3	-	-	-	-	-	2	2	3	L5
CO4	3	3	3	3	3	-	-	-	-	-	2	2	3	L5
CO5	3	3	3	3	3	-	-	-	-	-	2	2	3	L4

## SYLLABUS

### UNIT-I : Introduction to Intelligent Control Systems

Overview of traditional control systems vs. intelligent control systems. Intelligent control paradigms: Fuzzy Logic, Neural Networks, Genetic Algorithms, Expert Systems. Components and structure of intelligent control systems. Advantages and limitations of intelligent control. Applications of intelligent control systems in various industries.

### UNIT-II : Artificial Neural Networks (ANNs)

Biological foundations of neural networks. Neurons, activation functions, and architecture of ANNs. Supervised and unsupervised learning algorithms. Perceptrons and multi-layer perceptrons (MLP). Backpropagation algorithm and gradient descent. Applications of neural networks in control system design. Training neural networks for control applications.

### UNIT-III: Fuzzy Logic Systems

Introduction to fuzzy sets and membership functions, Linguistic variables and fuzzy rules. Fuzzy inference systems: Mamdani and Sugeno methods. Defuzzification techniques: centroid, mean of maximum, etc. Fuzzy controllers design for nonlinear systems. Applications of fuzzy logic in control systems.

### UNIT-IV: Genetic Algorithms (GAs)

Fundamentals of genetic algorithms: selection, crossover, mutation, and fitness function. Representation of solutions in GAs (chromosomes). GA-based optimization for control system design. Hybrid GA-based optimization and neural networks. Applications of GAs in optimizing controllers for complex systems. Tuning control parameters using genetic algorithms with an example.

### UNIT-V: Hybrid Intelligent Systems and Applications

Overview of hybrid systems: combining fuzzy logic, neural networks, and genetic algorithms. Neuro-fuzzy systems and their design. Adaptive control using hybrid intelligent systems.

Case studies: Intelligent control in robotics, process control, and automation. Real-time applications and challenges in intelligent control systems. Simulation tools for implementing intelligent control systems

(MATLAB, Simulink, etc.).

**Textbooks:**

1. "Fuzzy Control Systems" by Driankov, Hellen Doorn, and Rein frank.
2. "Neural Networks for Control" by W. Thomas Miller II and Richard S. Sutton
3. "Genetic Algorithms in Search, Optimization, and Machine Learning" by David E. Goldberg
4. "Fuzzy Logic with Engineering Applications" by Timothy J. Ross

**Reference Books:**

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig.
2. "Intelligent Control Systems with LabVIEW" by D. R. Kiran and R. K. Gupta.
3. "Soft Computing and Intelligent Systems Design" by P. S. Karray and D. de Silva.

**Open Elective-I  
Renewable Energy Sources  
III B.TECH- I SEMESTER**

Course Title: <b>Renewable Energy Sources</b>	Course Code: R24EEOE1.4
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: Basic Electrical Engineering	

**COURSE OBJECTIVES:**

- To study the solar radiation data, equivalent circuit of PV cell and it's I-V & P-V characteristics.
- To understand the concept of Wind Energy Conversion & its applications.
- To study the principles of biomass, hydel and geothermal energy.
- To understand the principles of ocean Thermal Energy Conversion, waves and power associated with it.
- To study the various chemical energy sources such as fuel cell and hydrogen energy along with their operation and equivalent circuit.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage.

CO2: Illustrate the components of wind energy systems.

CO3: Illustrate the working of biomass, hydel plants and Geothermal plants.

CO4: Demonstrate the principle of Energy production from OTEC, Tidal and Waves.

CO5: Evaluate the concept and working of Fuel cells & MHD power generation.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	3	3	3	-	-	-	-	1	3	3	L4
CO2	3	2	1	2	2	3	-	-	-	-	1	3	3	L2

CO3	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO4	3	3	2	3	3	3	-	-	-	-	2	3	3	L3
CO5	3	3	3	3	3	3	-	-	-	-	2	3	3	L4

## SYLLABUS

### UNIT-I: Solar Energy

Introduction - Renewable Sources - prospects, solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.

### UNIT-II : Wind Energy

Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.

### UNIT-III : Biomass, Hydel and Geothermal Energy

**Biomass:** Introduction - Biomass conversion technologies- Photosynthesis. Factors affecting Bio digestion.

**Hydro plants:** Basic working principle – Classification of hydro systems: Large, small, micro hydel plants.

**Geothermal Energy:** Introduction, Geothermal Sources – Applications - operational and Environmental problems.

### UNIT-IV: Energy From oceans, Waves & Tides

**Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India.

**Waves:** Introduction - Energy and Power from the waves - Wave Energy conversion devices.

**Tides:** Basic principle of Tide Energy -Components of Tidal Energy.

### UNIT-V: Chemical Energy Sources

**Fuel Cells:** Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications.

**Hydrogen Energy:** Introduction - Methods of Hydrogen production - Storage and Applications

**Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation - Types.

#### Text Books:

1. G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.
2. John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

#### Reference Books:

1. S.P.Sukhatme & J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011.
2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2<sup>nd</sup> edition, 2013.
3. ShobaNath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.

**Online Learning Resources:**

1. <https://archive.nptel.ac.in/courses/103/103/103103206>
2. <https://archive.nptel.ac.in/courses/103/107/103107157>

**Open Elective-I**  
**Concepts of Power System Engineering**  
**III B.TECH- I SEMESTER**

Course Title: <b>Concepts of Power System Engineering</b>	Course Code: R24EEOE1.5
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: Basic knowledge of Electrical Circuits, Electromagnetic Fields, Electrical Machines, and Network Analysis.	

**COURSE OBJECTIVES:**

- To understand the types of electric power plants and their working principles.
- To understand the concepts of electric power transmission and distribution.
- To gain the knowledge of protection and grounding of power system components.
- To know the economic aspects of electrical energy.
- To learn the importance of power factor improvement and voltage control.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Know the concepts of power generation by various types of power plants.

CO2: Learn about transmission line concepts and distribution systems schemes.

CO3: Learn about protection equipment's and grounding methods of power system.

CO4: Know the economic aspects of electrical energy and their importance.

CO5: Know the importance of power factor improvement and voltage control in power systems.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO2	3	2	1	2	2	3	-	-	-	-	1	3	3	L2

CO3	3	3	2	3	3	3	-	-	-	-	1	3	3	L2
CO4	3	2	1	2	2	2	-	-	-	-	1	2	2	L2
CO5	3	3	2	3	3	3	-	-	-	-	1	3	3	L2

## SYLLABUS

### UNIT – I: Power Generation Concepts & Types

Generation and sources of Energy – working principle and Schematic diagram approach of Thermal Power Plant – Hydro Power Plant - Nuclear Power Plant – Gas Power Plants – Comparison between Power Plants.

### UNIT – II: Transmission and Distribution Concepts

Types of Conductors Materials – Constants of Transmission Line – Classification of Overhead Transmission Lines – Performance of Short Transmission Lines – Simple Problems.

Basic concept of Sub Station – Distribution Systems – Connection Schemes of Distribution Systems – Structure of Cables – Differences between Overhead & Underground systems.

### UNIT – III: Protection and Grounding

List of Faults – Basic concepts of fuse – Circuit Breakers – Relays – SF<sub>6</sub> Circuit Breakers – Vacuum Circuit Breakers – Operation of Lightning Arrester – Grounding and its advantages - Methods of Neutral Grounding: Resistance - Reactance and Resonant Grounding – Numerical Problems.

### UNIT – IV: Economic Aspects

Definitions of Load - Load & Load Duration Curves - Load Factor - Demand Factor – Utilization Factor – Types of Tariff - Cost of Electrical Energy – Expression for Cost of Electrical Energy – Numerical Problems

### UNIT – V: Power Factor Improvement and Voltage Control

Power Factor – Effects and Causes of low Power Factor- Shunt & Series Capacitor Compensation - Numerical Problems – Need of Voltage Control – Types of Voltage regulating Devices.

#### Text Books:

1. Principles of Power System by V.K.Mehata - Rohit Mehata - S.Chand Publishers.

#### Reference Books:

1. Electrical Power Systems by C.L.Wadwa - New Age International Publishers.

**Open Elective-II**  
**Fundamentals of Electric Vehicles**  
**III B.TECH- II SEMESTER**

Course Title: <b>Fundamentals of Electric Vehicles</b>	Course Code: R24EEOE2.1
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: Basic knowledge in Physics, Chemistry and Basics of Electrical and Electronics.	

**COURSE OBJECTIVES:**

- To familiarize the students with the need and advantages of electric and hybrid electric vehicles.
- To understand various power converters used in electric vehicles.
- To be familiar all the different types of motors suitable for electric vehicles.
- To know various architecture of hybrid electric vehicles.
- To have knowledge on latest developments in batteries and other storage systems.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Illustrate the use and advantages of different types of electric vehicles.

CO2: Use suitable power converters for EV application.

CO3: Select suitable electric motor for EV power train.

CO4: Design HEV configuration for a specific application.

CO5: Analyse various storage systems and battery management system for EVs.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO2	3	3	3	2	3	2	-	-	-	-	1	3	3	L3

CO3	3	3	3	2	3	2	-	-	-	-	1	3	3	L3
CO4	3	3	3	3	3	2	-	-	-	-	2	3	3	L5
CO5	3	3	2	3	3	3	-	-	-	-	2	3	3	L4

## SYLLABUS

### UNIT – I : Introduction

Fundamentals of vehicles – Vehicle model – Calculation road load and tractive force – Components of conventional vehicles – Drawbacks of conventional vehicles – Need for electric vehicles – Advantages and applications of Electric Vehicles – History of Electric Vehicles – EV Market in India and outside India – Types of Electric Vehicles.

### UNIT – II: Components of Electric Vehicles

Main components of Electric Vehicles – Electric Traction Motor and Controller – Power Converters – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.

### UNIT – III: Motors for Electric Vehicles

Characteristics of traction drive – requirements of electric machines for EVs – Comparison of Different motors for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only).

### UNIT – IV: Hybrid Electric Vehicles

Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs – Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples – Merits and Demerits.

### UNIT – V : Energy Sources for Electric Vehicles

Batteries – Types of Batteries – Lithium-ion – Nickel-metal hydride – Lead-acid – Comparison of Batterie Battery Charging – Fast Charging – Battery Management System – Ultra capacitors – Flywheels – Compressed air energy storage (CAES) – Fuel Cell – it's working.

#### Text Books

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021. ,
2. Tom DentonHayley Pells - Electric and hybrid vehicles, Third Edition, 2024

#### Reference Books:

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020.
2. Chau - Kwok Tong. Electric vehicle machines and drives: design - analysis and application. John Wiley & Sons - 2015.

3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge University Press - 2015.

**Online Learning Resources:**

1. MOOC at <https://www.edx.org/learn/electric-cars>
2. <https://archive.nptel.ac.in/courses/108/106/108106170>

**Open Elective-II**  
**Electrical Wiring Estimation and Costing**  
**III B.TECH- II SEMESTER**

Course Title: <b>Fundamentals of Electric Vehicles</b>	Course Code: R24EEOE2.2
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: Electrical Circuits, Basics of Power Systems and Electrical Machines.	

**COURSE OBJECTIVES:**

- Introduce the electrical symbols and simple electrical circuits
- Able to learn the design of electrical installations.
- Able to learn the design of electrical installation for different types of buildings and small industries.
- Learn the basic components of electrical substations.
- Familiarize with the motor control circuits

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Demonstrate the various electrical apparatus and their interconnections.

CO2: Examine various components of electrical installations.

CO3: Estimate the cost for installation of wiring for different types of building and small industries.

CO4: Illustrate the components of electrical substations.

CO5: Design suitable control circuit for starting of three phase induction motor and synchronous motor.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	2	2	3	2	-	-	-	-	1	3	3	L3

CO2	3	2	2	2	3	2	-	-	-	-	1	3	3	L3
CO3	3	3	3	2	3	2	-	-	-	-	2	3	3	L3
CO4	3	2	1	2	2	2	-	-	-	-	1	3	3	L2
CO5	3	3	3	3	3	2	-	-	-	-	2	3	3	L5

## SYLLABUS

### UNIT - I : Electrical Symbols and Simple Electrical Circuits

Identification of electrical symbols - Electrical wiring Diagrams - Methods of representation of wiring diagrams - introduction to simple light and fan circuits - system of connection of appliances and accessories.

### UNIT – II: Design Considerations of Electrical Installations

Electric supply system - Three-phase four wire distribution system - protection of electric installation against overload - short circuit and earth fault - earthing - neutral and earth wire - types of loads - systems of wiring - permissible of voltage drops and sizes of wires - estimating and costing of electrical installations.

### UNIT - III : Electrical Installation for Different Types of Buildings and Small Industries

Electrical installations for electrical buildings - estimating and costing of material - simple examples on electrical installation for residential buildings - electrical installations for commercial buildings - electrical installation for small industries-case study.

### UNIT - IV : Substations

Introduction - types of substations - outdoor substations-pole mounted type - indoor substations-floor mounted type - simple examples on quantity estimation-case studies.

### UNIT – V: Motor control circuits

Introduction to AC motors - starting of three phase squirrel cage induction motors - starting of wound rotor motors - starting of synchronous motors - contractor control circuit components - basic control circuits - motor protection – Schematic and wiring diagrams for motor control circuits.

#### Text Books:

1. Electrical Design and Estimation Costing - K. B. Raina and S.K.Bhattacharya – New Age International Publishers - 2007.

#### References Books:

1. Electrical wiring estimating and costing – S.L.Uppal and G.C.Garg – Khanna publishers - 6th edition - 1987.
2. A course in electrical installation estimating and costing – J.B.Gupta –Kataria SK & Sons - 2013.

**Open Elective-II**  
**Fundamentals of utilization of Electrical Energy**  
**III B.TECH- II SEMESTER**

Course Title: <b>Fundamentals of utilization of Electrical Energy</b>	Course Code: R24EEOE2.3
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: Basic knowledge of Physics, Electrical Circuits, and Engineering Mathematics	

**COURSE OBJECTIVES:**

- To study the various types of Illumination equipment, measurement of Illumination, Illumination techniques.
- To know the various technologies used for heating applications using electrical energy.
- To understand the various welding techniques and operations of welding equipment and comparison.
- To know the various systems of traction, equipment used for traction.
- To understand the importance and operation of various Energy storage systems and comparison & applications.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Know the concepts of illumination and various illumination methods.

CO2: Know about the resistance - induction and dielectric heating.

CO3: Learn about the resistance and arc welding and welding equipment

CO4: Know about the mechanisms - equipment and technology used in the electric traction.

CO5: Differentiate the importance of various energy storage systems

Course Outcomes (COs)	Mapping with POs and PSOs													DOK	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02		

CO1	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO2	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO3	3	3	2	3	3	2	-	-	-	-	1	3	3	L2
CO4	3	3	2	3	3	2	-	-	-	-	1	3	3	L2
CO5	3	2	1	2	2	3	-	-	-	-	1	3	3	L2

## SYLLABUS

### UNIT - I

**Illumination fundamentals** :Introduction - terms used in illumination–Laws of illumination–Lux meter–Sources of light.

**Various Illumination Methods** :Tungsten filament lamps and fluorescent lamps - Comparison –Basic principles of light control– Types and design of lighting and flood lighting–LED lighting - Energy conservation.

### UNIT - II

**Electric Heating** :Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating.

### UNIT - III

**Electric Welding** :Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding

### UNIT - IV

**Electric Traction** :System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves. Calculations of tractive effort– power – Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

### UNIT - V

**Introduction to Energy Storage Systems** :Need for energy storage - Types of energy storage-Thermal - electrical - magnetic and chemical storage systems - Comparison of energy storage technologies-Applications.

### Text Books:

1. Electrical Power Systems(Generation, Transmission, Distribution, Protection and Utilization of Electrical Energy) – Dr. S.L.Uppal and Prof. Sunil S.Rao – Khanna Publisher, 15th edition, 1987.

2. Electric Power Distribution – A S Pabla – McGrawHill.

**Reference Books:**

1. Generation Distribution and Utilization of Electrical Energy – C.L.Wadhwa- New Age International Publishers- revised third edition.

**Open Elective-II  
Indian Electricity Act  
III B.TECH- II SEMESTER**

Course Title: <b>Indian Electricity Act</b>	Course Code: R24EEOE2.4
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: Basic knowledge of Power Systems, Electrical Engineering Fundamentals, and Engineering Economics.	

**COURSE OBJECTIVES:**

- To acquire knowledge on national policy, plan and joint responsibilities of state and central governments.
- To understand the licensing procedures in transmission and distribution companies.
- To learn the regulatory body rules and protocols.
- To understand the offences and penalties related issues with respect to different tribunals.
- To learn the legal related issues and their resolutions.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Learn the national policy and plan and the joint responsibilities of state and central governments.

CO2: Analyze the licensing and the provisions related to transmission and distribution of electricity.

CO3: Remember the composition and powers of Regulatory commissions and CEA.

CO4: Learn the functions of Appellate Tribunal for electricity.

CO5: Know the constitution procedure and provisions in Special courts and dispute resolutions.

Course	Mapping with POs and PSOs	DOK
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Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	2	2	1	1	1	3	3	1	2	2	1	1	1	L2
CO2	3	3	2	2	2	3	2	1	2	2	1	1	1	L4
CO3	2	2	1	1	1	3	3	1	1	1	1	1	1	L1
CO4	2	2	1	1	1	3	3	1	1	2	1	1	1	L2
CO5	2	2	1	1	1	3	3	1	1	2	1	1	1	L2

### SYLLABUS

#### **UNIT – I : National Electricity Policy and Plan - Generation of Electricity**

Electricity Act: commencement - definitions - comments; national policy on standalone systems - non-conventional energy systems - electrification and local distribution for rural areas; joint responsibilities of state and central governments in rural electrification - requirement for setting up of generating station - hydro-electric generation - captive generation; duties of generating companies.

#### **UNIT – II: Licensing -Transmission and Distribution Of Electricity**

Licensing: powers - procedures - conditions - amendments - revocation - provisions - directions - suspension and sale; inter-state and intra-state transmission; other provisions relating to transmission; provisions with respect to distribution licenses - electricity traders - supply generally; consumer protection: standard performance.

Electrical Wiring, Estimation & Costing

#### **UNIT – III: Tariff - CEA and Regulatory Commissions**

Works of licenses - provisions relating to overhead lines; Constitution and functions of Central Electricity Authority (CEA) - directions and certain powers; Constitution - powers and functions of state and central commissions - other provisions - proceedings and powers of Appropriate commission - Grants - Fund - Accounts Audit and Report.

#### **UNIT – IV : Appellate Tribunal - Reorganisation of Boards - Offences and Penalty**

Appellate Tribunal for electricity; investigation and assessment; reorganisation of boards; Offences and penalties.

#### **UNIT – V: Special Courts - Dispute Resolution - Other Provisions and Miscellaneous**

Constitution of special courts - procedures - powers - appeal - revision; arbitration; protective clauses; miscellaneous and enactments.

#### **Text Books:**

1. The Electricity Act - 2003 {Act 36 of 2003 - dt.2-6-2003 - w.e.f. 10-6-2003 vide S.O. No. 669(E) - dt. 10-6-2003} published by Commercial Law Publishers (I) Pvt. Ltd.

**Open Elective-II**  
**Electrical Safety Management**  
**III B.TECH- II SEMESTER**

Course Title: <b>Electrical Safety Management</b>	Course Code: R24EEOE2.5
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: Basic knowledge of Power Systems, Electrical Engineering Fundamentals, and Engineering Economics.	

**COURSE OBJECTIVES**

- To introduce the fundamentals of electrical safety, hazards, shock effects, and preventive measures.
- To develop awareness about safety practices during installation, operation, and maintenance of electrical equipment and plants.
- To impart knowledge on electrical safety requirements in residential, commercial, and agricultural installations.
- To study safety practices in hazardous locations, equipment earthing, and system neutral earthing methods. To understand electrical safety management practices, statutory regulations, and Indian Electricity (IE) rules.

**COURSE OUTCOMES:**

At the end of the course, the student will be able to

CO1: Explain the objectives and precautions of Electrical safety, effects of shocks and their prevention.

CO2: Summarize the safety aspects during installation of plant and equipment.

CO3: Describe the electrical safety in residential, commercial and agricultural installations.

CO4: Describe the various Electrical safety in hazardous areas, Equipment earthing and system neutral earthing.

CO5: State the electrical systems safety management and IE rules.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	3	1	2	2	1	1	1	L2
CO2	3	2	1	2	2	3	2	1	2	2	1	1	1	L2
CO3	3	2	1	2	2	3	2	1	2	2	1	1	1	L2
CO4	3	2	1	2	2	3	2	1	2	2	1	1	1	L2
CO5	3	2	1	2	2	3	3	1	2	2	1	1	1	L2

## SYLLABUS

### UNIT-I: INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION

Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

### UNIT-II: SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT

Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during Course Code: 22EE11P2 installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

### UNIT-III: ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS

Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

### UNIT-IV: ELECTRICAL SAFETY IN HAZARDOUS AREAS

Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment

enclosure for various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations.

### **EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING**

Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding( System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

### **UNIT-V: SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS**

Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees. REVIEW OF IE RULES AND ACTS AND THEIR SIGNIFICANCE Objective and scope – ground clearances and section clearances – Classification of electrical installations –Rules regarding first aid and firefighting facility. The Electricity Act, 2003.

### **TEXT BOOK:**

1. S.Rao, Prof. H.L.Saluja, “Electrical safety, fire safety Engineering and safety management”, 1 st edition Khanna Publishers. New Delhi, 2016 Reprint.

### **REFERENCE:**

1. Pradeep Chaturvedi, “Energy management policy, planning and utilization”, Concept Publishing company, New Delhi, 1997.

### **WEBREFERENCE**

1. [www.apeasternpower.com/downloads/elecact2003.pdf](http://www.apeasternpower.com/downloads/elecact2003.pdf)

**Open Elective-III**  
**Battery Management Systems**  
**IV B.TECH- I SEMESTER**

Course Title: <b>Battery Management Systems</b>	Course Code: R24EEOE3.1
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: Basic knowledge of Electrical Circuits, Electrochemistry, Power Electronics, and Electric Vehicles.	

**COURSE OBJECTIVES:**

- Understand the fundamentals of batteries, configurations, and charging processes.
- Learn the functional requirements and architecture of a Battery Management System (BMS).
- Explore methods for estimating battery state of charge and health, along with balancing techniques.
- Study modeling approaches for simulating batteries and electric vehicle performance.
- Analyze design considerations for practical implementation of BMS in multi-battery systems.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to

CO1: Describe basic battery concepts, charging modes, and cell connections.

CO2: Explain BMS functionalities including sensing, protection, communication, and estimation tasks.

CO3: Apply SOC and SOH estimation methods and design balancing circuits for lithium-ion cells.

CO4: Use circuit and physics-based models to simulate battery and EV performance.

CO5: Develop BMS designs considering practical parameters such as load, range, and energy distribution.

<b>Course</b>	<b>Mapping with POs and PSOs</b>	<b>DOK</b>
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Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO2	3	3	2	3	3	2	-	-	-	-	1	3	3	L3
CO3	3	3	3	3	3	2	-	-	-	-	2	3	3	L5
CO4	3	3	3	3	3	2	-	-	-	-	2	3	3	L4
CO5	3	3	3	3	3	2	-	-	-	-	2	3	3	L5

## SYLLABUS

### UNIT-I: Introduction

Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cells, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging.

### UNIT-II: Battery Management System Requirement

Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power.

### UNIT-III: Battery State of Charge and State of Health Estimation, Cell Balancing

Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing.

### UNIT-IV : Modelling and Simulation

Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs.

### UNIT-V : Design of Battery BMS:

Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system.

### Text Books:

1. Plett, Gregory L. Battery management systems, Volume I: Battery modeling. Artech House, 2015.
2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.

**References:**

1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L “Battery Management Systems -Design by Modelling” Philips Research Book Series 2002.
2. Davide Andrea,” Battery Management Systems for Large Lithium-ion Battery Packs” Artech House, 2010
3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008.

**Open Elective-III**  
**Concepts of Smart Grid Technologies**  
**IV B.TECH- I SEMESTER**

Course Title: <b>Concepts of Smart Grid Technologies</b>	Course Code: R24EEOE3.2
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 Basic knowledge of Power Systems, Electrical Networks, Control Systems, and Communication Engineering.	

**COURSE OBJECTIVES:**

- Understand the architecture, components, and need for smart grids in modern power systems.
- Explore communication technologies and measurement tools essential for smart grid operation.
- Analyze performance through load flow, stability, and security studies tailored for smart grids.
- Apply computational and optimization tools to improve smart grid efficiency and ensure cyber security.
- Study the integration of renewable energy sources, storage, and microgrids into smart grid infrastructure.

**Course Outcomes:**

After the completion of the course the student should be able to

CO1: Explain the structure, benefits, and interoperability standards of smart grid systems.

CO2: Identify and apply appropriate communication and metering technologies for smart grid implementation.

CO3: Perform performance and security analyses for smart grid operations using advanced tools.

CO4: Utilize computational techniques for optimization and address security challenges in the smart grid.

CO5: Evaluate integration strategies for renewable energy, storage systems, and demand response mechanisms.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	2	3	3	-	-	2	-	1	3	3	L2
CO2	3	3	3	3	3	3	-	-	3	-	1	3	3	L3
CO3	3	3	3	3	3	2	-	-	3	-	2	3	3	L4
CO4	3	3	3	3	3	2	-	-	3	2	2	3	3	L5
CO5	3	3	3	3	3	3	-	-	2	2	2	3	3	L5

## SYLLABUS

### UNIT I : Smart Grid Architecture

Challenges in power grid, Advantages of building integrated and distributed power systems concept of smart grid, need for smart grid, smart grid components and their limitations, grid vision based on the intelligent architecture, Whole sale energy market in smart grid, Stake holders' roles and function, Approach to smart grid interoperability standards.

### UNIT II : Communications and Measurements

Latest wired and wireless technologies, Characteristics of smart grid communications technology and communication techniques, Switching techniques and communication channels, Wide area monitoring systems, Phasor measurements units, Key components of smart metering, Communication infrastructure and protocols for smart metering, Advanced metering infrastructure, Multi agent systems for smart grid implementation

### UNIT III : Performance Analysis Tools

Load flow studies for smart grid, extended formulations and algorithms, Smart Grid - Security assessment, Contingency studies, Voltage stability and Energy management.

### UNIT IV : Computational Tools and Security

Introduction to computational tools, Optimization techniques and applications to smart grid, Evolutionary computation techniques and computational challenges, Network security: Encryption and decryption, cyber-attacks, Authentication and cyber security standards

### UNIT V : Renewable Energy and Storage

Benefits of renewable generation, Importance of micro grid, Demand response issues, PHEV technology, Energy storage technologies, Grid integration issues of renewable energy sources.

**Text Books:**

1. James Momoh, “Smart Grid – fundamentals of design and analysis”, John Wiley and Sons, 2012
2. Stuart Borlase, “Smart Grids, Infrastructure, Technology and Solutions”, CRC press, 2013
3. Clark W. Gellings, “The Smart Grid- Enabling energy efficiency and demand response”, CRC press, 2009

**Reference Books:**

1. Janaka Ekanayake, “Smart Grid-Technology and Applications”, John Wiley and Sons, 2012
2. Fereidoon P.Sioshansi, “Smart grid- integrating renewable, distributed and efficient energy”, Elsevier, 2012

**Open Elective-III**  
**Introduction to Artificial Intelligence**  
**IV B.TECH- I SEMESTER**

Course Title: <b>Introduction to Artificial Intelligence</b>	Course Code: R24EEOE3.3
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: Basic knowledge of Mathematics, Programming, Data Structures, and Probability Concepts..	

**COURSE OBJECTIVES:**

- Introduce students to the fundamental concepts, history, and evolution of artificial intelligence
- Develop students' understanding of various AI problem-solving approaches and search algorithms
- Enable students to represent knowledge and perform reasoning in AI systems
- Familiarize students with probabilistic reasoning and decision-making under uncertainty
- Foster critical thinking about ethical and societal implications of AI technologies
- Provide hands-on experience implementing basic AI algorithms and applications

**COURSE OUTCOMES**

Upon successful completion of this course, students will be able to:

- CO1: Explain the fundamental concepts, history, and approaches in artificial intelligence and identify appropriate AI techniques for solving different types of problems
- CO2: Implement and evaluate various search algorithms to solve problems in the AI domain
- CO3: Design knowledge representation schemes and reasoning mechanisms for different AI applications

CO4: Apply probabilistic reasoning methods and decision theory to address uncertainty in AI systems

CO5: Assess the ethical and societal implications of AI systems and develop responsible AI solutions that consider fairness, privacy, and societal impact

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	2	3	2	-	-	2	-	1	3	3	L2
CO2	3	3	3	3	3	-	-	-	2	-	1	3	3	L3
CO3	3	3	3	3	3	-	-	-	3	-	2	3	3	L5
CO4	3	3	3	3	3	-	-	-	2	2	2	3	3	L5
CO5	2	3	2	2	2	3	3	3	3	3	2	3	3	L5

## SYLLABUS

### Unit 1: Foundations of AI

#### Unit Description

This unit introduces students to the core concepts, history, and evolution of artificial intelligence. Students will explore different types of AI, fundamental problem-solving approaches, and the wide range of AI applications across various domains. The unit also covers the basic structure of intelligent agents and their interactions with environments.

#### Syllabus Topics

1. Introduction to AI
  - Definitions and scope of artificial intelligence
  - Historical development and milestones in AI research
  - The AI winter periods and recent resurgence
  - Strong vs. weak AI concepts
2. Types of AI Systems
  - Narrow (weak) vs. general (strong) AI
  - Reactive machines vs. theory of mind systems
  - Self-aware systems and AI consciousness debates
  - Current state-of-the-art AI capabilities
3. Problem-Solving Approaches in AI
  - State space representation
  - Production systems
  - Problem reduction
  - Means-ends analysis
4. Agent-Based View of AI
  - Simple reflex agents
  - Model-based reflex agents
  - Goal-based agents
  - Utility-based agents
  - Learning agents

5. Application Domains of AI
  - Computer vision and image recognition
  - Natural language processing
  - Robotics and automation
  - Healthcare applications
  - Financial services applications
  - Autonomous vehicles

#### **Examples/Applications/Case Studies**

- Case Study: The evolution of chess-playing AI from Deep Blue to AlphaZero
- Application Example: Virtual assistants (Siri, Alexa, Google Assistant)
- Case Study: IBM Watson's journey from Jeopardy! champion to healthcare applications
- Application Example: Facial recognition systems in security and consumer technology

#### **Exercise/Project Problems**

1. Research and create a timeline of significant AI milestones from 1950 to present
2. Design a simple reflex agent for a specified environment (e.g., a vacuum cleaner agent)
3. Compare and contrast narrow AI applications in two different domains
4. Analyze a real-world problem and determine appropriate AI approaches

#### **Tool Studies**

- Introduction to Python programming for AI
- Overview of AI development frameworks (TensorFlow, PyTorch, scikit-learn)
- Jupyter notebooks for interactive AI experimentation
- GitHub repositories with AI examples and implementations

### **Unit 2: Search Algorithms**

#### **Unit Description**

This unit focuses on search algorithms as fundamental problem-solving techniques in AI. Students will learn how to formulate problems as search problems, implement uninformed and informed search strategies, and apply these techniques to various domains including adversarial scenarios and game playing.

#### **Syllabus Topics**

1. Problem Formulation
  - State space representation
  - Initial and goal states
  - Actions and transition models
  - Path cost and step cost functions
  - Problem types and complexity analysis
2. Uninformed Search Strategies
  - Breadth-first search
  - Depth-first search
  - Depth-limited search
  - Iterative deepening search
  - Bidirectional search
  - Uniform cost search
  - Time and space complexity analysis
3. Informed Search Strategies
  - Best-first search

- Greedy best-first search
  - A\* search algorithm
  - Heuristic functions: properties and design
  - Admissibility and consistency
  - Local search algorithms and optimization
4. Constraint Satisfaction Problems
    - Problem formulation as CSP
    - Constraint propagation
    - Backtracking search
    - Local search for CSPs
    - Applications of CSPs
  5. Adversarial Search and Game Playing
    - Minimax algorithm
    - Alpha-beta pruning
    - Stochastic games
    - Partially observable games
    - Monte Carlo tree search
    - Game theory concepts

#### **Examples/Applications/Case Studies**

- Case Study: Route finding applications like Google Maps
- Application Example: Puzzle solving (8-puzzle, Rubik's cube)
- Case Study: AlphaGo's strategies and their implications
- Application Example: Scheduling and resource allocation problems

#### **Exercise/Project Problems**

1. Implement breadth-first and depth-first search algorithms for the 8-puzzle problem
2. Design and implement an A\* search for a pathfinding problem with different heuristics
3. Develop a constraint satisfaction solver for Sudoku puzzles
4. Create a simple game AI using minimax algorithm with alpha-beta pruning

#### **Tool Studies**

- Python implementation of search algorithms
- Visualization tools for search algorithms (e.g., pathfinding visualizers)
- Game AI frameworks and libraries
- NetworkX library for graph representation and algorithms

### **Unit 3: Knowledge Representation**

#### **Unit Description**

This unit explores methods for representing and organizing knowledge in AI systems. Students will learn about various knowledge representation schemes including logic-based approaches, semantic networks, frames, and ontologies. The unit also covers reasoning mechanisms that operate on these knowledge representations to derive new information and make inferences.

#### **Syllabus Topics**

1. Logic and Inference
  - Propositional logic: syntax and semantics
  - First-order logic: quantifiers, variables, and predicates
  - Inference rules: modus ponens, resolution
  - Forward and backward chaining
  - Unification and substitution
2. Semantic Networks

- Network structure and node types
  - Inheritance hierarchies
  - Spreading activation
  - Semantic relationships
  - Implementation approaches
3. Frames and Scripts
    - Frame structure and slots
    - Default values and demons
    - Inheritance in frame systems
    - Scripts for representing procedural knowledge
    - Event and situation representation
  4. Ontologies and Knowledge Graphs
    - Ontology components and design principles
    - Web Ontology Language (OWL)
    - Knowledge graph construction
    - Entity-relationship modeling
    - Linked data concepts
  5. Rule-Based Systems
    - Production rules
    - Rule-based expert systems
    - Conflict resolution strategies
    - Explanation facilities
    - Certainty factors and confidence

#### **Examples/Applications/Case Studies**

- Case Study: WordNet as a lexical semantic network
- Application Example: DBpedia and Wikidata as knowledge graphs
- Case Study: Google's Knowledge Graph and its applications in search
- Application Example: MYCIN and DENDRAL as early expert systems

#### **Exercise/Project Problems**

1. Implement a small propositional logic reasoning system
2. Design a semantic network for a specific domain (e.g., university courses)
3. Create a frame-based representation for a common object or concept
4. Develop a simple rule-based expert system for a diagnostic task

#### **Tool Studies**

- Protégé ontology editor
- SWI-Prolog for logic programming
- RDF and OWL tools for semantic web applications
- Python libraries for knowledge representation (NLTK, NetworkX)

### **Unit 4: Reasoning Under Uncertainty**

#### **Unit Description**

This unit addresses methods for handling uncertainty in AI systems. Students will review probability theory fundamentals and learn about probabilistic reasoning techniques including Bayesian networks and Markov models. The unit also covers decision theory and its applications to AI decision-making under uncertainty.

#### **Syllabus Topics**

1. Probability Theory Review
  - Random variables and probability distributions
  - Joint, conditional, and marginal probabilities

- Bayes' theorem and its applications
  - Independence and conditional independence
  - Expectation and variance
2. Bayesian Networks
    - Graphical representation of probability distributions
    - Conditional independence in Bayesian networks
    - d-separation and Markov blanket
    - Inference in Bayesian networks
    - Parameter learning from data
    - Structure learning algorithms
  3. Markov Models
    - Markov chains and transition matrices
    - Hidden Markov Models (HMMs)
    - Viterbi algorithm
    - Forward-backward algorithm
    - Baum-Welch algorithm
    - Applications in temporal reasoning
  4. Decision Theory
    - Utility theory and utility functions
    - Decision networks (influence diagrams)
    - Value of information
    - Risk assessment and management
    - Multi-attribute utility theory
  5. Probabilistic Reasoning Applications
    - Medical diagnosis systems
    - Spam filtering and text classification
    - Financial risk assessment
    - Speech recognition
    - Robot localization and mapping

#### **Examples/Applications/Case Studies**

- Case Study: Naive Bayes classifiers for text categorization
- Application Example: Medical diagnosis expert systems
- Case Study: Speech recognition using Hidden Markov Models
- Application Example: Recommender systems using probabilistic models

#### **Exercise/Project Problems**

1. Implement a Naive Bayes classifier for spam detection
2. Build a simple Bayesian network for a diagnostic problem
3. Create a Hidden Markov Model for part-of-speech tagging
4. Develop a decision network for a personal finance recommendation system

#### **Tool Studies**

- Python libraries for probabilistic modeling (PyMC3, PyStan)
- Bayesian network tools (BayesiaLab, Hugin)
- Probabilistic programming languages (Stan, Pyro)
- WEKA machine learning toolkit for classification

### **Unit 5: Ethical and Societal Implications**

#### **Unit Description**

This unit explores the ethical and societal dimensions of artificial intelligence. Students will examine issues of bias and fairness in AI systems, privacy concerns, the impact of automation on employment,

and approaches to AI governance and regulation. The unit emphasizes responsible AI development practices and frameworks for assessing the broader implications of AI technologies.

### **Syllabus Topics**

1. AI Bias and Fairness
  - Sources of bias in AI systems
  - Fairness metrics and definitions
  - Bias detection and mitigation methods
  - Representation and inclusion in AI development
  - Case studies of algorithmic bias
2. Privacy and AI
  - Data collection and consent
  - Anonymization and de-identification techniques
  - Privacy-preserving AI methods
  - Differential privacy
  - Surveillance and privacy implications
3. Automation and Employment
  - Labor market impacts of AI automation
  - Skill-biased technological change
  - Future of work scenarios
  - Economic policy responses
  - Education and retraining approaches
4. AI Governance and Regulation
  - Regulatory frameworks for AI
  - Standards and certifications
  - Self-regulation and industry initiatives
  - International cooperation on AI governance
  - Risk assessment frameworks
5. Responsible AI Development
  - AI ethics principles
  - Explainable AI methods
  - Human-in-the-loop systems
  - Value alignment problem
  - Long-term AI safety considerations

### **Examples/Applications/Case Studies**

- Case Study: COMPAS recidivism prediction and racial bias
- Application Example: Privacy-preserving federated learning
- Case Study: Automation in manufacturing and service industries
- Application Example: Explainable AI in healthcare decision-making

### **Exercise/Project Problems**

1. Analyze a dataset for potential sources of bias and propose mitigation strategies
2. Design a privacy-preserving AI system for a sensitive application
3. Develop an impact assessment framework for an AI deployment scenario
4. Create an explainable AI approach for a black-box model

### **Tool Studies**

- Fairness-aware machine learning libraries (AI Fairness 360, Fairlearn)
- Explainable AI tools (LIME, SHAP, InterpretML)
- Privacy-preserving AI frameworks (PySyft, TensorFlow Privacy)
- Ethical assessment frameworks and checklists

**Textbooks and References****Primary Textbooks**

1. Russell, S., & Norvig, P. (2021). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson.
2. Luger, G. F. (2020). *Artificial Intelligence: Structures and Strategies for Complex Problem Solving* (6th ed.). Pearson.

**Additional References**

1. Poole, D. L., & Mackworth, A. K. (2017). *Artificial Intelligence: Foundations of Computational Agents* (2nd ed.). Cambridge University Press.
2. Nilsson, N. J. (2009). *The Quest for Artificial Intelligence: A History of Ideas and Achievements*. Cambridge University Press.
3. Koller, D., & Friedman, N. (2009). *Probabilistic Graphical Models: Principles and Techniques*. MIT Press.
4. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. MIT Press.
5. Kaplan, J. (2016). *Artificial Intelligence: What Everyone Needs to Know*. Oxford University Press.
6. O'Neil, C. (2016). *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*. Crown.
7. Tegmark, M. (2017). *Life 3.0: Being Human in the Age of Artificial Intelligence*. Knopf.
8. Ertel, W. (2018). *Introduction to Artificial Intelligence* (2nd ed.). Springer.

**Open Elective-III****Concepts of Microprocessors and Microcontrollers****IV B.TECH- I SEMESTER**

Course Title: <b>Concepts of Microprocessors and Microcontrollers</b>	Course Code: R24EEOE3.4
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: Basic knowledge of Digital Electronics, Computer Organization, Programming Concepts, and Electronic Circuits.	

**COURSE OBJECTIVES:**

- To understand the organization and architecture of Microprocessor.
- To understand addressing modes to access memory.
- To understand the interfacing of Microprocessor with I/O as well as other devices
- To understand 8051 micro controller architecture
- To understand interfacing of 8051 and their applications.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Know the concepts of the Microprocessor capability in general and explore the evaluation of microprocessors.

CO2: Analyse the instruction sets - addressing modes - minimum and maximum modes operations of 8086 Microprocessors

CO3: Analyse the Microcontroller and interfacing capability.

CO4: Describe the architecture and interfacing of 8051 controller.

CO5: Know the concepts of PIC micro controller and its programming

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	-	-	-	-	-	1	3	3	L2
CO2	3	3	3	3	3	-	-	-	2	-	2	3	3	L4
CO3	3	3	3	3	3	-	-	-	2	-	2	3	3	L4
CO4	3	2	2	2	3	-	-	-	2	-	1	3	3	L2
CO5	3	2	2	2	3	-	-	-	1	-	1	3	3	L2

## SYLLABUS

### UNIT – I: Introduction to Microprocessor Architecture

Introduction and evolution of Microprocessors – Architecture of 8086 – Memory Organization of 8086 – Register Organization of 8086– Introduction to 80286 - 80386 - 80486 and Pentium (brief description about architectural advancements only).

### UNIT – II: Minimum and Maximum Mode Operations

Instruction sets of 8086 - Addressing modes – Assembler directives - General bus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.

### UNIT – III: Microprocessors I/O Interfacing

8255 PPI– Architecture of 8255–Modes of operation – Interfacing I/O devices to 8086 using 8255 – Interfacing A to D converters – Interfacing D to A converters – Stepper motor interfacing– Static memory interfacing with 8086.

### UNIT – IV: 8051 Microcontroller

Overview of 8051 Microcontroller – Architecture – Signal description – Register set – Memory and I/O addressing.

### UNIT - V: 8051 Interfacing and Applications

Instruction set – I/O ports and Interrupts – Timers and Counters – Serial Communication – Interfacing of peripherals – Applications of microcontrollers.

### Text Books:

1. Ray and Burchandi - "Advanced Microprocessors and Interfacing" - Tata McGraw–Hill - 3rd edition - 2006.
2. Kenneth J Ayala - "The 8051 Microcontroller Architecture - Programming and Applications" - Thomson Publishers - 2nd Edition.

**Reference Books:**

1. Microprocessors and Interfacing - Douglas V Hall - Mc–Graw Hill - 2nd Edition.
2. R.S. Kaler - "A Text book of Microprocessors and Micro Controllers" - I.K. International Publishing House Pvt. Ltd.

**Open Elective-III**  
**Concepts of Internet of Things**  
**IV B.TECH- I SEMESTER**

Course Title: <b>Concepts of Internet of Things</b>	Course Code: R24EEOE3.5
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: Basic knowledge of Computer Networks, Embedded Systems, Sensors, and Programming Concepts.	

**COURSE OBJECTIVES:**

From the course the student will learn

- the application areas of IOT
- the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- building blocks of Internet of Things and characteristics

**COURSE OUTCOMES:**

By the end of the course, student will be able to

CO1: Review Internet of Things (IoT).

CO2 :Demonstrate various business models relevant to IoT.

CO3:Construct designs for web connectivity

CO4:Organize sources of data acquisition related to IoT, integrate to enterprise systems.

CO5:Describe IoT with Cloud technologies.

Course	Mapping with POs and PSOs	DOK
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Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	3	2	-	-	2	-	1	3	3	L2
CO2	2	3	3	2	3	2	-	1	3	2	1	3	3	L3
CO3	3	3	3	3	3	1	-	2	3	2	2	3	3	L5
CO4	3	3	3	3	3	2	-	2	3	2	2	3	3	L4
CO5	3	2	1	2	3	3	-	-	2	-	1	3	3	L2

## SYLLABUS

### UNIT-I :The Internet of Things-

An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, Examples OF IoTs, Design Principles For Connected Devices, Internet connectivity, **Application Layer Protocols-** HTTP, HTTPS, FTP

### UNIT-II

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability.

### UNIT-III

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

### UNIT-IV

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/Services/Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

### UNIT-V

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

### Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

**Reference Books:**

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things, CunoPfister , Oreilly

**Open Elective-IV**  
**Electrical Energy Conservation and Auditing**  
**IV B.TECH- II SEMESTER**

Course Title: <b>Electrical Energy Conservation and Auditing</b>	Course Code: R24EEOE4.1
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: Basic knowledge of Electrical Engineering, Energy Systems, Thermodynamics, and Engineering Economics.	

**COURSE OBJECTIVES:**

- To understand basic concepts of Energy Audit & various Energy conservation schemes.
- To design energy an energy management program.
- To understand concept of Energy Efficient Motors and lighting control efficiencies.
- To estimate/calculate power factor of systems and propose suitable compensation techniques.
- To calculate life cycle costing analysis and return on investment on energy efficient technologies.

**COURSE OUTCOMES:**

After the completion of the course the student should be able to:

CO1: Understand the principles of energy audit along with various Energy related terminologies.

CO2: Asses the role of Energy Manager and Energy Management program.

CO3: Design a energy efficient motors and good lighting system.

CO4: Analyse the methods to improve the power factor and identify the energy instruments for various

real time applications.

CO5: Evaluate the computational techniques with regard to economic aspects.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO2	3	3	2	2	2	3	3	1	2	2	1	3	3	L3
CO3	3	3	3	3	3	3	-	-	-	-	2	3	3	L5
CO4	3	3	2	3	3	3	-	-	-	-	2	3	3	L4
CO5	3	3	3	3	3	2	-	-	-	2	2	3	3	L5

## SYLLABUS

### Unit-I: Basic Principles of Energy Audit

Energy audit- definitions - concept - types of audit - energy index - cost index - pie charts - Sankey diagrams and load profiles - Energy conservation schemes- Energy audit of industries- energy saving potential - energy audit of process industry - thermal power station - building energy audit - Conservation of Energy Building Codes (ECBC-2017) -

### Unit-II: Energy Management

Principles of energy management - organizing energy management program - initiating - planning - controlling - promoting - monitoring - reporting. Energy manager - qualities and functions - language - Questionnaire – check list for top management.

### Unit-III: Energy Efficient Motors and Lighting

Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics – variable speed - RMS - voltage variation-voltage unbalance-over motoring-motor energy audit. lighting system design and practice - lighting control - lighting energy audit.

### Unit-IV: Power Factor Improvement And Energy Instruments

Power factor – methods of improvement - location of capacitors - Power factor with non-linear loads - effect of harmonics on p.f - p.f motor controllers – Energy Instruments- watt meter - data loggers - thermocouples - pyrometers - lux meters - tongue testers.

### Unit-V: Economic Aspects and Their Computation

Economics Analysis depreciation Methods - time value of money - rate of return - present worth method - replacement analysis - lifecycle costing analysis – Energy efficient motors. Calculation of simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment.

### Text Books:

1. Energy management by W.R.Murphy&G.Mckay Butter worth - Heinemann publications - 1982.

2. Energy management hand book by W.CTurner - John wiley and sons - 1982.

**Reference Books:**

1. Energy efficient electric motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd edition - 1995
2. Energy management by Paul o' Callaghan - Mc-graw Hill Book company-1st edition - 1998
3. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

**Open Elective-IV  
Power Electronics for EV  
IV B.TECH- II SEMESTER**

Course Title: <b>Power Electronics for EV</b>	Course Code: R24EEOE4.2
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: Basic knowledge of Electrical Circuits, Power Electronics, Electrical Machines, and Energy Storage Systems.	

**COURSE OBJECTIVE:**

The objective of this course is to provide students with basic knowledge of electric vehicles, power semiconductor devices, DC–DC converters, inverters, motor drives, battery systems, and EV charging infrastructure. It helps students understand the working of EV power train systems and energy conversion techniques used in modern electric mobility.

**COURSE OUTCOMES**

- CO1: Explain the fundamentals, architecture, and applications of electric vehicles.
- CO2: Describe the operation and characteristics of power semiconductor devices used in EVs.
- CO3: Analyze the working of DC–DC converters in EV power systems.
- CO4: Explain the operation of inverters and motor drives used in electric vehicles.
- CO5: Describe battery technologies, BMS, and EV charging methods and infrastructure.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO2	3	2	1	2	2	2	-	-	-	-	1	3	3	L2
CO3	3	3	3	3	3	2	-	-	-	-	2	3	3	L4
CO4	3	3	2	3	3	2	-	-	-	-	2	3	3	L3
CO5	3	2	1	2	2	3	-	-	-	-	1	3	3	L2

## SYLLABUS

### UNIT – I: EV Fundamentals

Overview of Electric Vehicles, Types of Electric Vehicles (BEV, HEV, and PHEV), Comparison of Electric and Conventional Vehicles, Electric Vehicle Architecture, Energy Flow in EVs, Power Electronic Converters in EVs, Electric Traction Systems, Electric Motors for Vehicle Propulsion, and Role of Power Electronics in EV Performance and Efficiency.

### UNIT – II: Power Semiconductor Devices

Power Semiconductor Devices for Electric Vehicles, MOSFETs and IGBTs, Construction and Operating Principles, Static and Dynamic Characteristics, Switching and Conduction Losses, Device Selection Criteria, Gate Driving Techniques, Protection Circuits, Thermal Management Considerations, and Applications of Power Semiconductor Devices in EV Power Conversion Systems.

### UNIT – III: DC–DC Converters

Introduction to DC–DC Converters, Buck, Boost and Buck–Boost Converters, Operating Principles, Steady-State Analysis, Voltage Regulation Techniques, Converter Waveforms, Bidirectional DC–DC Converters, Regenerative Braking, Energy Recovery and Battery Charging, and Applications of DC–DC Converters in EV Energy Management.

### UNIT – IV: Inverters and Motor Drives

Single-Phase and Three-Phase Inverters, DC–AC Conversion Principles, Pulse Width Modulation (PWM) Techniques, Sinusoidal PWM (SPWM), Voltage and Frequency Control, BLDC Motors, Induction Motors, Motor Characteristics, Speed Control Methods, and Applications of Motor Drives in Electric Vehicle Propulsion Systems.

### UNIT – V: Battery Systems and Charging

Battery Technologies for Electric Vehicles, Lithium-Ion Batteries, Battery Characteristics and Performance, Battery Management System (BMS), State of Charge (SOC) Estimation, Battery Protection and Safety, EV Charging Systems, AC Charging, DC Fast Charging, Charging Standards, Charging Station Architecture, and Grid Integration of Electric Vehicle Charging Infrastructure.

### Text Books

1. Electric and Hybrid Vehicles: Design Fundamentals – Iqbal Husain, CRC Press.
2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles – Mehrdad Ehsani, Yimin Gao, Sebastian E. Gay, and Ali Emadi, CRC Press.
3. Power Electronics: Converters, Applications, and Design – Ned Mohan, Tore M. Undeland, and William P. Robbins, Wiley India.
4. Fundamentals of Power Electronics – Robert W. Erickson and Dragan Maksimovic, Springer.

### Reference Books

1. Electric Vehicle Technology Explained – James Larminie and John Lowry, Wiley.
2. Power Electronics – P. S. Bimbhra, Khanna Publishers.
3. Electric Drives – G. K. Dubey, Narosa Publications.
4. Battery Management Systems for Large Lithium-Ion Battery Packs – Davide Andrea, Artech House.

### Open Elective-IV Fuzzy logic and Neural Networks IV B.TECH- II SEMESTER

Course Title: <b>Fuzzy logic and Neural Networks</b>	Course Code: R24EEOE4.3
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: Basic knowledge of Mathematics, Control Systems, Programming Concepts, and Electrical Engineering Fundamentals.	

### COURSE OBJECTIVES:

- To understand artificial neuron models & learning methods of ANN.
- To utilize different algorithms of ANN.
- To distinguish between classical and fuzzy sets.
- To illustrate different modules of fuzzy controller.
- To analyze applications of neural networks and fuzzy logic.

### COURSE OUTCOMES:

After the completion of the course the student should be able to:

CO1: Analyse different models of artificial neuron.

CO2: Illustrate training and classification using perceptron algorithms.

CO3: Evaluate different paradigms of ANN.

CO4: Classify between classical and fuzzy sets.

CO5: Analyse various modules of Fuzzy logic controller.

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	3	2	3	3	-	-	-	-	-	1	2	2	L4
CO2	3	3	3	3	3	-	-	-	-	-	1	2	2	L4
CO3	3	3	3	3	3	-	-	-	-	-	1	2	2	L5
CO4	3	2	1	1	2	-	-	-	-	-	1	1	1	L2
CO5	3	3	2	3	3	-	-	-	-	-	1	2	2	L4

## SYLLABUS

### UNIT – I: Introduction

Artificial Neural Networks (ANN) – Humans and Computers – Biological Neural Networks – ANN Terminology – Models of Artificial Neuron – activation functions – typical architectures – biases and thresholds – learning strategy (supervised - unsupervised and reinforced) – Neural networks learning rules.

### UNIT – II: Feed Forward Networks:

Single Layer Feed Forward Neural Networks: Concept of Pattern And Its Types - Perceptron Training and Classification Using Discrete and Continuous Perceptron Algorithms – Linear Separability- XOR Function.

### UNIT – III: ANN Paradigms

Multi-layer feed forward networks – Generalized delta rule – Back Propagation algorithm – Radial Basis Function (RBF) network - Kohonen's self-organizing feature maps (KSOFM) – Bidirectional Associative Memory (BAM).

### UNIT – IV: Classical and Fuzzy Sets

Introduction to classical sets- properties - Operations and relations;

Fuzzy sets - Operations - Properties - Fuzzy relations - Cardinalities - Membership functions.

### UNIT – V: Fuzzy Logic Modules

Fuzzification - Membership value assignment - development of rule base and decision making system - Defuzzification to crisp sets - Defuzzification methods.

### Text Books:

1. Introduction to Artificial Neural Systems - Jacek M. Zurada - Jaico Publishing House - 1997.
2. Neural Networks -Fuzzy logic - Genetic algorithms: synthesis and applications by Rajasekharan

and Pai – PHI Publication.

**Reference Books:**

1. Artificial Neural Network – B.Yegnanarayana - PHI - 2012.
2. Fuzzy logic with Fuzzy Applications – T.J Ross – Mc Graw Hill Inc - 1997.
3. Introduction to Neural Networks using MATLAB 6.0 – S N Sivanandam – S. Sumathi - S N Deepa TMGH
4. Introduction to Fuzzy Logic using MATLAB – S N Sivanandam – S. Sumathi - S N Deepa Springer - 2007.

**Open Elective-IV  
Quantum Computing  
IV B.TECH- II SEMESTER**

Course Title: <b>Quantum Computing</b>	Course Code: R24EEOE4.4
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: Basic knowledge of Mathematics, Control Systems, Programming Concepts, and Electrical Engineering Fundamentals.	

**Course 1: Introduction to Quantum Computing**

1. Classical Computing Foundations
  - Binary representation and Boolean logic
  - Complexity theory and computational limits
  - Linear algebra review for quantum computing
  - Reversible computing
2. Quantum Mechanics Fundamentals
  - Wave-particle duality and superposition
  - Measurement and uncertainty principles
  - Quantum states and probability amplitudes

- Hilbert spaces and Dirac notation
- 3. Quantum Bits and Gates
  - Qubit representation and Bloch sphere
  - Single-qubit gates (X, Y, Z, H, S, T)
  - Multi-qubit gates and entanglement
  - Universal gate sets
- 4. Quantum Circuits
  - Circuit notation and composition
  - Basic circuit identities and simplifications
  - Quantum circuit simulation
  - Introduction to quantum algorithms
- 5. Quantum Computing
  - Platforms Superconducting qubits
  - Trapped ions
  - Photonic quantum computing
  - Current quantum hardware landscape

## **Course 2: Quantum Algorithms I**

1. **Quantum Algorithm Fundamentals**
  - Quantum parallelism and interference
  - Quantum algorithm design principles
  - Quantum query model
  - Probability amplification techniques
2. Quantum Oracles and Black Box Problems
  - Classical vs. quantum oracles
  - Bernstein-Vazirani algorithm
  - Deutsch-Jozsa algorithm
  - Simon's algorithm
3. Quantum Fourier Transform
  - Discrete Fourier transform review
  - Quantum Fourier transform construction
  - QFT circuit implementation
  - Applications in quantum algorithms
4. Period Finding and Shor's Algorithm

- Number theory background
  - Quantum phase estimation
  - Period finding algorithm
  - Shor's factoring algorithm
5. Quantum Search
- Unstructured search problems
  - Grover's algorithm fundamentals
  - Amplitude amplification
  - Applications and limitations

### **Course 3: Quantum Information Theory**

1. Classical Information Theory Review
  - Entropy and information content
  - Data compression
  - Channel capacity
  - Error correction fundamentals
2. Quantum States and Measurements
  - Density matrix formalism
  - POVM measurements
  - Quantum state discrimination
  - Quantum state tomography
3. Quantum Entanglement
  - Bell states and entanglement measures
  - Bell's inequalities and non-locality
  - Entanglement as a resource
  - Applications in quantum protocols
4. Quantum Channels and Operations
  - Quantum operations and Kraus representation
  - Completely positive maps
  - Quantum channel capacity
  - Quantum noise models
5. Quantum Shannon Theory
  - Von Neumann entropy
  - Holevo bound
  - Quantum data compression
  - Quantum channel capacity theorems

**Course 4: Quantum Error Correction****1. Quantum Noise and Decoherence**

- Sources of quantum errors
- Error models and characterization
- Decoherence mechanisms
- Quantum error mitigation techniques

**2. Classical Error Correction Review**

- Linear codes
- Parity check matrices
- Syndrome decoding
- Classical code families

**3. Quantum Error Correction Fundamentals**

- No-cloning theorem challenges
- Quantum error correction criteria
- Error detection vs. correction
- Stabilizer formalism

**4. Quantum Error Correcting Codes**

- Three-qubit code
- Shor's nine-qubit code
- Steane code
- Surface codes introduction

**5. Fault-Tolerant Quantum Computing**

- Fault-tolerance principles
- Threshold theorem
- Logical operations on encoded qubits
- Magic state distillation

**Course 5: Quantum Algorithms II and Applications****1. Advanced Quantum Search Techniques**

- Quantum walks
- Quantum minimum finding
- Amplitude amplification extensions
- NAND tree evaluation

**2. Quantum Machine Learning**

- Quantum data encoding
- Quantum neural networks

- HHL algorithm for linear systems
  - Quantum support vector machines
3. Quantum Simulation
    - Hamiltonian simulation
    - Trotter-Suzuki formulas
    - Quantum chemistry applications
    - Materials science applications
  4. Quantum Optimization
    - Quantum approximate optimization algorithm (QAOA)
    - Quantum adiabatic algorithm
    - Quantum annealing
    - Variational quantum algorithms
  5. Emerging Quantum Applications
    - Quantum finance
    - Quantum networking and cryptography
    - Quantum sensing and metrology
    - Quantum computational advantage demonstrations

## **Course 6: Quantum Software Development and Programming**

1. Quantum Programming Fundamentals
  - Classical vs. quantum programming models
  - Quantum algorithm implementation strategies
  - Quantum-classical hybrid computing
  - Cloud-based quantum computing services
2. Quantum Programming Languages
  - Qiskit ecosystem
  - Cirq and other Google frameworks
  - Q# and Microsoft quantum development kit
  - PyQuil and other frameworks
3. Quantum Circuit Optimization
  - Circuit depth reduction
  - Gate decomposition
  - Transpilation strategies
  - Hardware-specific optimizations
4. Quantum Software Testing and Verification

- Quantum program verification
  - Testing strategies for quantum software
  - Benchmarking quantum programs
  - Performance analysis techniques
5. Quantum Software Project
- Project planning and requirements
  - Algorithm implementation
  - Testing and optimization
  - Results analysis and presentation

This minor program provides comprehensive coverage of quantum computing fundamentals, algorithms, information theory, error correction, applications, and software development, giving undergraduate students a strong foundation in this emerging field.

**Open Elective-IV**  
**Solar PV Systems**  
**IV B.TECH- II SEMESTER**

Course Title: <b>Solar PV Systems</b>	Course Code: R24EEOE4.5
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: Basic knowledge of Electrical Circuits, Semiconductor Devices, Power Systems, and Renewable Energy Concepts..	

**COURSE OBJECTIVES**

1. To introduce the fundamentals of solar photovoltaic systems and power-energy calculations.
2. To study the characteristics, parameters, and array configurations of PV modules.
3. To develop the ability to design and analyze solar PV systems and their economic aspects.
4. To understand balance of system components and Maximum Power Point Tracking (MPPT) techniques.
5. To study battery technologies and their applications in standalone and remote solar PV systems.

**COURSE OUTCOMES:**

At the end of the course, the student will be able to

CO1: Describe the basics of Power and Energy calculations in relation to SPV Systems.

CO2: Interpret the parameters of PV Modules and their connections to form Arrays

CO3: Demonstrate the design, integration and economics of PV Systems

CO4: Understand the Importance of balance of System and MPPT

CO5: Explain types of batteries and their necessity for remote applications of Solar PV Systems

Course Outcomes (COs)	Mapping with POs and PSOs													DOK
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02	
CO1	3	2	1	2	2	3	-	-	-	-	1	3	3	L2
CO2	3	3	2	3	3	3	-	-	-	-	1	3	3	L3
CO3	3	3	3	3	3	3	-	-	-	2	2	3	3	L5
CO4	3	2	2	2	3	3	-	-	-	-	1	3	3	L2
CO5	3	2	1	2	2	3	-	-	-	-	1	3	3	L2

## SYLLABUS

### UNIT-I: SOLAR PHOTOVOLTAIC ENERGY

Basics of Electricity – DC and AC Power – Measurement of Electrical Quantities- Basic Concepts about Energy and Its Use - Estimating Energy Requirement - Energy from Solar Photovoltaic (PV) Conversion- Other Renewable Energy Technologies

### UNIT – II: SOLAR CELLS , PV MODULES AND ARRAYS

Parameters of Solar Cells , Factors affecting Electricity generated from a Solar Cell , Solar PV Modules–Ratings , Module Parameters Factors Affecting Electricity Generated by a Solar PV Module, Measuring Module Parameters, Solar PV Module Arrays - Connection of Modules in Series, in Parallel and in Series and Parallel ((Mixed Combination)

### UNIT – III: SOLAR PV SYSTEM DESIGN

Types of Solar PV Systems – Standalone, Grid-connected and Hybrid, Design Methodology for SPV System, Grid-connected Solar PV Power Systems – Introduction, Components and Configurations, Grid-connected PV System Design for Small Power Applications and for Power Plants. Economics of PV Systems-sample payback period, lifecycle costing, Introduction to Solar Advisory Model (SAM) Software.

### UNIT – IV: CHARGE CONTROLLER, MPPT AND INVERTERS

Need For Balance of System (BoS) , Power Converters and their efficiency , DC to AC Converters ( Inverters) , DC to DC Converters , Charge Controllers, Maximum Power Point Tracking(MPPT), Types of Wires and Wire Sizing, Junction Box.

### UNIT-V: BATTERIES AND THEIR APPLICATIONS TO SOLAR PV SYSTEMS

Types of batteries , Parameters of Batteries, How to select a battery, Connecting Batteries together– Series , Parallel and mixed combination, Estimating Number of Batteries to be Connected in a

batteryBank, Testing and Maintenance of Batteries , Fault Detection, Instruments used for Maintenance.  
Sample Case Study of a Solar PV System, Environmental Considerations of PV Systems.

**TEXT BOOKS:**

1. Chetan Singh Solanki ,Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, PHI Learning Publications, 3rd Edition, 2015
2. SAM Ver. 2.0 User guide - <https://www.nrel.gov/docs/fy08osti/43704.pdf>

**REFERENCES:**

1. Chetan Singh Solanki,Solar Photovoltaics: Fundamentals, Technologies and Applications, PHILearning Publications, 3rd Edition, 2015
2. Roger A. Messenger and Jerry Ventre, 'Photovoltaic Systems Engineering', Taylor andFrancisGroup Publications, 3rd Edition, 2010(CRC Press Reprint – 2018)
3. Soteris A. Kalogirou, Solar Energy Engineering: Processes and Systems, AcademicPress, (Elsevier)2nd edition ,2014.

**WEB REFERENCES:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee71/preview](https://onlinecourses.nptel.ac.in/noc22_ee71/preview)