PRESIDENCY UNIVERSITY

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# PROGRAMME REGULATIONS & CURRICULUM

2024-28

## PRESIDENCY
## SCHOOL OF ENGINEERING
### DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

### BACHELOR OF TECHNOLOGY
### ELECTRICAL & ELECTRONICS ENGINEERING

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PRESIDENCY UNIVERSITY

Established under Section 2(f) of UGC Act, 1956 I Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013
Approved by AICTE, New Delhi

## School of Engineering
## Department of Electrical and Electronics Engineering

# Program Regulations and Curriculum

### Based on Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

**Program: BACHELOR OF TECHNOLOGY IN ELECTRICAL & ELECTRONICS ENGINEERING**

**B. Tech. [EEE]**

## 2024-2028

***(As amended up to the 24th Meeting of the Academic Council held on 3rd August 2024. This document supersedes all previous guidelines)***

**Regulations No: PU/AC24.9/SOE19/EEE/2024-28**

(***Resolution No. 9 of the 24th Meeting of the Academic Council held on 3rd August 2024, and ratified by the Board of Management in its 24th Meeting held on 5th August, 2024)***

**August 2024**

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**PART A – PROGRAM REGULATIONS**

## 1. Vision & Mission of the University and the School / Department

### *1.1 Vision of the University*

To be a Value-driven Global University, excelling beyond peers and creating professionals of integrity and character, having concern and care for society.

### *1.2 Mission of the University*

- Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer.
- Pursue Research and Development and its dissemination to the community, at large.
- Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
- Provide knowledge-based technological support and services to the industry in its growth and development.
- To impart globally-applicable skill-sets to students through flexible course offerings and support industry's requirement and inculcate a spirit of new-venture creation.

### *1.3 Vision of Presidency School of Engineering*

To be a value based, practice-driven School of Engineering and Technology, committed to developing globally-competent Engineers, dedicated to transforming Society.

### *1.4 Mission of Presidency School of Engineering*

- Cultivate a practice-driven environment with a contemporary Learning-pedagogy, integrating theory and practice.
- Attract and nurture world-class faculty to excel in Teaching and Research, in the field of Core Engineering.
- Establish state-of-the-art facilities for effective Teaching and Learning-experiences.
- Promote Interdisciplinary Studies to nurture talent and impart relevant skill-sets for global impact.
- Instil Entrepreneurial and Leadership Skills to address Social, Environmental, and Community-needs.

### *1.5 Vision of Department of Electrical and Electronics Engineering*

To be an industry driven Electrical & Electronics Engineering Department committed to develop globally competent Electrical & Electronics Engineering professionals dedicated to transform the society

### *1.6 Mission of Department of Electrical and Electronics Engineering*

- Committed to inculcate application of Engineering knowledge, develop problem analysis and solving skills to be able to investigate complex engineering problems with modern tools.
- Create value-driven engineering professionals who are sensitive to societal concerns of environmental sustainability through ethical conduct.

- Develop excellent communication abilities with core skills of project management and teamwork.
- Imbibe passion for lifelong learning with individual growth path.
- Commitment towards excellence in Petroleum Engineering education through advancements in research and innovation.
- Design flexible course contents in disciplinary, interdisciplinary and research areas to enhance student's competitiveness.

## 2. Preamble to the Program Regulations and Curriculum

This is the subset of Academic Regulations, and it is to be followed as a requirement for the award of B. Tech degree.

The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Social Project Based Learning, Industrial Training, and Internship to enable the students to become eligible and fully equipped for employment in industries, choose higher studies or entrepreneurship.

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations, of the University, the Academic Council hereby makes the following Regulations.

## 3. Short Title and Applicability

a. These Regulations shall be called the Bachelor of Technology Degree Program Regulations and Curriculum 2024-2028.
b. These Regulations are subject to, and pursuant to the Academic Regulations.
c. These Regulations shall be applicable to the ongoing Bachelor of Technology Degree Programs of the 2024-2028 batch, and to all other Bachelor of Technology Degree Programs which may be introduced in future.
d. These Regulations shall supersede all the earlier Bachelor of Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.
e. These Regulations shall come into force from the Academic Year 2024-2025.

## 4. Definitions

*In these Regulations, unless the context otherwise requires:*

*a. "Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;*
*b. "Academic Council" means the Academic Council of the University;*
*c. "Academic Regulations" means the Academic Regulations, of the University;*
*d. "Academic Term" means a Semester or Summer Term;*
*e. "Act" means the Presidency University Act, 2013;*
*f. "AICTE" means All India Council for Technical Education;*
*g. "Basket" means a group of courses bundled together based on the nature/type of the course;*
*h. "BOE" means the Board of Examinations of the University;*
*i. "BOG" means the Board of Governors of the University;*
*j. "BOM" means the Board of Management of the University;*

k. *"BOS" means the Board of Studies of a particular Department/Program of Study of the University;*

l. *"CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;*

m. *"Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;*

n. *"COE" means the Controller of Examinations of the University;*

o. *"Course In Charge" means the teacher/faculty member responsible for developing and organising the delivery of the Course;*

p. *"Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;*

q. *"Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific Academic Term;*

r. *"Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.*

s. *"DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;*

t. *"Dean" means the Dean / Director of the concerned School;*

u. *"Degree Program" includes all Degree Programs;*

v. *"Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;*

w. *"Discipline" means specialization or branch of B.Tech. Degree Program;*

x. *"HOD" means the Head of the concerned Department;*

y. *"L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;*

z. *"MOOC" means Massive Open Online Courses;*

aa. *"MOU" means the Memorandum of Understanding;*

bb. *"NPTEL" means National Program on Technology Enhanced Learning;*

cc. *"Parent Department" means the department that offers the Degree Program that a student undergoes;*

dd. *"Program Head" means the administrative head of a particular Degree Program/s;*

ee. *"Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum, 2024-2028;*

ff. *"Program" means the Bachelor of Technology (B.Tech.) Degree Program;*

*gg. "PSOE" means the Presidency School of Engineering;*

*hh. "Registrar" means the Registrar of the University;*

*ii. "School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;*

*jj. "Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;*

*kk. "SGPA" means the Semester Grade Point Average as defined in the Academic Regulations;*

*ll. "Statutes" means the Statutes of Presidency University;*

*mm. "Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;*

*nn. "Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;*

*oo. "SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.*

*pp. "UGC" means University Grant Commission;*

*qq. "University" means Presidency University, Bengaluru; and*

*rr. "Vice Chancellor" means the Vice Chancellor of the University.*

## 5. Program Description

The Bachelor of Technology Degree Program Regulations and Curriculum 2024-2028 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology (B.Tech.) Degree Programs of 2024-2028 offered by the Presidency School of Engineering (PSOE):

1. Bachelor of Technology in Civil Engineering, abbreviated as B.Tech. (Civil Engineering)
2. Bachelor of Technology in Electronics and Communication Engineering, abbreviated as B.Tech. (Electronics and Communication Engineering)
3. Bachelor of Technology in VLSI, abbreviated as B.Tech. (VLSI)
4. Bachelor of Technology in Electrical and Electronics Engineering, abbreviated as B.Tech. (Electrical and Electronics Engineering)
5. Bachelor of Technology in Mechanical Engineering, abbreviated as B.Tech. (Mechanical Engineering); and
6. Bachelor of Technology in Petroleum Engineering, abbreviated as B.Tech. (Petroleum Engineering)

5.1 These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

5.2 These Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to

ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations

## 6. Minimum and Maximum Duration

6.1 Bachelor of Technology Degree Program is a Four-Year, Full-Time Semester based program. The minimum duration of the B.Tech. Program is four (04) years and each year comprises of two academic Semesters (Odd and Even Semesters) and hence the duration of the B.Tech. program is eight (08) Semesters.

6.2 A student who for whatever reason is not able to complete the Program within the normal period or the minimum duration (number of years) prescribed for the Program, may be allowed a period of two years beyond the normal period to complete the mandatory minimum credits requirement as prescribed by the concerned Program Regulations and Curriculum. In general, the permissible maximum duration (number of years) for completion of Program is 'N' + 2 years, where 'N' stands for the normal or minimum duration (number of years) for completion of the concerned Program as prescribed by the concerned Program Regulations and Curriculum.

6.3 The time taken by the student to improve Grades/CGPA, and in case of temporary withdrawal/re-joining (Refer to Clause **Error! Reference source not found.** of Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

6.4 In exceptional circumstances, such as temporary withdrawal for medical exigencies where there is a prolonged hospitalization and/or treatment, as certified through hospital/medical records, women students requiring extended maternity break (certified by registered medical practitioner), and, outstanding sportspersons representing the University/State/India requiring extended time to participate in National/International sports events, a further extension of one (01) year may be granted on the approval of the Academic Council.

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.**Error! Reference source not found.** of Academic Regulations) in the prescribed maximum duration (Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

## 7 Programme Educational Objectives (PEO)

After four years of successful completion of the program, the graduates shall be:

**PEO 01**: An Electrical & Electronics Engineering Professional serving the society.

**PEO 02**: A Teaching and Research Professional in the area of Electrical & Electronics engineering through lifelong learning.

**PEO 03**: A Freelancing consultant to the Electrical &Electronics Engineering Industry.

**PEO 04**: An entrepreneur in the Electrical &Electronics Engineering and other related areas of specialization.

## 8 Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

### 8.1 Programme Outcomes (PO)

On successful completion of the Program, the students shall be able to:

**PO1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2. Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3. Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4. Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

**PO6. The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7. Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11. Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12. Life-Long Learning:** Recognize the need for,and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### 8.2 Program Specific Outcomes (PSOs):

On successful completion of the Program, the students shall be able to:

**PSO 01: [Problem Analysis]:** Identify, review research articles, formulate and analyse complex engineering problems related to modern Power System and Power Electronics & drives and to arrive substantiated inferences using first principles of mathematics, natural sciences and engineering sciences.

**PSO 02: [Design/development of Solutions]:** Design, develop and solve complex engineering problems related to modern Power System and Power Electronics & drives by designing system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations.

**PSO 03: [Modern Tool usage]:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities related

## 9 Admission Criteria (as per the concerned Statutory Body)

The University admissions shall be open to all persons irrespective of caste, class, creed, gender or nation. All admissions shall be made on the basis of merit in the qualifying examinations; provided that forty percent of the admissions in all Programs of the University shall be reserved for the students of Karnataka State and admissions shall be made through a Common Entrance Examination conducted by the State Government or its agency and seats shall be allotted as per the merit and reservation policy of the State Government from time to time**.** The admission criteria to the B.Tech. Program is listed in the following Sub-Clauses:

9.1 An applicant who has successfully completed Pre-University course or Senior Secondary School course (+2) or equivalent such as (11+1), 'A' level in Senior School Leaving Certificate Course from a recognized university of India or outside or from Senior Secondary Board or equivalent, constituted or recognized by the Union or by the State Government of that Country for the purpose of issue of qualifying certificate on successful completion of the course, may apply for and be admitted into the Program.

9.2 Provided further, the applicant must have taken Physics and Mathematics as compulsory subjects in the Pre-University / Higher Secondary / (10+2) / (11+1) examination, along with either Chemistry / Biology / Electronics / Computer Science / Biotechnology subject, and, the applicant must have obtained a minimum of 45% of the total marks (40% in case of candidates belonging to the Reserved Category as classified by the Government of Karnataka) in these subjects taken together.

9.3 The applicant must have appeared for Joint Entrance Examinations (JEE) Main / JEE (Advanced) / Karnataka CET / COMED-K, or any other State-level Engineering Entrance Examinations.

9.4 Reservation for the SC / ST and other backward classes shall be made in accordance

with the directives issued by the Government of Karnataka from time to time.

9.5 Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time, by the Government of India.

9.6 Candidates must fulfil the medical standards required for admission as prescribed by the University.

9.7 If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation and any other falsification, the Registrar shall report the matter to the Board of Management (BOM), recommending revoking the admission of the candidate.

9.8 The decision of the BOM regarding the admissions is final and binding.

## 10 Lateral Entry / Transfer Students requirements

### 10.1 Lateral Entry

The University admits students directly to the second year (3rd Semester) of the B.Tech. Degree program as per the provisions and/or regulations of the Government of Karnataka pertaining to the "Lateral Entry" scheme announced by the Government from time to time. Further, the general conditions and rules governing the provision of Lateral Entry to the B.Tech. Program of the University are listed in the following Sub-Clauses:

10.1.1 Admission to 2nd year (3rd Semester) of the B.Tech. Degree program shall be open to the candidates who are holders of a 3-year Diploma in Engineering (or equivalent qualification as recognized by the University), who have secured not less than forty-five percentage (45%) marks in the final year examination (5th and 6th Semesters of the Diploma Program) in the appropriate branch of Engineering. Provided that, in case of SC / ST and OBC candidates from Karnataka the minimum marks for eligibility shall be forty percent (40%).

10.1.2 Provided further that, candidates seeking Lateral Entry may be required to complete specified bridge Courses as prescribed by the University. Such bridge Courses, if any, shall not be included in the CGPA computations.

10.1.3 All the existing Regulations and Policies of the University shall be binding on all the students admitted to the Program through the provision of Lateral Entry.

10.1.4 The Course requirements prescribed for the 1st Year of the B.Tech. Program shall be waived for the student(s) admitted through Lateral Entry and the duration of the B.Tech. Program for such students is three (03) years, commencing from the 3rd Semester (commencement of the 2nd Year) of the B.Tech. Program and culminating with the 8th Semester (end of the 4th Year) of the B.Tech. Program.

10.1.5 Provided that, if a Lateral Entry student misses any mandatory program specific courses that are typically offered in the 1st year (1st or 2nd semesters), then those courses must be cleared by the students as soon as possible, preferably during the Summer Term.

10.1.6 The existing Program Regulations of the concerned Program to which the student is admitted through the provision of Lateral Entry shall be binding on the student with effect from the 3rd Semester of the Program. i.e., the Program Structure and Curriculum from the 3rd to 8th Semesters of the Program concerned shall be binding on the student admitted through Lateral Entry. Further, any revisions / amendments made to the Program Regulations thereafter, shall be binding on all the students of the concerned Program.

10.1.7 All the Courses (and the corresponding number of Credits) prescribed for the 1st Year of the concerned B.Tech. Program shall be waived for the student(s) admitted to the concerned B.Tech Program through Lateral Entry. Further, the *Minimum Credit Requirements* for the award of the B.Tech. Degree in the concerned Program shall be prescribed / calculated as follows:

The ***Minimum Credit Requirements*** for the award of the Bachelor of Technology (B.Tech.) Degree prescribed by the concerned Bachelor of Technology Degree Program Regulations and Curriculum, 2024-2028, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1st Year (1st and 2nd Semesters) of the B.Tech. Program.

For instance, if the *Minimum Credit Requirements* for the award of the Bachelor of Technology (B.Tech.) Degree as prescribed by the Regulations for B.Tech. (Electrical and Electronics Engineering) is "N" Credits, and, if the total credits prescribed in the 1st Year (total credits of the 1st and 2nd Semesters) of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. in Electrical and Electronics Engineering for a student who joins the Program through the provision of the Lateral Entry, shall be "N – M" Credits.

10.1.8 Further, no other waiver except the Courses prescribed for the 1st year of the B.Tech. Program of the University shall be permissible for students joining the B.Tech. Program through the provision of Lateral Entry.

**10.2 Transfer of student(s) from another recognized University to the 2nd year (3rd Semester) of the B.Tech. Program of the University**

A student who has completed the 1st Year (i.e., passed in all the Courses / Subjects prescribed for the 1st Year) of the B.Tech. / B.E. / B.S., Four-Year Degree Program from another recognized University, may be permitted to transfer to the 2nd Year (3rd Semester) of the B.Tech. Program of the University as per the rules and guidelines prescribed in the following Sub-Clauses:

**10.1.1** The concerned student fulfils the criteria specified in Sub-Clauses 10.1.1,10.1.2 and 10.1.3.

**10.1.2** The student shall submit the Application for Transfer along with a non-refundable Application Fee (as prescribed by the University from time to time) to the University no later than July 10 of the concerned year for admission to the 2nd Year (3rd Semester) B.Tech. Program commencing on August 1 on the year concerned.

**10.1.3** The student shall submit copies of the respective Marks Cards / Grade Sheets / Certificates along with the Application for Transfer.

**10.1.4** The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1st Year of the B.Tech. / B.E. / B.S. Four Degree Program from the concerned University, are declared equivalent and acceptable by the Equivalence Committee constituted by the Vice Chancellor for this purpose. Further, the Equivalence Committee may also prescribe the Courses and Credits the concerned students shall have to mandatorily complete, if admitted to the 2nd Year of the B.Tech. Program of the University.

**10.1.5** The Branch / Discipline allotted to the student concerned shall be the decision of the University and binding on the student.

## 11 Change of Branch / Discipline / Specialization

A student admitted to a particular Branch of the B.Tech. Program will normally continue studying in that Branch till the completion of the program. However, the University reserves the right to provide the option for a change of Branch, or not to provide the option for a change of Branch, at the end of 1st Year of the B.Tech. Program to eligible students in accordance with the following rules and guidelines: framed by the University from time to time.

11.1 Normally, only those students, who have passed all the Courses prescribed for the 1st Year of the B.Tech. Program and obtained a CGPA of not less than 6.50 at the end of the 2nd Semester, shall be eligible for consideration for a change of Branch.

11.2 Change of Branch, if provided, shall be made effective from the commencement of the 3rd Semester of the B.Tech. Program. There shall be no provision for change of Branch thereafter under any circumstances whatsoever.

11.3 The student provided with the change of Branch shall fully adhere to and comply with the Program Regulations of the concerned Branch of the B.Tech. Program, the Fee Policy pertaining to that Branch of the B.Tech. Program, and, all other rules pertaining to the changed Branch existing at the time.

11.4 Change of Branch once made shall be final and binding on the student. No student shall be permitted, under any circumstances, to refuse the change of Branch offered.

11.5 The eligible student may be allowed a change in Branch, strictly in order of

*inter se* merit, subject to the conditions given below:

11.5.1 The actual number of students in the 3rd Semester in any particular Branch to which the transfer is to be made, should not exceed the intake fixed by the University for the concerned Branch;

11.5.2 The actual number of students in any Branch from which transfer is being sought does not fall below 75% of the total intake fixed by the University for the concerned Branch.

The process of change of Branch shall be completed within the first five days of Registration for the 3rd Semester of the B.Tech. Program.

## 12 Specific Regulations regarding Assessment and Evaluation (including the Assessment Details of NTCC Courses, Weightages of Continuous Assessment and End Term Examination for various Course Categories)

**12.1** The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.

**12.2** Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 12.5 of Academic regulations) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

**12.3** Format of the End-Term examination shall be specified in the Course Plan.

**12.4** Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students based on the relative performance of the students registered in the concerned Course except in the following cases:

- Non-Teaching Credit Courses (NTCC)
- Courses with a class strength less than 30

Absolute grading method may be adopted, where necessary with prior approval of concerned DAC.

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause **Error! Reference source not found.** of Academic regulations) shall be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

**12.5 Assessment Components and Weightage**

| Table 1: Assessment Components and Weightage for different category of Courses | | | | | |
|---|---|---|---|---|---|
| **Nature of Course and Structure** | **Evaluation Component** | | **Weightage** | **Minimum Performance Criteria** | |
| **Lecture-based Course** L component in the L-T-P Structure is predominant (more than 1) (Examples: 3-0-0; 3-0-2; 2-1-0; 2-0-2, 2-0-4 etc.) | Continuous Assessments | Assignments, Seminars, Poster Presentations, Quizzes, Mini Projects, Term Papers, Hack-a-thons, Make-a-thons, Code-a-thons, etc. as prescribed in the Course Plan | 25% | - | 40% |
| | | Mid Term Examination (to be conducted by CoE centrally) | 25% | | |
| | End Term Examination | | 50% | 30% | |
| **Lab/Practice-based Course** P component in the L-T-P Structure is Predominant (Examples: 0-0-4; 1-0-4; 1-0-2; etc.) | Continuous Assessments | Laboratory Work / Practical exercises, conducted in every Laboratory / Practice session / activity, including Laboratory records, practice / project reports, attendance / class participation as applicable, and as prescribed in the Course Plan | 50% | - | 40% |
| | | Mid Term Examination (to be conducted at Department/ School Level during regular lab slots) | 25% | | |
| | End Term Examination | | 25% | 30% | |
| **Skill based Courses** like Industry Internship, Capstone project, Research Dissertation, Integrative Studio, Interdisciplinary Project, Summer / Short Internship, Social Engagement / Field Projects, Portfolio, and such similar Non-Teaching Credit Courses, where the pedagogy does | Guidelines for the assessment components for the various types of Courses, with recommended weightages, shall be specified in the concerned Program Regulations and Curriculum / Course Plans, as applicable. | | | 40% | |

| | | |
|---|---|---|
| not lend itself to a typical L-T-P structure | | |

The exact weightages of Evaluation Components shall be clearly specified in the respective Course Plan.

Normally, for Practice/Skill based Courses, without a defined credit structure (L–T–P) [NTCC], but with assigned Credits (as defined in Clause **Error! Reference source not found.** of the Academic Regulations), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

### 12.6 Minimum Performance Criteria:

#### 12.6.1 Theory only Course and Lab/Practice Embedded Theory Course

A student shall satisfy the following minimum performance criteria to be eligible to earn the credits towards the concerned Course:

a. A student must obtain a minimum of 30% of the total marks/weightage assigned to the End Term Examinations in the concerned Course.
b. The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

#### 12.6.2 Lab/Practice only Course and Project Based Courses

The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of all assessment components in the concerned Course.

**12.6.3** A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as "Fail" and given "F" Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the "Make-Up Examinations" as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per Sub-Clause 12.6.1

and 12.6.2 of Academic regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

## 13 Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc. – Note: These are covered in Academic Regulations

The University allows students to acquire credits from other Indian or foreign institutions and/or Massive Open Online Course (MOOC) platforms, subject to prior approval. These credits may be transferred and counted toward fulfilling the minimum credit requirements for the award of a degree. The process of transfer of credits is governed by the following rules and guidelines:

**13.1** The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer **Error! Reference source not found.** of Academic regulations) and approved by the Dean - Academics.

**13.2** Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

**13.3** Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:

**13.3.1** A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause13.3(as per Academic regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

**13.3.2** SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 13.3 (as per Academic regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

**13.3.3** Parent Departments may release a list of SWAYAM/NPTEL/other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.

**13.3.4** Students may Pre-Register for the SWAYAM/NPTEL/other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body/institute/ university.

**13.3.5** A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 13.3.1 above.

**13.3.6** SWAYAM/NPTEL/other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM/NPTEL/other approved MOOCs and obtained a certificate of successful/satisfactory completion.

**13.3.7** A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall forwarded to the COE for processing of results of the concerned Academic Term.

**13.3.8** The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table **Error! Reference source not found.**. in the Academic regulations.

**Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses**

| Sl. No. | Course Duration | Credit Equivalence |
|---|---|---|
| 1 | 4 Weeks | 1 Credit |
| 2 | 8 Weeks | 2 Credits |
| 3 | 12 Weeks | 3 Credits |

**13.3.9** The maximum permissible number of credits that a student may request for credit transfer from MOOCs shall not exceed 20% of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree.

**13.3.10** The University shall not reimburse any fees/expense; a student may incur for the SWAYAM/NPTEL/other approved MOOCs.

**13.3.11** The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions/MOOCs, as mentioned in this Section (13.**Error! Reference source not found.**), shall not be included in the calculation of the CGPA.

## 14. Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements

The B. Tech. (Electrical and Electronics Engineering) Program Structure (2024-2028) totalling 160 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

**Table 3: B. Tech. (Electrical and Electronics Engineering) 2024-2028: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets**

| Sl. No. | Baskets | Credit Contribution |
|---|---|---|
| 1 | Humanities and Social Sciences including Management Courses (HSMC) | **9** |
| 2 | Basic Science Courses (BSC) | **17** |
| 3 | Engineering Science Courses (ESC) | **24** |
| 4 | Professional Core Courses (PCC) | **64** |
| 5 | Professional Elective Courses (PEC) | **21** |
| 6 | Open Elective Courses (OEC) | **9** |
| 7 | Project Work (PRW) | **16** |
| 8 | Mandatory Courses (MAC) | **0** |
| | **Total Credits** | **160 (Minimum)** |

In the entire Program, the practical and skill based course component contribute to an extent of approximately 57% out of the total credits of 160 for B. Tech. (Electrical and Electronics Engineering) program of four years' duration.

## 15. Minimum Total Credit Requirements of Award of Degree

As per the AICTE guidelines, a minimum of 160 credits is required for the award of a B.Tech. Degree.

## 16. Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies,

16.1 The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University**.**

16.2 A student shall be declared to be eligible for the award of the concerned Degree if she/he:

a. Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;

b. Secure a minimum CGPA of 4.50 in the concerned Program at the end of the Semester/Academic Term in which she/he completes all the requirements for the award of the Degree as specified in Sub-Clause a of Academic Regulations**;**

c. No dues to the University, Departments, Hostels, Library, and any other such Centres/ Departments of the University; and

d. No disciplinary action is pending against her/him.

17. Curriculum Structure – Basket Wise Course List:

| Table 3.1 Humanities and Social Sciences including Management Courses (HSMC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
| 1 | ENG1002 | Technical English | 1 | 0 | 2 | 2 | | |
| 2 | PPS1001 | Introduction to soft skills | 0 | 0 | 2 | 1 | | |
| 3 | ENG2001 | Advanced English | 1 | 0 | 2 | 2 | | |
| 4 | PPS1012 | Enhancing Personality through Soft Skill | 0 | 0 | 2 | 1 | | |
| 5 | MGTxxxx | Management Course (Select any one course from Management Basket - I) | 3 | 0 | 0 | 3 | | |
| | | Total No. of Credits | | | | 9 | | |

| List of Management Courses | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Management Basket - I | | | | | | | | |
| 1 | MGT2015 | Engineering Economics | 3 | 0 | 0 | 3 | SD | |
| 2 | MGT2004 | Development of Enterprises | 3 | 0 | 0 | 3 | SD / EM / EN | |
| 3 | MGT2007 | Digital Entrepreneurship | 3 | 0 | 0 | 3 | SD / EM / EN | HP |
| 4 | MGT2023 | People Management | 3 | 0 | 0 | 3 | SD / EM / EN | HP |

| **Table 3.2 Basic Science Courses (BSC)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
| 1 | MAT1003 | Applied Statistics | 1 | 0 | 2 | 2 | | |
| 2 | MAT1001 | Calculus and Linear Algebra | 3 | 1 | 0 | 4 | | |
| 3 | PHY1002 | Optoelectronics and Device Physics | 2 | 0 | 2 | 3 | | |
| 4 | CHE1017 | Applied Chemistry for Engineers | 1 | 0 | 2 | 2 | | |
| 5 | MAT2501 | Integral Transforms and Partial Differential Equations | 3 | 0 | 0 | 3 | | |
| 6 | MAT2502 | Numerical Methods and Complex Variables | 3 | 0 | 0 | 3 | | |
| | | **Total No. of Credits** | | | | 17 | | |

| **Table 3.3 Engineering Science Courses (ESC)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | CIV1008 | Basic Engineering Sciences | 2 | 0 | 0 | 2 | | |
| 2 | CSE1004 | Problem Solving Using C | 1 | 0 | 4 | 3 | | |
| 3 | EEE1007 | Basics of Electrical and Electronics Engineering | 3 | 0 | 2 | 4 | | |
| 4 | CSE1006 | Problem Solving using JAVA | 1 | 0 | 4 | 3 | | |
| 5 | MEC1006 | Engineering Graphics | 2 | 0 | 0 | 2 | | |
| 6 | ECE2010 | Innovative Projects using Arduino | - | - | - | 1 | | |
| 7 | CSE20XX | C Programming and Data Structures | 3 | 0 | 0 | 3 | | |
| 8 | CSE20XX | C Programming and Data Structures Lab | 0 | 0 | 2 | 1 | | |
| 9 | CSE1700 | Essentials of AI | 3 | 0 | 0 | 3 | | |
| 10 | CSE1701 | Essentials of AI Lab | 0 | 0 | 4 | 2 | | |
| **Total No. of Credits** | | | | | | 24 | | |

**Table 3.4 Professional Core Courses (PCC)**

| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
|---|---|---|---|---|---|---|---|---|
| 1 | EEE2500 | Electric Circuit Analysis | 3 | 1 | 0 | 4 | S | - |
| 2 | EEE2009 | Analog Electronics Circuits | 3 | 0 | 0 | 3 | S | - |
| 3 | EEE2015 | Digital Electronics | 3 | 0 | 0 | 3 | S | - |
| 4 | EEE2501 | Signals and Systems | 3 | 1 | 0 | 4 | S | - |
| 5 | EEE2502 | Electromagnetic Fields | 3 | 1 | 0 | 4 | S | - |
| 6 | EEE2503 | DC Machines and Special Machines | 3 | 0 | 0 | 3 | S | - |
| 7 | EEE2504 | AC Machines | 3 | 0 | 0 | 3 | S | - |
| 8 | EEE2505 | Op amps and Linear Integrated Circuits | 3 | 0 | 0 | 3 | S | - |
| 9 | EEE2506 | Microprocessor and Microcontrollers | 3 | 0 | 0 | 3 | S | - |
| 10 | EEE2507 | Control Systems Engineering | 3 | 1 | 0 | 4 | S | - |
| 11 | EEE2508 | Electrical and Electronics Measurements and Instrumentation | 3 | 0 | 0 | 3 | S | - |
| 12 | EEE2509 | Transmission and Distribution | 3 | 1 | 0 | 4 | S | HP |
| 13 | EEE2510 | Electrical Power Generation and Economics | 2 | 0 | 0 | 2 | S | |
| 14 | EEE2511 | Power Electronics | 3 | 0 | 0 | 3 | S | - |
| 15 | EEE3001 | Electrical Drives | 3 | 1 | 0 | 4 | S | ES |
| 16 | EEE3057 | Power System Analysis | 3 | 1 | 0 | 4 | S | - |
| 17 | EEE2561 | Analog and Digital Electronics Laboratory | 0 | 0 | 2 | 1 | S | - |
| 18 | EEE2560 | Signal and Systems laboratory | 0 | 0 | 2 | 1 | S | - |
| 19 | EEE2562 | DC Machines and Special Machines Laboratory | 0 | 0 | 2 | 1 | S | - |
| 20 | EEE2563 | AC Machines Laboratory | 0 | 0 | 2 | 1 | S | - |
| 21 | EEE2564 | Microprocessors and Microcontrollers Laboratory | 0 | 0 | 2 | 1 | S | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 22 | EEE2565 | Measurements and Instrumentation Laboratory | 0 | 0 | 2 | 1 | S | |
| 23 | EEE2566 | Control Systems Engineering Laboratory | 0 | 0 | 2 | 1 | S | - |
| 24 | EEE2567 | Electrical CAD Laboratory | 0 | 0 | 2 | 1 | S | - |
| 25 | EEE2568 | Power Electronics Laboratory | 0 | 0 | 2 | 1 | S | - |
| 26 | EEE3560 | Power System Simulation Laboratory | 0 | 0 | 2 | 1 | S | |
| **Total No. of Credits** | | | | | | 64 | | |

**Table 3.5 Professional Core Courses (PCC)**

| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
|---|---|---|---|---|---|---|---|---|
| 1 | EEEXXXX | Professional Elective - I | 3 | 0 | 0 | 3 | EM / EN | - |
| 2 | EEEXXXX | Professional Elective - II | 3 | 0 | 0 | 3 | EM / EN | - |
| 3 | EEEXXXX | Professional Elective - III | 3 | 0 | 0 | 3 | EM / EN | - |
| 4 | EEEXXXX | Professional Elective - IV | 3 | 0 | 0 | 3 | EM / EN | - |
| 5 | EEEXXXX | Professional Elective - V | 3 | 0 | 0 | 3 | EM / EN | - |
| 6 | EEEXXXX | Professional Elective - VI | 3 | 0 | 0 | 3 | EM / EN | - |
| 7 | EEEXXXX | Professional Elective - VII | 3 | 0 | 0 | 3 | EM / EN | - |
| **Total No. of Credits** | | | | | | 21 | | |

**Table 3.6 Open Elective Courses (OEC)**

| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
|---|---|---|---|---|---|---|---|---|
| 1 | XXXXXXX | Open Elective - I | 3 | 0 | 0 | 3 | EM / EN | - |
| 2 | XXXXXXX | Open Elective - II | 3 | 0 | 0 | 3 | EM / EN | - |
| 3 | XXXXXXX | Open Elective - III | 3 | 0 | 0 | 3 | EM / EN | - |
| **Total No. of Credits** | | | | | | 9 | | |

**Table 3.7 Project Work (PRW)**

| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
|---|---|---|---|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | EEE7000 | Internship | - | - | - | 2 | SD / EM / EN | ES / HP |
| 2 | EEE7100 | Minor Project | - | - | - | 4 | SD / EM / EN | ES / HP |
| 3 | EEE7300 | Capstone Project | - | - | - | 10 | SD / EM / EN | ES / HP |
| **Total No. of Credits** | | | | | | 16 | | |

| **Table 3.8 Mandatory Courses (MAC)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
| 1 | CHE1018 | Environmental Science | 1 | 0 | 2 | 0 | S | - |
| 2 | LAW1007 | Indian Constitution and Professional Ethics for Engineers | 1 | 0 | 0 | 0 | S | - |
| **Total No. of Credits** | | | | | | 0 | | |

## 18. Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations, are simply assigned the number of Credits based on the quantum of work / effort required to full fill the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip B.Tech. graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations, 2021). The same shall be prescribed in the Course Handout.

### *18.1 Internship*

A student may undergo an Internship for a period of 4-6 weeks in an industry / company or academic / research institution during the Semester Break between 4$^{th}$ and 5$^{th}$ Semesters or 6$^{th}$ and 7$^{th}$ Semesters, subject to the following conditions:

**18.1.1** The Internship shall be in conducted in accordance with the Internship Policy prescribed by the University from time to time.

**18.1.2** The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Internship to a student;

**18.1.3** The number of Internships available for the concerned Academic Term. Further, the available number of internships shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Internship, as stated in Sub-Clause 18.1.2 above.

**18.1.4** A student may opt for Internship in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Internship confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

**18.1.5** A student selected for an Internship in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

### *18.2 Minor Project Work*

A student may opt to do a Minor Project Work for a period of 4-6 weeks in an Industry / Company or academic / research institution or the University Department(s) during the 5$^{th}$ / 6$^{th}$ / 7$^{th}$ Semester as applicable, subject to the following conditions:

**18.2.1** The Minor Project Work shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

**18.2.2** The student may do the Minor project work in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.2.1). Provided further, that the Industry / Company or academic / research institution offering such project work confirms to the University that the project work will be conducted in accordance with the Program Regulations and requirements of the University.

### *18.3 Capstone Project*

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 7$^{th}$ / 8$^{th}$ Semester as applicable, subject to the following conditions:

**18.3.1** The Capstone Project shall be in conducted in accordance with the Capstone Project Policy prescribed by the University from time to time.

**18.3.2** The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Capstone Project to a student;

**18.3.3** The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the

students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause 18.3.2 above.

**18.3.4** A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Capstone Project on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Capstone Project confirms to the University that the Capstone Project shall be conducted in accordance with the Program Regulations and Capstone Project Policy of the University.

**18.3.5** A student selected for a Capstone Project in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Capstone Project Policy of the University.

### *18.4 Research Project / Dissertation*

A student may opt to do a Research Project / Dissertation for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Capstone Project, subject to the following conditions:

**18.4.1** The Research Project / Dissertation shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.4.1). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

## 19.List of Elective Courses under various Specialisations / Stream Basket

**Table 3. 8: Professional Electives Courses/Specialization Tracks– Minimum of 12 credits is to be earned by the student in a particular track and overall 21 credits.**

Track 1: General Basket

| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
|---|---|---|---|---|---|---|---|---|
| 1 | EEE3003 | Switchgear and Protection | 3 | 0 | 0 | 3 | S | - |
| 2 | EEE3008 | Materials in Electrical Systems | 3 | 0 | 0 | 3 | EM | ES |
| 3 | EEE3006 | High Voltage Engineering | 3 | 0 | 0 | 3 | EM | - |
| 4 | EEE3010 | Electrical Estimation and Costing | 3 | 0 | 0 | 3 | EM | - |
| 5 | EEE3014 | Digital Signal Processing Systems | 3 | 0 | 0 | 3 | EM | - |
| 6 | EEE3013 | VLSI Systems | 3 | 0 | 0 | 3 | EM | - |
| 7 | EEE3011 | Testing and Commissioning of Electrical Equipment's | 3 | 0 | 0 | 3 | EN | HP |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | EEE3015 | Industrial Automation with PLC and SCADA | 3 | 0 | 0 | 3 | EM | - |
| 9 | EEE3009 | AI applications for Electrical Engineering | 3 | 0 | 0 | 3 | EM | - |
| 10 | EEE3012 | Reactive power compensation and Management | 3 | 0 | 0 | 3 | EM | - |
| Track 2: Power and Energy system Basket | | | | | | | | |
| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
| 1 | EEE3400 | Solar photovoltaic & Wind Energy Systems | 3 | 0 | 0 | 3 | EM | ES |
| 2 | EEE3401 | Electrical Power Utilization | 3 | 0 | 0 | 3 | EM | HP |
| 3 | EEE3402 | Power System Operation & Control | 3 | 0 | 0 | 3 | EM | - |
| 4 | EEE3403 | Energy Auditing & Demand Side Management | 3 | 0 | 0 | 3 | EN | HP |
| 5 | EEE3404 | Microgrid Operation & Control | 3 | 0 | 0 | 3 | EM | ES |
| 6 | EEE3405 | Smart Grid Technologies | 3 | 0 | 0 | 3 | EM | - |
| 7 | EEE3406 | Big Data Analytics in Power Systems. | 3 | 0 | 0 | 3 | EM | - |
| 8 | EEE3407 | Energy Storage Systems | 3 | 0 | 0 | 3 | EM | ES |
| 9 | EEE3408 | Electrical Distribution System | 3 | 0 | 0 | 3 | EM | - |
| 10 | EEE3409 | Power Market and Policy | 3 | 0 | 0 | 3 | EM | ES |
| Track 3: Automotive Electronics Basket | | | | | | | | |
| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
| 1 | EEE3500 | Electric Vehicle Technology | 3 | 0 | 0 | 3 | EN | - |
| 2 | EEE3501 | Battery Management Systems | 3 | 0 | 0 | 3 | EN | ES |
| 3 | EEE3502 | Automotive Embedded systems | 3 | 0 | 0 | 3 | EM | - |
| 4 | EEE3503 | Power Electronics Applications for Electrical Vehicles | 3 | 0 | 0 | 3 | EN | - |
| 5 | EEE3504 | AI Techniques for EVs and HEVs | 3 | 0 | 0 | 3 | EM | ES |
| 6 | EEE3505 | Micro Electro Mechanical Systems | 3 | 0 | 0 | 3 | EM | - |
| 7 | EEE3506 | Sensors and Transducers | 3 | 0 | 0 | 3 | EM | - |
| 8 | EEE3507 | Advanced Driver Assistance Systems (ADAS) | 3 | 0 | 3 | 3 | EM | - |
| 9 | EEE3508 | Electric Mobility and Charging Infrastructure | 3 | 0 | 3 | 3 | EM | - |
| 10 | EEE3509 | Vehicle Electrification and Renewable Integration | 3 | 0 | 0 | 3 | EM | - |
| Track 4: Power Electronics and Industrial Drives | | | | | | | | |
| S. No | Course code | Course Name | L | T | P | C | Type of skill | Course caters to |
| 1 | EEE3600 | Special Electrical Machines | 3 | 0 | 0 | 3 | EN | - |
| 2 | EEE3601 | Power Quality and Harmonics | 3 | 0 | 0 | 3 | EN | ES |
| 3 | EEE3602 | Modern power electronics and AC drives | 3 | 0 | 0 | 3 | EM | - |
| 4 | EEE3603 | Flexible A. C Transmission Systems (FACTS) | 3 | 0 | 0 | 3 | EN | - |
| 5 | EEE3604 | HVDC transmission | 3 | 0 | 0 | 3 | EM | ES |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | EEE3605 | Wireless Power Transfer and Emerging Technologies | 3 | 0 | 0 | 3 | EM | - |
| 7 | EEE3606 | Electromagnetic Interference (EMI) and Protection | 3 | 0 | 0 | 3 | EM | - |
| 8 | EEE3607 | Machine Modeling & Analysis | 3 | 0 | 0 | 3 | EM | - |
| 9 | EEE3608 | Switched Mode Power Supplies | 3 | 0 | 0 | 3 | EM | - |
| 10 | EEE3609 | FPGA for Power Electronic Converters | 3 | 0 | 0 | 3 | EM | - |

## 20. List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters.

**Table 3.9 : Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 9**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Chemistry Basket** | | | | | | | | |
| 1 | CHE3001 | Smart Materials and 3D Printing | 3 | 0 | 0 | 3 | ES | - |
| 2 | CHE3002 | Enenrgy and Sustainability | 3 | 0 | 0 | 3 | ES | - |
| 3 | CHE3003 | Nano technology and its applications | 3 | 0 | 0 | 3 | ES | - |
| 4 | CHE3004 | Corrosion and control | 3 | 0 | 0 | 3 | ES | - |
| 5 | CHE3005 | Green Chemistry and Sustainable Technology | 3 | 0 | 0 | 3 | ES | - |
| 6 | CHE3006 | Food Technology | 3 | 0 | 0 | 3 | ES | - |
| **Civil Engineering Basket** | | | | | | | | |
| 1 | CIV3100 | Disaster mitigation and management | 3 | 0 | 0 | 3 | SD | ES / HP |
| 2 | CIV3101 | Sustainability Concepts in Engineering | 3 | 0 | 0 | 3 | FC | ES |
| 3 | CIV3102 | Occupational Health and Safety | 3 | 0 | 0 | 3 | SD | ES |
| 4 | CIV3103 | Sustainable Materials and Green Buildings | 3 | 0 | 0 | 3 | SD | |
| 5 | CIV3104 | Integrated Project Management | 3 | 0 | 0 | 3 | SD / EM | ES |
| 6 | CIV3105 | Environmental Impact Assessment | 3 | 0 | 0 | 3 | SD / EM / EN | HP / GS |
| 7 | CIV3106 | Infrastructure Systems for Smart Cities | 3 | 0 | 0 | 3 | EM / EN | ES |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | CIV3107 | Geospatial Applications for Engineers | 2 | 0 | 2 | 3 | EM / EN | ES |
| 9 | CIV3108 | Environmental Meteorology | 3 | 0 | 0 | 3 | SD / EM | ES |
| 10 | CIV3109 | Project Problem Based Learning | 3 | 0 | 0 | 3 | SD | ES |
| 11 | CIV3110 | Sustainability for Professional Practice | 3 | 0 | 0 | 3 | SD | ES |
| **Commerce Basket** | | | | | | | | |
| **1** | MGT2015 | Engineering Economics | 3 | 0 | 0 | 3 | | |
| **2** | MGT2020 | Marketing Fundamentals for Engineers | 3 | 0 | 0 | 3 | | |
| **3** | MGT2021 | Finance for Engineers | 3 | 0 | 0 | 3 | | |
| **4** | MGT2007 | Digital Entreprenuership | 3 | 0 | 0 | 3 | | |
| **5** | COM1020 | Business Accounting & Financial Analysis | 2 | 1 | 0 | 3 | | |
| **6** | COM2005 | Introduction to Insurance | 3 | 0 | 0 | 3 | | |
| **7** | BBA2088 | Management and Behavioural Practices | 3 | 0 | 0 | 3 | | |
| **Design Basket** | | | | | | | | |
| 1 | DES2001 | Design Thinking | 3 | 0 | 0 | 3 | S.EM,EN | GS, ES, HP |
| **Electrical and Electronics Engineering Basket** | | | | | | | | |
| 1 | EEE3100 | IoT based Smart Building Technology | 3 | 0 | 0 | 3 | SD | - |
| 2 | EEE3101 | Basic Circuit Analysis | 3 | 0 | 0 | 3 | SD | - |
| 3 | EEE3102 | Fundamentals of Industrial Automation | 3 | 0 | 0 | 3 | SD | - |
| 4 | EEE3103 | Electric Vehicles & Battery technology | 3 | 0 | 0 | 3 | SD | - |
| 5 | EEE3104 | Smart Sensors for Engineering Applications | 3 | 0 | 0 | 3 | SD | - |
| **Electronics and Communication Engineering Basket** | | | | | | | | |
| 1 | ECE3800 | Fundamentals of Electronics | 3 | 0 | 0 | 3 | SD | |
| 2 | ECE3801 | Microprocessor based systems | 3 | 0 | 0 | 3 | FC | EM |
| 3 | ECE3802 | Artificial Neural Networks | 3 | 0 | 0 | 3 | FC | EM |
| 4 | ECE3803 | Smart Electronics in Agriculture | 3 | 0 | 0 | 3 | FC | EM |
| 5 | ECE3804 | Environment Monitoring Systems | 3 | 0 | 0 | 3 | SD / FC | EM/ EN |
| 6 | ECE3805 | Consumer Electronics | 3 | 0 | 0 | 3 | FC | EM |
| 7 | ECE3806 | Product Design of Electronic Equipment | 3 | 0 | 0 | 3 | FC | EM |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | ECE3807 | Introduction to Data Analytics | 3 | 0 | 0 | 3 | SD | |
| 9 | ECE3808 | Machine Vision for Robotics | 3 | 0 | 0 | 3 | SD | |
| **English Basket** | | | | | | | | |
| 1 | ENG1906 | Law and Crime in Popular Imagination | 3 | 0 | 0 | 3 | SD | |
| 2 | ENG1909 | Exploring Gender: Narratives from Campus to Community | 3 | 0 | 0 | 3 | SD | |
| 3 | ENG1910 | Trauma Narratives: From Page to Pixel | 3 | 0 | 0 | 3 | SD | |
| 4 | ENG1911 | 'Nonsense' Across Media | 3 | 0 | 0 | 3 | | |
| 5 | ENG1912 | Language and Interpretation | 3 | 0 | 0 | 3 | | |
| **Law Basket** | | | | | | | | |
| 1 | LAW2015 | Cyber Law | 3 | 0 | 0 | 3 | FC | HP |
| 2 | LAW5005 | Law relating to Infrastructure Projects | 3 | 0 | 0 | 3 | FC | HP |
| **Mathematics Basket** | | | | | | | | |
| 1 | MAT3031 | Basic Statistics & Data Analysis | 3 | 0 | 0 | 3 | - | - |
| 2 | MAT3032 | Mathematics for Machine Learning | 3 | 0 | 0 | 3 | - | - |
| 3 | MAT3033 | Bioinformatics & Computational Biology | 3 | 0 | 0 | 3 | - | - |
| 4 | MAT3034 | Time-Frequency Transforms for Signal Analysis | 3 | 0 | 0 | 3 | - | - |
| 5 | MAT3035 | Mathematical Modeling | 3 | 0 | 0 | 3 | - | - |
| **Mechanical Engineering Basket** | | | | | | | | |
| 1 | MEC3250 | Engineering Drawing | 1 | 0 | 4 | 3 | EM | - |
| 2 | MEC3251 | Supply Chain Management | 3 | 0 | 0 | 3 | EM | - |
| 3 | MEC3252 | Six Sigma for Professionals | 3 | 0 | 0 | 3 | EM | - |
| 4 | MEC3253 | Fundamentals of Aerospace Engineering | 3 | 0 | 0 | 3 | EM | - |
| 5 | MEC3254 | Safety Engineering | 3 | 0 | 0 | 3 | EM | - |
| 6 | MEC3255 | Additive Manufacturing | 3 | 0 | 0 | 3 | EM | - |
| 7 | MEC3256 | Sustainable Technologies and Practices | 3 | 0 | 0 | 3 | EM | - |
| 8 | MEC3257 | Industry 4.0 | 3 | 0 | 0 | 3 | EM | - |
| **Petroleum Engineering Basket** | | | | | | | | |
| 1 | PET3301 | Energy Industry Dynamics | 3 | 0 | 0 | 3 | FC / SD / EM | ES |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | PET3302 | Energy Sustainability Practices | 3 | 0 | 0 | 3 | FC / SD / EM | ES |
| **Media Studies Basket** | | | | | | | | |
| 1 | BAJ 1024 | Media Psychology | 3 | 0 | 0 | 3 | **EM** | |
| 2 | BAJ 1025 | Creative Writing for Media | 3 | 0 | 0 | 3 | **EM** | |
| 3 | BAJ 1026 | Multimedia Storytelling | 3 | 0 | 0 | 3 | **EM** | |
| 4 | BAJ 1027 | Digital Advertising & Branding | 3 | 0 | 0 | 3 | **EM** | |
| 5 | BAJ 1028 | Content Creation for Social Media | 3 | 0 | 0 | 3 | **EM** | |

## 21.List of MOOC (NPTEL) Courses

### 21.1 NPTEL - Discipline Elective Courses for B. Tech. (Electrical and Electronics Engineering)

| Sl. No. | Course ID | Course Name | Duration |
|---|---|---|---|
| 1 | noc25-ee14 | Computer-Aided Design of Electrical Machines | 12 Weeks |
| 2 | noc25-ee31 | Embedded Sensing, Actuation and Interfacing Systems | 12 Weeks |
| 3 | noc25-ee40 | Fuzzy Sets, Logic and Systems & Applications | 12 Weeks |
| 4 | noc25-ee51 | Modern Computer Vision | 12 Weeks |
| 5 | noc25-ee57 | Operation and Planning Of Power Distribution Systems | 12 Weeks |
| 6 | noc25-ee58 | Optical Fiber Sensors | 12 Weeks |
| 7 | noc25-ee63 | Power Management Integrated Circuits | 12 Weeks |
| 8 | noc25-ee69 | Principles of Digital Communication | 12 Weeks |

### 21.2 NPTEL - Open Elective Courses for B. Tech. (Electrical and Electronics Engineering)

| Sl. No. | Course ID | Course Name | Duration |
|---|---|---|---|
| 1 | noc25-ag06 | Machine Learning for Soil and Crop Management | 12 Weeks |
| 2 | noc25-ag09 | Soil and Water Conservation Engineering | 12 Weeks |
| 3 | noc25-ag10 | Water Quality Management Practices | 12 Weeks |
| 4 | noc25-cs08 | Blockchain and its Applications | 12 Weeks |
| 5 | noc25-cs49 | Machine Learning for Engineering and science applications | 12 Weeks |
| 6 | noc25-de04 | Strategies for Sustainable Design | 12 Weeks |

| | | | |
|---|---|---|---|
| 7 | noc25-ge31 | Rural Water Resources Management | 12 Weeks |
| 8 | noc25-ge25 | One Health | 12 Weeks |
| 9 | noc25-ge17 | Introduction to Environmental Engineering and Science - Fundamental and Sustainability Concepts | 12 Weeks |

## 22. Recommended Semester Wise Course Structure / Flow including the Programme / Discipline Elective Paths / Options

**Semester 1 - Basic Engineering Science Cycle**

| Sl. No. | Course Code | Course Name | L | T | P | Credits | Contact Hours | Basket |
|---|---|---|---|---|---|---|---|---|
| **1** | CIV1008 | Basic Engineering Sciences | 2 | 0 | 0 | 2 | 2 | ESC |
| **2** | CSE1004 | Problem Solving Using C | 1 | 0 | 4 | 3 | 5 | ESC |
| **3** | EEE1007 | Basics of Electrical and Electronics Engineering | 3 | 0 | 2 | 4 | 5 | ESC |
| **4** | MAT1003 | Applied Statistics | 1 | 0 | 2 | 2 | 3 | BSC |
| **5** | ENG1002 | Technical English | 1 | 0 | 2 | 2 | 3 | HSMC |
| **6** | PPS1001 | Introduction to soft skills | 0 | 0 | 2 | 1 | 2 | HSMC |
| **7** | LAW1007 | Indian Constitution and Professional Ethics for Engineers | 1 | 0 | 0 | 0 | 1 | MAC |
| **8** | CHE1018 | Environmental Science | 1 | 0 | 2 | 0 | 3 | MAC |
| | | **Total** | **10** | **0** | **14** | **14** | **24** | |

HSMC = Humanities and Social Sciences including Management Courses, BSC = Basic Science Courses, ESC = Engineering Science Courses, PCC = Professional Core Courses, PEC = Professional Elective Courses, OEC = Open Elective Courses, PRW = Project Work, MAC = Mandatory Courses.

**Semester 2 - Physics Cycle**

| Sl. No. | Course Code | Course Name | L | T | P | Credits | Contact Hours | Basket |
|---|---|---|---|---|---|---|---|---|
| **1** | CSE1006 | Problem Solving using JAVA | 1 | 0 | 4 | 3 | 5 | ESC |
| **2** | MAT1001 | Calculus and Linear Algebra | 3 | 1 | 0 | 4 | 4 | BSC |
| **3** | PHY1002 | Optoelectronics and Device Physics | 2 | 0 | 2 | 3 | 4 | BSC |
| **4** | MEC1006 | Engineering Graphics | 2 | 0 | 0 | 2 | 2 | ESC |
| **5** | EEE2030 | Electrical Power Generation and Economics | 2 | 0 | 0 | 2 | 2 | PCC |
| **6** | ENG2001 | Advanced English | 1 | 0 | 2 | 2 | 3 | HSMC |
| **7** | ECE2010 | Innovative Projects using Arduino | - | - | - | 1 | 0 | ESC |
| **8** | PPS1012 | Enhancing Personality through Soft Skill | 0 | 0 | 2 | 1 | 2 | HSMC |
| **9** | CHE1017 | Applied Chemistry for Engineers | 1 | 0 | 2 | 2 | 3 | BSC |
| | | **Total** | **12** | **1** | **12** | **20** | **25** | |

HSMC = Humanities and Social Sciences including Management Courses, BSC = Basic Science Courses, ESC = Engineering Science Courses, PCC = Professional Core Courses, PEC = Professional Elective Courses, OEC = Open Elective Courses, PRW = Project Work, MAC = Mandatory Courses.

**Semester 3**

| Sl. No. | Course Code | Course Name | L | T | P | Credits | Contact Hours | Basket |
|---|---|---|---|---|---|---|---|---|
| 1 | MAT2501 | Integral Transforms and Partial Differential Equations | 3 | 0 | 0 | 3 | 3 | BSC |
| 2 | CSE20XX | C Programming and Data Structures | 3 | 0 | 0 | 3 | 3 | ESC |
| 3 | CSE20XX | C Programming and Data Structures Lab | 0 | 0 | 2 | 1 | 2 | ESC |
| | ECE2011 | Innovative Projects using Raspberry Pi | - | - | - | 1 | | ESC |
| 4 | EEE2500 | Electric Circuit Analysis | 3 | 1 | 0 | 4 | 4 | PCC |
| 5 | EEE2009 | Analog Electronics Circuits | 3 | 0 | 0 | 3 | 3 | PCC |
| 6 | EEE2015 | Digital Electronics | 3 | 0 | 0 | 3 | 3 | PCC |
| 7 | XXXXXXX | Open Elective - I | 3 | 0 | 0 | 3 | 3 | OEC |
| 8 | EEE2503 | DC Machines and Special Machines | 3 | 0 | 0 | 3 | 3 | PCC |
| 9 | EEE2561 | Analog and Digital Electronics Lab | 0 | 0 | 2 | 1 | 2 | PCC |
| 10 | EEE2562 | DC Machines and Special Machines Lab | 0 | 0 | 2 | 1 | 2 | PCC |
| | | **Total** | **21** | **1** | **6** | **26** | **28** | |

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**Semester 4**

| Sl. No. | Course Code | Course Name | L | T | P | Credits | Contact Hours | Basket |
|---|---|---|---|---|---|---|---|---|
| 1 | MAT2502 | Numerical Methods and Complex Variables | 3 | 0 | 0 | 3 | 3 | BSC |
| 2 | EEE2501 | Signals and Systems | 3 | 1 | 0 | 4 | 4 | PCC |
| 3 | EEE2508 | Electrical and Electronics Measurements and Instrumentation | 3 | 0 | 0 | 3 | 3 | PCC |
| 4 | EEE2505 | Opamps and Linear Integrated Circuits | 3 | 0 | 0 | 3 | 3 | PCC |
| 5 | EEE2506 | Microprocessor and Microcontrollers | 3 | 0 | 0 | 3 | 3 | PCC |
| 6 | EEE2504 | AC Machines | 3 | 0 | 0 | 3 | 3 | PCC |
| 7 | EEE2502 | Electromagnetic Fields | 3 | 1 | 0 | 4 | 4 | PCC |
| 8 | EEE2565 | Measurements and Instrumentation Lab | 0 | 0 | 2 | 1 | 2 | PCC |
| 9 | EEE2564 | Microprocessors and Microcontrollers Lab | 0 | 0 | 2 | 1 | 2 | PCC |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **10** | EEE2560 | Signal and Systems lab | 0 | 0 | 2 | 1 | 2 | PCC |
| **11** | EEE2563 | AC Machines Lab | 0 | 0 | 2 | 1 | 2 | PCC |
| | | **Total** | **21** | **1** | **8** | **27** | **31** | |

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**Semester 5**

| Sl. No. | Course Code | Course Name | L | T | P | Credits | Contact Hours | Basket |
|---|---|---|---|---|---|---|---|---|
| **1** | EEE2507 | Control Systems Engineering | 3 | 1 | 0 | 4 | 4 | PCC |
| **2** | EEE2509 | Transmission and Distribution | 3 | 1 | 0 | 4 | 4 | PCC |
| **3** | EEE2511 | Power Electronics | 3 | 0 | 0 | 3 | 3 | PCC |
| **4** | EEEXXXX | Professional Elective - I | 3 | 0 | 0 | 3 | 3 | PEC |
| **5** | MGTxxxx | Management Course (Select any one course from Management Basket - I) | 3 | 0 | 0 | 3 | 3 | HSMC |
| **6** | EEE2566 | Control Systems Engineering Lab | 0 | 0 | 2 | 1 | 2 | PCC |
| **7** | EEE2567 | Electrical CAD Lab | 0 | 0 | 2 | 1 | 4 | PCC |
| **8** | CSExxxx | Essentials of AI using Python | 3 | 0 | 0 | 3 | 3 | ESC |
| **9** | CSExxxx | Essentials of AI using Python Lab | 0 | 0 | 4 | 2 | 4 | ESC |
| **10** | EEE7100 | Minor Project | - | - | - | 4 | - | PRW |
| | | **Total** | **18** | **2** | **8** | **28** | **30** | |

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**Semester 6**

| Sl. No. | Course Code | Course Name | L | T | P | Credits | Contact Hours | Basket |
|---|---|---|---|---|---|---|---|---|
| **1** | EEE3058 | Electrical Drives | 3 | 1 | 0 | 4 | 4 | PCC |
| **2** | EEE3057 | Power System Analysis | 3 | 1 | 0 | 4 | 4 | PCC |
| **3** | EEEXXXX | Professional Elective - II | 3 | 0 | 0 | 3 | 3 | PEC |
| **4** | EEEXXXX | Professional Elective - III | 3 | 0 | 0 | 3 | 3 | PEC |
| **5** | EEEXXXX | Professional Elective - IV | 3 | 0 | 0 | 3 | 3 | PEC |
| **6** | EEEXXXX | Professional Elective - V | 3 | 0 | 0 | 3 | 3 | PEC |
| **7** | XXXXXXX | Open Elective - II | 3 | 0 | 0 | 3 | 3 | OEC |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **8** | EEE2568 | Power Electronics Lab | 0 | 0 | 2 | 1 | 2 | PCC |
| **9** | EEE3560 | Power System Simulation Lab | 0 | 0 | 2 | 1 | 2 | PCC |
| | | **Total** | **21** | **2** | **4** | **25** | **27** | |

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**Semester 7**

| Sl. No. | Course Code | Course Name | L | T | P | Credits | Contact Hours | Basket |
|---|---|---|---|---|---|---|---|---|
| **1** | EEEXXXX | Professional Elective - VI | 3 | 0 | 0 | 3 | 3 | PEC |
| **2** | EEEXXXX | Professional Elective - VII | 3 | 0 | 0 | 3 | 3 | PEC |
| **3** | XXXXXXX | Open Elective - III | 3 | 0 | 0 | 3 | 3 | OEC |
| **4** | EEE7000 | Internship | - | - | - | 2 | 0 | PRW |
| | | **Total** | **9** | **0** | **0** | **11** | **9** | |

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**Semester 8**

| Sl. No. | Course Code | Course Name | L | T | P | Credits | Contact Hours | Basket |
|---|---|---|---|---|---|---|---|---|
| **1** | EEE7300 | Capstone Project | - | - | - | 10 | 0 | PRW |
| | | **Total** | **0** | **0** | **0** | **10** | **0** | |

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**23. Course Catalogue**

<table>
<tr><td>Course Code:<br>ENG1002</td><td colspan="4">Course Title: Technical English<br>Type of Course: 1] School Core<br>2] Laboratory integrated</td><td>L-T-P-C</td><td>1</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td>Version No.</td><td colspan="9">V. 3</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="9">Intermediate Level English</td></tr>
<tr><td>Course Anti-requisites</td><td colspan="9">NIL</td></tr>
<tr><td>Course Description</td><td colspan="9">Technical English course is designed to equip students with the language skills necessary for effective communication in technical and scientific contexts. The course focuses on the specialized vocabulary, writing styles, and communication techniques used in various technical fields, including engineering and information technology.</td></tr>
<tr><td>Course Objectives</td><td colspan="9">The objective of this course is to develop the learners' EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING and PARTICIPATIVE LEARNING TECHNIQUES.</td></tr>
<tr><td>Course Outcomes</td><td colspan="9">On successful completion of the course, the students shall be able to:<br>1. Develop proficiency in using technical vocabulary and terminology.<br>2. Apply language skills for better speaking skills in technical fields.<br>3. Write technical descriptions<br>4. Demonstrate writing skills in writing technical documents such as reports, manuals, and articles.</td></tr>
<tr><td>Course Content:</td><td colspan="9"></td></tr>
<tr><td>Module 1</td><td colspan="2">Fundamentals of Technical Communication</td><td>Worksheets& Quiz</td><td>Vocabulary building</td><td colspan="4">9 Classes</td></tr>
<tr><td colspan="10">Introduction to Technical English, Differences between Technical English and General, English, Technical Writing Basics, Technical Vocabulary</td></tr>
<tr><td>Module 2</td><td colspan="2">Technical Presentation</td><td>Presentations</td><td>Speaking Skills</td><td colspan="4">12 Classes</td></tr>
<tr><td colspan="10">Introduction<br>Planning the Presentation, Creating the Presentation, Giving the Presentation</td></tr>
<tr><td>Module 3</td><td colspan="2">Technical Description</td><td>Assignment</td><td>Group Presentation</td><td colspan="4">12 Classes</td></tr>
<tr><td colspan="10">Product Description, Process Description, User Manuals, Transcoding: Diagrams, charts and images</td></tr>
</table>

| Module 4 | Technical Writing | Assignment | Writing Skills | 12 Classes |
|---|---|---|---|---|

Email Writing, Persuasive and Descriptive Language, Professional Email Etiquette, Writing clear and concise technical emails, Communicating technical information effectively,
Technical Report Writing, Types of technical reports (Lab reports, research reports, etc.) Components of technical reports, Writing an abstract and executive summary, Structure and content organization, Transcoding: diagrams, charts and images

**List of Laboratory Tasks:**

1. Module-1
   Level 1: Worksheets
   Level 2: Worksheets
2. Module 2
   Level 1: Preparing Presentation
   Level 2: Giving Presentation (Individual)
3. Module-3
   Level 1: Product Description & User Manual
   Level 2: Process Description & Transcoding
4. Module 4
   Level 1: Email Writing
   Level 2: Report Writing

**Targeted Applications & Tools that can be used:**

1. Flip grid
2. Quizzes
3. Youtube Videos
4. Podcast

**Project work/Assignment: Mention the Type of Project /Assignment proposed for this course**

1. Bring out the essence of technical communication with reference to the conventions of technical communication, with examples
2. Prepare a technical presentation on the importance of Technical Communication and its relevance in a technical field, with real-life examples.

The following individual, as well as group Assignments, will be given to the students.

1. Presentation
2. Describing a product/process
3. Individual Reports

**Text Books**


1. Kumar,Sanjay;Pushpalatha.*EnglishLanguageandCommunicationSkillsforEngineers.*OxfordUniversityPress. 2018.
2. Brieger, Nick and Alison Paul. *Technical English Vocabulary and Grammar*. https://nmetau.edu.ua/file/technical_english_vocabulary_and_grammar.pdf


**Reference Book:**


1. Chauhan, Gajendra Singh, and Kashmiramka, Smita, ***Technical Communication.*** Cengage Publication. 2018.
2. Sunder Jain. *Technical Report Writing*. Centrum Press, 2013.
3. John Bowden. "Writing a Report: How to Prepare, Write & Present Really Effective Reports?". 9th Edition 2011

Comfort, Jeremy et. al. 1984. *Business Reports in English*. Cambridge University Press.

4. Sharma, R.C. and K. Mohan. 2011. Business Correspondence and Report Writing, Fourth Edition. Tata McGraw Hill.

| |
|---|
| **Web Resources:**<br><br>1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=JSTOR1_3307.<br>2;https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=5&sid=3a77d69b-abe5-4681-b39d-32dfdcb8f4a5%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=154223466&db=iih<br>3: Last,Suzan, et. al. ***Technical Writing Essentials.*** University of Victoria, British Columbia, 2019 ( E- Book)<br>4 Wambui, Tabita Wangare, et al. ***Communication Skills- Volume 1,*** LAP LAMBRET, USA, 2012 ( E Book) |
| **Topics Relevant to the Development of Employability Skills:**<br>**Speaking Skills, Writing Skills, Critical Thinking and Critical Analysis,and Group Communication.** |

| | |
|---|---|
| **Catalogue prepared by** | **Dr. Vinodhini Chinnaswamy & Dr. T. Naresh Naidu** |
| **Recommended by the Board of Studies on** | 11th BoS, 05th July, 2024 |
| **Date of Approval by the Academic Council** | 3rd August, 2024 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **ENG2001** | **Advanced English** | **L- T- P- C** | 1 | 0 | 2 | 2 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | ENG1002 Technical English | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course is designed to equip students to enhance their communication abilities in Listening, Speaking, Reading, and Writing. The curriculum covers interpersonal communication principles, the art of speech writing and delivery (including impromptu speaking), strategic approaches to critical reading, the identification of logical fallacies, and persuasive writing. Furthermore, the course will introduce students to the potential of AI tools and the techniques of prompt engineering to elevate their communication skills in the digital age. Upon course completion, students will be well-prepared to communicate effectively and critically in both academic and professional environments. | | | | | |

<table>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of the course the students shall be able to:<br>1. Recognize the elements of interpersonal and cross-cultural communication to address communication challenges effectively.<br>1. Demonstrate the ability to deliver structured and impromptu speeches using effective speaking techniques.<br>2. Interpret textual and visual materials using critical reading strategies to evaluate arguments, logic, and persuasion.<br>3. Produce persuasive and analytical essays using effective argumentation techniques and structured writing strategies.</td></tr>
<tr><td colspan="5">Course Content: Theory</td></tr>
<tr><td>Module 1</td><td>Foundations of Effective Communication</td><td>Case Studies/ Role play</td><td>Cross-Cultural Competency</td><td>4 Classes</td></tr>
<tr><td colspan="5">Topics:<br>• Fundamentals of Interpersonal Communication<br>• Verbal, Non-verbal, and Paraverbal communication.<br>• Cultural dimensions theory (Hofstede’s Cultural Dimensions).<br>• Active Listening Techniques<br>• Common Errors in Communication</td></tr>
<tr><td>Module 2</td><td>Mastering Speech Delivery</td><td>JAM</td><td>Public Speaking Confidence</td><td>4Classes</td></tr>
<tr><td colspan="5">Topics:<br>• Introduction to Prompt Engineering<br>• Speech Preparation and Organization<br>• Techniques for Effective Impromptu Speaking<br>• Practice Speech Delivery</td></tr>
<tr><td>Module 3</td><td>Critical Reading and Logical Analysis</td><td>Worksheet</td><td>Critical Thinking and Analysis</td><td>4 Classes</td></tr>
<tr><td colspan="5">Topics:<br>• Critical Reading Strategies: Contextualizing, Figurative Language, Evaluating Logic of an Argument, Recognizing Emotional Manipulation, Analysing Visuals<br>• Recognizing Logical Fallacies: Slippery Slope, False Dilemma, Post Hoc, Hasty Generalization, Ad Hominem, Straw Man, Bandwagon, No True Scotsman, Red Herring, Appeal to Authority, Sunk Cost, Appeal to ignorance</td></tr>
<tr><td>Module 4</td><td>Writing Effective Arguments</td><td>Assignment</td><td>Clear and Coherent Writing</td><td>3 Classes</td></tr>
<tr><td colspan="5">Topics:<br>• Understanding Critical Writing<br>• Building Arguments (Pathos, Ethos, Logos)<br>• Techniques for Persuasion</td></tr>
<tr><td colspan="5">Course Content: Practical Sessions</td></tr>
<tr><td>Module 1</td><td colspan="3">Foundations of Effective Communication</td><td>8 Classes</td></tr>
<tr><td colspan="5">1. Interpersonal Communication</td></tr>
</table>

Charades with a Twist/Tone and Emotion Experiment/Mixed Messages Challenge/Role Reversal Conversations/Observation Exercise

2. **Cross-cultural Communication**
   Cultural Iceberg Analysis/Role-Play: Cross- Cultural Scenarios/Stereotypes vs Realities/Cross- /Cultural Negotiation Exercise/Cultural Sensitivity Case Studies
3. **Active Listening**
   Bingo TEDx /Story Building/Listening for Key Details/Interactive Podcast Listening/Fact or Opinion
4. **Instagram/YouTube Vocabulary Activity**

| **Module 2** | **Mastering Speech Delivery** | **8Classes** |
|---|---|---|

5. **Speech Writing**
6. **Impromptu Speech**
   JAM /"Would You Rather" Explainer/Picture Prompt Speech/Reverse Speech Crafting

| **Module 3** | **Critical Reading and Logical Analysis** | **8 Classes** |
|---|---|---|

7. **Critical Reading Strategies**
   Critical Reading Worksheet/Identifying Bias in News Articles
8. **Recognizing Logical Fallacies**
   Debate Challenge with Fallacy Detection/Fallacy Investigation with Podcasts or Social Media

| **Module 4** | **Writing Effective Arguments** | **6 Classes** |
|---|---|---|

9. **Building Arguments**
   Causes or Effects/Appeal Mash-Up/Debates on Controversial Topics
10. **Persuasive Writing**
    Creative Persuasive Writing/Opinion Writing

**Targeted Application & Tools that can be used:** Quizziz, Chatgpt, Gemini, Youtube, Instagram, Quillbot, Grammarly, Padlet

**References**


1. Adler, R. B., Rodman, G., &DuPré, A. (2019). *Understanding human communication (14th ed.)*. Oxford University Press.
2. Moore, B. N., & Parker, R. (2020). *Critical thinking* (13th ed.). McGraw-Hill Education.
3. DeVito, J. A. (2019). The interpersonal communication book (15th ed.). Pearson.
4. Ting-Toomey, S., & Dorjee, T. (2018). Intercultural competence: A model for teaching and assessing cross-cultural communication. *Journal of Intercultural Communication, 47*(2), 213–229. https://doi.org/10.1016/j.jicc.2018.03.004
5. https://www.ted.com/


**Topics Relevant to "employability":**Teamwork and Collaboration,Critical Thinking and Problem-Solving

**Topics Relevant to "Human Values and Professional Ethics":** Critical reasoning, Inclusivity and Fairness

| **Catalogue prepared by** | **Dr. Tychicus David, Dr. Jayalakshmi E** |
|---|---|
| **Recommended by the Board of Studies on** | **8th January 2025** |

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| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code:** MGT2015 | **Course Title**: Engineering Economics | L-T-P- C | 3 | 0 | 0 | 3 |
| **Course Pre-requisites** | Students are expected to meet the core participation requirements for the course outlines. Should possesses knowledge on contemporary issues of real world economic environment and be willing to understand the cost benefit analysis and a minimum of numerical orientation. | | | | | |
| **Anti-requisites** | NIL | | | | | |
| **Course Description** | The course introduces the student to the discipline of economics and its application in the field of engineering through market and cost structures. The course examines the concept of time value of money and how engineers can apply it for making economic decisions. It also explains how interest rates and different compounding periods influence the value of various capital expenditures. The course also deals with the effect of depreciation, taxes and inflation on capital expenditure decisions. | | | | | |
| **Course Outcomes** | On completion of the course the students are able to:<br>CO1 :Apply the appropriate engineering economics analysis methods for problem solving<br>CO2 :Evaluate the cost effectiveness of individual engineering projects<br>CO3 :Compare the life cycle cost of multiple projects and make a quantitative decision between alternative projects<br>CO4 : Perform ratio analysis and calculate time value of money to prepare and understand engineering project development and report generation.<br>CO5 : Compute the depreciation of an asset using standard depreciation techniques to assess its impact. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Engineering Economics and attain Entrepreneurship through Participative Learning techniques. | | | | | |
| **Module1** | Introduction to Engineering Economy and Engg Economic Decisions | Assignment | Assignment | 9 Sessions | | |
| Topics: Introduction, Origins and Principles of engineering economy, engineering economy and design process. Rational decision making and economic decisions, types of strategic engg economic decisions. Circular flow of income, difference between micro and macroeconomics, Production possibility curve. | | | | | | |
| **Module2** | Theory of Demand and Supply | Assignment | Assignment | 8 Sessions | | |
| Topics: Demand-law of demand, demand curve, determinants of demand, exceptions to Law of demand. Elasticity of demand-Price, elasticity and income elasticity. Calculation of Price and income elasticity of demand. Supply-law of supply, supply curve and determinants of supply. Elasticity of supply-its type. Equilibrium of demand and supply. | | | | | | |
| **Module3** | Theory of Production and Cost | Assignment | Assignment | 8 Sessions | | |

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|---|---|---|---|---|
| Topics: Production function, Factors of Production, Law of Variable Proportion and Returns to Scale, Cost and its classification, short and long run cost curves, cost behaviour, cost concepts and decision making, breakeven analysis. Calculation of costs and Breakeven point. | | | | |
| **Module4** | Time Value of Money and Depreciation | Assignment | Assignment | 8 Sessions |
| Topics: Cost of money, Interest formulas, Present, Future Values, Internal Return method. Payback period method, rate of return method, Internal rate of return methods. Concept of Depreciation, factors and methods of depreciation | | | | |
| **Module5** | Economy–Macro, Monetary and Fiscal | Assignment | Assignment | 8 Sessions |
| Topics: Basic introduction to macro economics and key terms. National income measures–GDP, GNP, etc. Monetary and fiscal measures | | | | |

**Targeted Application &Tools that can be used:**
Evaluation of cost effectiveness of individual engineering projects. Economic analysis can be used for problem solving.

**Text Book**

1. Engineering Economics, R. Pannerselvan. Reference Books:
2. Pindyck, R.S., Rubinfeld, D.L. and Mehta, P.L.,Micro Economics, Pearson Education
3. Samuelson, P.A. and Nordhaus, W.D.,Economics, McGrawHill
4. Browning, E.K. and Browning, J.M, Micro economic theory and applications, Kalyani Publishers.

**References**

https://presiuniv.knimbus.com/user#/home
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO106_REDO_560
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER4_1406
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=JSTOR1_128
HBR Digital Articles:
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_B ASED & unique_id=JSTOR1_129
Videos
Economics–
Link:https://www.youtube.com/watch?v=CR3y2QdbIlY
Acenture's Top Strategy for Managing and Retaining to economics -Link: https://www.youtube.com/watch?v=mj7q7H7ioME
Enhancing An Effective economics management - Link: https://www.youtube.com/watch?v=d806M_U-XSA
Setting out the process of development economics management and succession-
Link:https://www.youtube.com/watch?v=heWMVSbsyYc

Topics relevant to development of "ENTREPRENEURSHIP": law of supply for **Entrepreneurship through Participative Learning Techniques.** This is attained through assessment component mentioned in course handout.

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| **Catalogue prepared by** | Dr. Shabeena |
| **Recommended by The Board of Studies on** | 4th Board of Studies, 11th July, 2024 |

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| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|
| **Course Code:** MGT2007 | **Course Title:** Digital Entrepreneurship<br>Type of Course: Open Elective | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | |
| **Course Pre-requisites** | Students are expected to know:<br>Understand why digital technologies are at the forefront of entrepreneurship. The internet impacts entrepreneurial competition including network effects and platform technologies. | | | | |
| **Anti-requisites** | NIL | | | | |
| **Course Description** | The course aims to strengthen the capabilities of participants to use disruptive digital technologies to design innovative and viable business models, processes, services, products and strategies. This course specifically focused on learning lean startup principles, how to identify potential new venture ideas that boost market growth, state customer value propositions and economic value. The course deals with the competencies needed to become an innovative, opportunity-driven, market-ready and entrepreneurial manager. This course examines successful strategies, business models, frameworks, funding process, barriers and risks for introducing break-through products and services. Topics include business model innovation, strategic leadership, human centered and design-driven innovation, creativity and change management. | | | | |
| **Course Outcomes** | On successful completion of the course the students shall be able to: | | | | |
| | CO1 | Explain Outline the rise and development of the concept of digital entrepreneurship | Bloom-1-Remember | | |
| | CO2 | Comprehend Explain various the development of unique digital business models | Bloom-2-Understand | | |
| | CO3 | Apply their knowledge in problem solving and building the understand and interpret the digital business venturing. | Bloom-3- Apply | | |
| **Course Objective** | This course is designed to improve the learner's skill development by using Experiential Learning Techniques. There are projects works and practical assignments. | | | | |
| **Module 1** | Introduction to Digital Entrepreneurship | Assignment | Case study (Participative Learning | 11 Hours | |
| Topics: Background of Entrepreneurship, Moving towards Digital business, Digital entrepreneurship(DE), Who is an Entrepreneur, Definition, 5 Ds of Entrepreneurship, Zest 2 Zoom, Zen Thinking, Creativity to Entrepreneurship, Drivers and Enablers of business, Value creation, Gap analysis, Impact of ICT on Business, Cornerstones of Entrepreneurship, Market analysis, Customer and financial analysis, Lifecycle Model of DE, MAP features. | | | | | |
| **Module 2** | Digital Technologies, Value and Design Thinking | Assignment (Participative Learning) | Case Study | 12 Hours | |

Topics: Digital Platform, Emerging Technologies and Entrepreneurial Opportunities, Sustainable Development Goals, Opportunity vs Clarity, Disruptive Technologies, Innovation, Types of innovation, Importance of creativity, 5 steps of Entrepreneurial Innovation Process, Value, domestic vs industrial products, Goal of Business, Value Engineering, Value creation, Design Thinking, Tools and templates, Design Process, Design Principle, Phases of Design, Prerequisites of Financial Support.

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| **Module 3** | Business Model and Business Plan Formulation | Assignment (Participative Learning) | Case Study | 12 Hours |

Topics:Traits, Competences and Drivers of DE Success, Leadership skills for DE, Characteristics of Digital business, 7 layers of Digital business platforms, DE process, Foundation of Profit, Skills of Digital Enterprise Management Business Model, Who Business model, Market potentiality analysis, Business opportunity, Execution strategy, Constituents of Business model, Revenue management strategy, Business Model Canvass, The 9 Blocks, Critical Success factor, Preparation of Business plan, Business Plan Presentation

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| **Module 4** | Market size, Prospects & Risks of proposed business venture. | Assignment (Participative Learning) | Case Study | 10 Hours |

Topics: Essential abilities of Entrepreneurship, Key questions of Entrepreneurship, 5 Steps of prospect estimation, Decoding customer pains, market size and prospect, market structure, target fixation, size of target market, Business development strategy matrix, Expected EBITDA, Problem solving.

**Targeted Application & Tools that can be used:**

Students would be encouraged to take up live projects and through experiential learning activities in the classroom.

**Project work/Assignment:**

Assignment 1: quiz.
Assignment 2: Preparation of Business Plan & Presentations
Assignment 3 : Review of digital/e-resource from PU link given in references section [Mandatory to submit screen shot accessing digital resource, otherwise it will not be evaluated]

**Text Books:**

Rogers. D., Digital Transformation Playbook – Rethink Your Business for the Digital Age, Columbia Business School Publishing, 2016.

**References:**

1.Mayer, M. H., New Venture Creation: An Innovator's Guide to Entrepreneurship, 2nd Edition, Sage Publication, 2013.
2. Kuratko, D. F., & Rao, T. V., Entrepreneurship: A South Asian Perspective, Cengage Learning IndiaPvt. Ltd, Delhi, 2016.
3. Osterwalder, A. and Pigneur, Y., Business Model Generation: A Handbook for Visionaries, Game
4: New Venture Creation- Allen Kathleen R, Cengage Learning, ISBN: 9788131521021, 9788131521021, 6th Edition.
5: Crane, Andrew & Matten Dirk (2010) Business Ethics, Oxford Publications

| |
|---|
| **Online Resources:**<br>1. Digital Entrepreneurship and Creative Industries in Tourism: A Research Agenda - Publicly Available Content Database - ProQuest<br>2. Digital Sustainable Entrepreneurship: A Digital Capability Perspective through Digital Innovation Orientation for Social and Environmental Value Creation - Publicly Available Content Database - ProQuest<br>3. Transition to Digital Entrepreneurship with a Quest of Sustainability: Development of a New Conceptual Framework - Publicly Available Content Database - ProQuest |
| **Articles:**<br>Art 1 : Digital Entrepreneurship and Creative Industries in Tourism: A Research Agenda<br>Art 2: Digital Sustainable Entrepreneurship: A Digital Capability Perspective through Digital Innovation Orientation for Social and Environmental Value Creation<br>Art 3 : Transition to Digital Entrepreneurship with a Quest of Sustainability: Development of a New Conceptual Framework<br>Art 4 : Digital Transformation and Competitive Advantage in the Service Sector: A Moderated-Mediation Model<br><br>Case Studies:<br>https://www.sciencedirect.com/science/article/abs/pii/S2210670721003978<br>https://www.elgaronline.com/edcollbook/book/9781802203868/9781802203868.xml<br>https://www.taylorfrancis.com/chapters/edit/10.4324/9780429293207-5/digital-entrepreneurs-sharing-economy-birgit-leick-mehtap-aldogan-eklund-bj%C3%B8rnar-karlsen-kivedal |

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| **Catalogue prepared by** | Dr.Geetha C J |
| **Recommended by the Board of Studies on** | |
| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code:** **MAT1003** | **Course Title:** **Applied Statistics (Only Theory 3 hours)**<br>**Type of Course:** School Core | **L T P C** | 3 | 0 | 0 | 3 |
| **Version No.** | 3.0 | | | | | |
| **Course Pre-requisites** | None | | | | | |
| **Anti-requisites** | None | | | | | |
| **Course Description** | The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mindthe future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability | | | | | |

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| | distributions, standard discrete and continuous probability distributions. | | | |
| **Course Objective** | The objective of the course is to **familiarize the learners with the concepts of "**Applied Statistics"and attain**Skill Development Through Problem Solving techniques**. | | | |
| **Expected Outcome:** | At the end of this course, students will be in a position to<br>1. Apply the techniques of descriptive statistics effectively<br>2. interpret the ideas of probability and conditional probability<br>3. demonstrate the knowledge of probability distributions<br>4. Compute statistical parameters, correlation and regression, probability and sampling distributions using R software. | | | |
| **Module 1** | **Descriptive Statistics** | Assignment | Coding needed | **10 classes** |
| Introduction to Statistics, Data and statistical thinking, review of basic statistical parameters, Covariance, Correlation, Types of Measures of Correlation -Karl Pearson's Correlation Coefficient, Spearman Rank Correlation, linear regression, Multi linear regression**.** | | | | |
| **Module 2** | **Probability** | | | **6 classes** |
| Introduction to Probability, Probability of an event, Addition Principle, Multiplication law, Conditional Probability, Total Probability and Baye's theorem with examples | | | | |
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| **Module 3** | **Random Variables and Probability Distributions** | | Coding needed | **14 classes** |
| Introduction to Random variables, Discrete Random Variables and Continuous Random Variables, Probability Distributions, Probability Mass Function and Probability Density Function, Various Probability distributions, Binomial, **Negative Binominal (Self Study)**, Poisson, Normal and Exponential distributions | | | | |
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| **Module 4** | **Sampling Theory** | | Coding needed | **15 classes** |
| Introduction to Sampling Theory, Population, Statistic, Parameter, Sampling Distribution, Standard Error. Testing of Hypothesis, Types of Errors, Critical Region, level of Significance. Difference between Parametric and Non-parametric Tests, Large Sample Tests: Z-Test for Single Mean and **Difference of Means (Self Study)**, Small Sample Tests: Student's t-Test for Single Mean and **Difference of Means,** F-Test, Chi-Square Test. | | | | |
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| **Targeted Application & Tools that can be used:**<br>The objective of the course is to familiarize students with the theoretical concepts of probability and statistics and to equip them with basic statistical tools to tackle engineering and real-life problems.<br><br>Tools used: R Software / MS-Excel | | | | |
| **Text Book** | | | | |

<table>
<tr><td colspan="2">1. Ronald E Walpole, Raymond H Myers, Sharon L Myers, and Keying E Ye, Probability and Statistics for Engineers and Scientists, Pearson Education, 2016.</td></tr>
<tr><td colspan="2">References<br>1. James T. McClave, P. George Benson and Terry Sincich, Statistics for Business and Economics, 2018.<br>2. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Modern Business Statistics with Microsoft Excel, 2020.<br>3. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Statistics for Business and Economics, 2019.<br>4. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons, 2018.<br>5. Richard A. Johnson, Miller and Freund’s Probability and Statistics for Engineers, 2018.<br>6. Kishor S Trivedi, Probability and Statistics with reliability, Queuing and Computer Science Applications, John Wiley & Sons, 2008.</td></tr>
<tr><td colspan="2">Topics relevant to SKILL DEVELOPMENT: The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability distributions, standard discrete and continuous probability distributions for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td>Dr. Sathish S and Dr. Juliet Raja</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td>13th BOS held on 04/01/2025</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td>24th ACM held in 3rd August 2024</td></tr>
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|---|---|---|---|---|---|---|
| **Course Code: MAT1001** | **Course Title: Calculus and Linear Algebra**<br><br>**Type of Course:1] School Core Lab Integrated** | **L-T-P- C** | **3** | **1** | **0** | **4** |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | Basic Concepts of Limits, Differentiation, Integration | | | | | |
| **Anti-requisites** | **NIL** | | | | | |

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| **Course Description** | The course focuses on the concepts of calculus and linear algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature. |
| **Course Objective** | The objective of the course is to **familiarize the learners with the concepts of "**CALCULUS AND LINEAR ALGEBRA"**and attain <u>Skill Development</u> throughproblem solving techniques**. |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1) Comprehend the knowledge of applications of matrix principles.<br>2) Understand the concept of partial derivatives and their applications.<br>3) Apply the principles of integral calculus to evaluate integrals.<br>4) Adopt the various analytical methods to solve differential equations. |
| **Course Content:** | |

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| **Module 1** | **Linear Algebra** | | | | **16 Classes** |

Review: Types of matrices, elementary transformations,

**Linear Algebra:**

Echelon form, rank of a matrix, consistency and solution of system of linear equations - Gauss elimination method, Gauss-Jordan method.

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

Engineering Applications of Linear Algebra.

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| **Module 2** | **Partial Derivatives** | | | | **14 CLASSES** |

Review: Differential calculus with single variable.

**Differential Calculus:**

Partial differentiation, Homogeneous functions and Euler's theorem, Total derivative, Change of variables, Jacobians, Partial differentiation of implicit functions, Taylor's series for functions of two variables, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.

Engineering Applications of partial derivatives.

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| **Module 3** | **Integral calculus** | | | | **12 Classes** |

Review: Integral calculus for single integrals.

**Integral calculus:**

Multiple Integrals- Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical polar co-ordinates.

Beta and Gamma functions–inter-relation-evaluation of integrals using gamma and beta functions. Evaluate double & triple integrals.

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| **Module 4** | **Differential Equations** | **Assignment** | | **Programming** | **16 Classes** |

Definition, types of differential equations, order and degree, Linear Differential Equations, Bernoulli's Differential Equation, Exact and Non - Exact Differential Equations.

Higher order Differential Equation with constant coefficients and with right hand side of the form eax, sinax, cosax, eaxf(x), xnf(x) etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange's Equation, Method of Variation of Parameters.

Engineering applications of differential equations.

**Targeted Application & Tools that can be used:**

The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design.
Tools Used: Python.

**Assignment:**

1. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using C Programming/Python.
2. Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – Obtain the solution and compare the solution sets by varying the values of the dependent variable.

**Text Book**

1. Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

**References:**


1. Victor Henner, Tatyana Belozerova, MickhailKhenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.
2. Walter Ledermann, Multiple integrals, Springer, 1st edition
3. Lay, Linear Algebra ansd its applications, 3rd Ed., 2002, Pearson Education India.
4. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
5. MatLab usage manual


**E-resources/ Web links:**

1. https://nptel.ac.in/courses/109104124
2. https://nptel.ac.in/courses/111106051
3. https://nptel.ac.in/courses/111102137
4. https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/
5. https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus
6. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/
7. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
8. https://www.scu.edu.au/study-at-scu/units/math1005/2022/

**Topics relevant to SKILL DEVELOPMENT:** The course focuses on the concepts of calculus and linear algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature. The lab sessions associated with the course are concerned with acquiring an ability to use the MATLAB software. for **Skill Development through** Experiential Learning **methodologies.** This is attained through assessment component mentioned in course handout.

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| **Catalogue prepared by** | Dr Veeresh A Sajjanara and Dr V Nagendramma |
| **Recommended by the Board of Studies on** | 13th BOS held on 04/01/2025 |
| **Date of Approval by the Academic Council** | 24th ACM held in 3rd August 2024 |

| Course Code: MAT2501 | Course Title: Integral Transforms and Partial Differential Equations<br>Type of Course:1] School Core | L-T- P-C | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | Calculus and Differential Equations | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course aims to introduce various transform techniques such as Laplace transform, Fourier transform and Z-transform in addition to expressing functions in terms of Fourier series. The course covers applications of Laplace transform to LCR circuits and solutions of different equations using Z-transform. The course also deals with the analytical methods for solving partial differential equations and the classical applications of partial differential equations. | | | | | |
| **Course Objective** | The objective of the course is to **familiarize the learners with the concepts of "Transform Techniques, Partial Differential Equations**" and attain **Skill Development through Problem Solving Techniques**. | | | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>CO1 - Express functions in terms of uniformly convergent Fourier series.<br>CO2 - Apply Laplace transform technique to solve differential equations.<br>CO3 - Employ Z-transform techniques to solve difference equations.<br>CO4 - Solve a variety of partial differential equations analytically. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | **Laplace Transforms** | | | **(12 Classes)** | | |
| Definition and Laplace transform of elementary functions. Properties of Laplace transform, and Laplace transform of periodic function, unit-step function and Impulse function – related problems. Inverse Laplace transform of standard functions - problems, initial and final value theorem. Convolution theorem, solution of linear and simultaneous differential equations and LCR Circuit. | | | | | | |
| **Module 2** | **Fourier Series** | **Assignment** | | **(8 Classes)** | | |
| **Fourier Series:** Periodic functions, Dirichlet's condition. Fourier series of periodic functions period $2\pi$ and arbitrary period. Half range Fourier series. Practical harmonic analysis. | | | | | | |
| **Module 3** | **Fourier Transforms and Z - Transforms** | | | **(13 Classes)** | | |
| **Fourier Transforms:** Definitions, infinite Fourier transforms, Fourier sine and cosine transforms, inverse Fourier transforms, Problems.<br>**Difference equations and Z-transforms:** Z-transforms – Basic definitions, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Difference equations – Basic definitions, Application of Z-transforms to solve difference equations. | | | | | | |
| **Module 4** | **Partial Differential Equations** | **Assignment** | | **(12 Classes)** | | |
| Formation of PDE, Solution of non-homogeneous PDE by direct integration, Solution of homogeneous PDE involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear PDE. of the type $P p + Q q = R$.<br>Applications of PDE: Derivation of one-dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two-dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions (Boundary value problems). | | | | | | |
| Targeted Application & Tools that can be used: | | | | | | |

The objective of the course is to familiarize students with a variety of numerical techniques and the theoretical concepts of probability and statistics to equip them with the necessary numerical approaches and basic statistical tools to tackle engineering and real-life problems.

**Assignment:**

Newton-Raphson Methods, Gauss-Seidel Method, LU Decomposition, Trapezoidal Rule, Simpson's rule, Runge-Kutta 4$^{th}$ Order.

**Text Book**

1. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

**References:**

1. Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.
2. Walter Ledermann, Multiple integrals, Springer, 1st edition

**E-resources/ Web links:**

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_140238
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_233298
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_204892
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_246791
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_223548
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_134719
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_32614
https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
https://www.scu.edu.au/study-at-scu/units/math1005/2022/

**Topics relevant to SKILL DEVELOPMENT:** The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

| | | |
|---|---|---|
| **Catalogue prepared by** | | **Dr. Husna** |
| **Recommended by the Board of Studies on** | | **13$^{th}$ BOS held on 04/01/2025** |
| **Date of Approval by the Academic Council** | | **24$^{th}$ ACM held in 3$^{rd}$ August 2024** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code: MAT2502** | **Course Title: Numerical Methods and Complex Variables**<br>**Type of Course:1] School Core** | **L-T- P-C** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| **Version No.** | | 2.0 |
| **Course Pre-requisites** | | Calculus & Differential Equations |
| **Anti-requisites** | | **NIL** |
| **Course Description** | | Numerical methods contain solutions of system of linear equations, roots of non-linear equations, interpolation, numerical differentiation and integration. It plays an important role in solving various engineering sciences problems.<br>Complex Variable is functions involving complex numbers as variables, exploring concepts like limits, continuity, differentiation, integration, and series within the complex plane, with a focus on key topics like Cauchy-Riemann equations, complex exponentials, contour integration, residues, and applications to solving real-world problems in physics and engineering. |
| **Course Objective** | | Numerical methods is to provide approximate, yet accurate solutions to complex mathematical problems that are often difficult or impossible to solve analytically, by using computational techniques to generate solutions through iterative processes, especially when dealing with real-world scenarios involving large datasets or intricate equations.<br>Complex variable is to study the techniques of complex variables and functions together with their derivatives, Contour integration and transformations. To study complex power series, classification of singularities, calculus of residues and its applications in the evaluation of integrals, and other concepts and properties. |
| **Course Out Comes** | | On successful completion of the course the students shall be able to:<br>CO1 - Demonstrate the applications of numerical methods to find the roots of<br>polynomial equations and eigen values of real symmetric matrices.<br>CO2 - Interpret the fitted parameters and apply curve fitting techniques to real-world data analysis problems.<br>CO3 - Apply various numerical methods for solving linear Ordinary & Partial differential equations arising in engineering field.<br>CO4 - Apply the Cauchy-Riemann equations to identify analytic functions. |
| **Course Content:** | | |

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| **Module 1** | **Solution of Linear Systems of Equation** | | ***(10 Classes)*** |
| Solution of algebraic and transcendental equations: Various types of errors - Bisection method, Regula-Falsi method, Newton-Raphson method, Graffe's method - Bairstow's method - Newton's method for solving f(x,y) = 0 and g(x,y) = 0, secant method, Fixed point iteration method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method, Iterative methods of Gauss Jacobi and Gauss Seidel, Sufficient conditions for convergence - LU decomposition method, Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices. | | | |
| **Module 2** | **Interpolation and Curve Fitting** | **Assignment** | ***(10 Classes)*** |
| Newton's forward and backward interpolation, Divided difference method, Lagrange's method. Method of least squares to fit equations of the form $y = ax + b$, $y = ax^2 + bx + c$, $y = ae^{bx}$, $y = ab^x$ and $y = ax^b$. | | | |
| **Module 3** | **Numerical Differentiation and Integration** | | ***(10 Classes)*** |
| Numerical differentiation, Numerical integration: Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Gaussian quadrature rule. Solution of ordinary differential equations: Taylor series method, modified Euler's method, Runge-Kutta method for 4th order. | | | |

Euler's method - Taylor's method - Runge-Kutta method of fourth order - Numerical solution of Laplace equation - One-dimensional heat flow equation and wave equation by finite difference methods.

| **Module 4** | **Complex Variables** | **Assignment** | ***(15 Classes)*** |
|---|---|---|---|

Introduction, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; Conformal mappings.

Complex Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

Targeted Application & Tools that can be used:

Numerical methods are widely applied in various fields like engineering, physics, finance, and biology, primarily used to solve complex problems where analytical solutions are difficult or impossible to find, allowing for the approximation of solutions through computational algorithms.

Complex variable methods are applied to elliptical problems in fluid mechanics, and linear elasticity. The techniques presented for solving parabolic problems are the Laplace transform and separation of variables, illustrated for problems of heat flow and soil mechanics.

**Assignment:**

1. Calculate its absolute and relative errors for different input values using a numerical method like the Taylor series approximation.
2. Given sin 45° = 0.7071, sin 50° = 0.7660, sin 55° = 0.8192, sin 60° = 0.8660 find sin 57° *and* *sin* 52° using an appropriate interpolation formula.
3. Find the equation of the polynomial which passes through the points (4,-43), (7, 83), (9, 327), (12, 1053) using Newton's divided difference interpolation formula.

**Text Book**


1. Brown & Churchill, Complex Variables and Applications, McGraw Hill Higher Education; 9th edition.
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.


**References:**


1. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computations, 6th Edition, New age Publishing House, 2015.
3. Carlos A. Berenstein & Roger Gay, Complex Variables - An Introduction, Springer-Verlag New York Inc.


**E-resources/ Web links:**

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_166145
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_141727
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_135224
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_246791
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_190270
https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
https://www.scu.edu.au/study-at-scu/units/math1005/2022/

**Topics relevant to SKILL DEVELOPMENT:** The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual

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| and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout. | | |
| | | |
| **Catalogue prepared by** | | **Dr. Chandni Kumar & Dr. Heena Firdose** |
| **Recommended by the Board of Studies on** | | **13th BOS held on 04/01/2025** |
| **Date of Approval by the Academic Council** | | **24th ACM held in 3rd August 2024** |

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|---|---|---|---|---|---|---|
| **Course Code: PHY1002** | **Course Title: Optoelectronics and Device Physics**<br>**Type of Course: 1] School Core & Laboratory integrated** | L-T-P-C | 2 | 0 | 2 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | **NIL** | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The purpose of this course is to enable the students to understand the fundamentals, working and applications of optoelectronic devices and to develop the basic abilities to appreciate the applications of advanced microscopy and quantum computers. The course develops the critical thinking, experimental and analytical skills. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to use the concepts for technological applications. The laboratory tasks aim to develop following skills:**An attitude of enquiry, confidence and ability to tackle new problems, ability to interpret events and results, observe and measure physical phenomena, select suitable equipment, instrument and materials, locate faults in systems.** | | | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>CO1: Describe the concepts of semiconductors, magnetic materials and superconductors.<br>CO2: Apply the concept of materials in the working of optoelectronic and magnetic devices.<br>CO3: Discuss the quantum concepts used in advanced microscopy and quantum computers.<br>CO4: Explain the applications of lasers and optical fibers in various technological fields. | | | | | |

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| | CO5: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices. **[Lab oriented].** | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of "Optoelectronics and device physics "and attain **Skill Development** through **Experiential Learning** techniques | | | |
| **Course Content:** | | | | |
| **Module 1** | **Fundamentals of Materials.** | Assignment | Plotting of magnetization (M) v/s Magnetic field (H) for diamagnetic, paramagnetic and ferromagnetic materials using excel/ origin software. | **No. of Classes: 07** |
| Topics: Concept of energy bands, charge carriers, carrier concentration, concept of Fermi level, Hall effect, Superconductors: Josephson effect. | | | | |
| **Module 2** | **Advanced Devices and applications** | Assignment | Data collection on efficiency of solar cells. | **No. of Classes: 8** |
| Topics: p-n junctions, Zener diode, transistor characteristics, Optoelectronic devices:, Solar cells, I-V characteristics, and LEDs | | | | |
| **Module 3** | **Quantum concepts and Applications** | Term paper | Seminar on quantum computers. | **No. of classes: 8** |
| Topics: Planck's quantum theory, applications of Quantum theory: de-Broglie hypothesis, matter waves, properties. de-Broglie wavelength associated with an electron.Heisenberg's uncertainty principle | | | | |
| **Module 4** | **Lasers and Optical fibers** | Term paper | Case study on medical applications of Lasers. | **No. of classes :07** |
| Topics: Interactions of radiations with matter, Characteristics of laser, conditions and requisites of laser, Modern day applications of laser: LIDAR, LASIK, Cutting, Welding and Drilling.<br>Principle of optical fibers, Numerical aperture and acceptance angle (Qualitative), Attenuation, Applications: Point to point communication with block diagram, application of optical fibers in endoscopy. | | | | |
| List of Laboratory Tasks:<br>Experiment No. 1: Experimental errors and uncertainty using excel<br>Level 1: Calculation of accuracy and precision of a given data<br>Level 2: propagation of errors in addition, subtraction, multiplication and division.<br>Experiment No 2: To determine the wavelength of semiconductor diode Laser and to estimate the particle size of lycopodium powder using diffraction.<br>Level 1: Determination of Wavelength of Laser | | | | |

Level 2: Finding the particle size of lycopodium powder.
Experiment No. 3: To determine the proportionality of Hall Voltage, magnetic flux density and the polarity of Charge carrier.
Level 1: To determine the proportionality of Hall Voltage and magnetic flux density
Level 2: To determine the polarity of Charge carrier.
Experiment No. 4: To study the I-V characteristics of a given zener diode in forward and reverse bias conditions.
Level 1: To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage.
Level 2: To study I –V characteristics of the given Zener diode in forward bias and to determine knee voltage and forward resistance.
Experiment No. 5: To study input and output characteristics of a given Transistor.
Level 1: To determine the input resistance of a given transistor.
Level 2: To determine current transfer characteristics and transistor parameters of a given transistor.
Experiment No. 6: Determination of Fermi energy and Fermi temperature of a given metal and bimetallic wire.
Level 1: Determination of Fermi energy and Fermi temperature of given metal wire.
Level 2: Determination of Fermi energy and Fermi temperature of given bimetallic wire.
Experiment No. 7: To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance and To measure the photo-current as a function of the irradiance at constant voltage.
Level 1 To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance.
Level 2: To measure the photo-current as a function of the irradiance at constant voltage.
Experiment No. 8: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance.
Level 1: To study the I-V characteristics
Level 2: I-R characteristics of a solar cell as a function of the irradiance.
Experiment No. 9: Calculate the numerical aperture and study the losses that occur in optical fiber cable. .
Level 1: Calculate the numerical aperture.
Level 2: study the losses that occur in optical fibre cable.
Experiment No. 10: To determine the magnetic susceptibility of a given diamagnetic and paramagnetic substances using Quincke's method.
Level 1: To determine the magnetic susceptibility of a given diamagnetic substance.
Level 2: To determine the magnetic susceptibility of a given paramagnetic substance.
Experiment No. 11: To study the hysteresis loop of an iron core and to find its coercivity and retentivity. To show the effect of varying voltage and frequency on hysteresis loop.
Level 1: To study the hysteresis loop of an iron core and to find its coercivity and retentivity.
Level 2: To show the effect of varying voltage and frequency on hysteresis loop.
Experiment No. 12: Determining the wavelength of the electrons for different accelerator voltages by applying the Bragg condition and Confirming the de Broglie equation for the wavelength.
Level 1: Determining the wavelength of the electrons for different accelerator voltages by applying the Bragg condition.
Level 2: Confirming the de Broglie equation for the wavelength.
Experiment No. 13: To measure the transition temperature and resistivity of a high temperature superconductor.
Level 1: To measure the transition temperature.

Level 2: To determine the resistivity of a high temperature superconductor.

Experiment No. 14: Plotting I-V characteristics in forward and reverse bias for LEDs and Determination of knee voltage.
Level 1: Plotting I-V characteristics in forward and reverse bias for LEDs
Level 2: Determination of knee voltage.
Experiment No. 15: Determination of Stefan's constant and verification of Stefan-Boltzmann Law.
Level 1: Determination of Stefan's constant
Level 2: Verification of Stefan-Boltzmann Law.

**Targeted Application & Tools that can be used:**

1. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy, SQUIDS in MRI, Advanced material characterizations using SEM and STM.
2. Origin, excel and Mat lab soft wares for programming and data analysis.

| **Project work/Assignment: Mention the Type of Project /Assignment proposed for this course** | |
|---|---|

**Assessment Type**

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning
- Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons.
- Write a report on importance of quantum entanglement in supercomputers.

**Text Book**

Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2018.

**References:**


1. Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1st Edition, Pearson Publications, 2002
2. Principles of Quantum Mechanics by R Shankar, 2nd edition, springer Publications, 2011.
3. Optoelectronics: An Introduction by John Wilson and John Hawkes, 3rd edition, Pearson Publications, 2017.
4. Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012.
5. Introduction to Quantum Mechanics, David J Griffiths, Cambridge University Press, 2019


**E-Resources:**

1. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live
2. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live
3. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live

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| 4. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live<br>5. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486032&site=ehost-live |
| **Topics relevant to "SKILL DEVELOPMENT": Fundamentals of materials, Lasers and optical fibers.**<br>For Skill Development through Participative Learning Techniques. This is attained through the Assignment/ Presentation as mentioned in the assessment component in course handout. |

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| **Catalogue prepared by** | Dr.Anindita, Dr.Sivasankar Reddy, Dr. Naveen C S, Dr. Mohan kumar Naidu, Dr.Deepthi P R, Dr.Mahaboob Pasha, Dr.Ranjeth Kumar Reddy, Dr. Pradeep Bhaskar, Dr. G. Srinivas Reddy, Dr.Saurav Kumar Kajli, Dr.CharanPrasanth |
| **Recommended by the Board of Studies on** | 12th BOS conducted on 11th January 2025 |
| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code: CHE1017** | **Course Title: Applied Chemistry**<br>**Type of Course: Program Core-Lab embedded theory course** | **L- T-P-C** | **1** | **0** | 2 | 2 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | NIL | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The primary objective of the course is to emphasize the concepts and applications of chemistry in Engineering. The course also aims to enhance the knowledge of chemical composition and properties of chemical molecules. The course cultivates an ability to identify chemistry in each and every piece of smart engineered products used in households and industry. It targets to strengthen the fundamental concepts of chemistry and then builds an interface with their industrial applications.<br>**This course is designed to cater to Environment and Sustainability** | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of **Applied Chemistry** and attain **'SKILL DEVELOPMENT'** through **EXPERIENTIAL LEARNING** techniques**.** | | | | | |

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| **Course Outcomes** | On successful completion of this course the students shall be able to:<br>1) Identify the suitable polymers to replace the conventional materials<br>2) Summarize the importance of various electrochemical sources in energy systems<br>3) Describe the knowledge of electrochemistry principles for protection of different metals from corrosion.<br>4) Explain the fundamental principles in water treatment |

**Course Content:**

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|---|---|---|---|---|
| **Module 1** | **Polymers** | Case study | Data Collection and analysis | **4 Classes** |
| **Polymers:** Introduction, Types of Polymerization, Thermoplastics & Thermosetting Polymers. Preparation, Properties, and Applications of the Teflon, PVC, Nylon and Phenol Formaldehyde; Elastomers: Classification; Natural Rubber, Vulcanization of Rubber, Synthetic Rubber and Inorganic Rubbers, Polymer Composites- Properties and Advantages, Synthesis and Applications of Kevlar, Conducting Polymers | | | | |
| **Module 2** | **Battery Technology** | Assignment | Data Collection | **3 Classes** |
| Basics of Electrochemical Energy Systems, Construction, Working Mechanism and Applications of Primary (Dry Cell) and Secondary (Lead-Acid) Batteries, Lithium Batteries: Primary and Secondary. Fuel Cells: Hydrogen-Oxygen, Methanol-Oxygen: Principle, Working and Their Applications | | | | |
| **Module 3** | **Corrosion and its Control** | Case study | Data analysis | **3 Classes** |
| Definition, Dry and Wet Corrosion, Electrochemical Theory of Corrosion, Types of Wet Corrosion –Differential Aeration, Galvanic, and Stress Corrosion Cracking. Factors that Enhance Corrosion and Choice of Parameters to Mitigate Corrosion.<br>Corrosion Control – Anodic and Cathodic Coating, Cathodic Protection- Sacrificial Anodic Protection, Electro Plating of Chromium, Electroless Plating of Copper on PCBs | | | | |
| **Module 4** | **Water Technology** | Case study | Data analysis | **4 Classes** |
| Degree of Hardness, Numerical Problems on Hardness Domestic Treatment, Desalination Techniques, Boiler Feed Water, External and Internal Treatments, Waste Water Treatment, Rain Water Harvesting | | | | |

**Laboratory experiments:**

1. Estimation of Fe(II) in Mohr's salt using Std. Potassium permanganate solution.
2. Estimation of Calcium in cement solution sample by rapid EDTA method.
3. Estimation of Copper by Iodometry.
4. Determination of Acid number of an oil.
5. Synthesis of polyaniline.
6. Determination of pKa value of weak acid using pH meter
7. Potentiometric estimation of FAS using Std. Potassium dichromate solution
8. Estimation of strength of acid mixture by conductometric titration
9. Estimation of Copper by colorimetric method
10. Determination of Viscosity co-efficient of a liquid using Ostwald's viscometer.

**Targeted Application & Tools that can be used:**

Application areas are Polymer, oil and gas, Boiler, automotive and mechanical industries
**Tools:** Statistical analysis of Corrosion in materials using tools like Design expert software (ANOVA, RSM, etc.)

**Project work/Assignment:**

**Assessment Type**

- **Midterm exam**
- **Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)**
- **Quiz**
- **End Term Exam**
- **Self-Learning**

**Assignment: 1:** Report writing on recycling plastic waste into plastic lumber
**Assignment 2:** Identify a corrosion problem encountered in your immediate surroundings and discuss your choice of mitigation

**Text Book**

1. Wiley, "Engineering Chemistry", Wiley.

**Reference Books**

1. Engineering Chemistry, Jain and Jain (18th Edition) Dhanpat Rai Publishing Company
2. Engineering Chemistry, Shika Agrawal (2018), Cambridge University Press

**E resources**

1. https://presiuniv.knimbus.com/user#/searchresult?searchId=Polymers%20from%20Renewable%20Resources&_t=1660212823387
2. https://presiuniv.knimbus.com/user#/searchresult?searchId=fuel%20an%20ecocritical%20history&_t=1660213039873
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=BOOKYARDS_1_13487
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_6676
5. https://nptel.ac.in/courses/113108051
6. https://www.youtube.com/watch?v=XuLT8i4g4Yw
7. https://www.youtube.com/watch?v=3QjwRqnquxA
8. https://www.youtube.com/watch?v=VxMM4g2Sk8U

**The topics related to Skill Development**
Quantifying alkalinity in water sample, concentration of acid, pKa of acid, viscosity co-efficient, amount of Ca in cement solution for **Skill Development through Experiential Learning Techniques**. This is attained through assessment component as mentioned in course handout.

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| **Catalogue prepared by** | Department of Chemistry, SOE |
| **Recommended by the Board of Studies on** | 7thBoS on 25 July 2022 |
| **Date of Approval by the Academic Council** | 18th BOS meeting held on 3rd August 2022 |

<table>
<tr><td>Course Code:<br>CHE1018</td><td colspan="3">Course Title: Environmental Science<br><br>Type of Course: School Core- Theory and Lab</td><td>L- T- P- C</td><td>1</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td></td><td colspan="3"></td><td>Contact hours</td><td>1</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">This course emphasizes the need to conserve biodiversity and adopt a more sustainable lifestyle by utilizing resources in a responsible way. Topics covered include basic principles of ecosystem functions; biodiversity and its conservation; human population growth; water resources, pollution; climate change; energy resources, and sustainability; Sustaining human societies, policies, and education.<br><br>This course is designed to cater to Environment and Sustainability</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of “Environmental Science” and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">On successful completion of this course the students shall be able to:<br><br>5) Appreciate the historical context of human interactions with the environment and the need for eco-balance.<br>6) Describe basic knowledge about global climate change with particular reference to the Indian context.<br>7) Understand biodiversity and its conservation<br>8) Develop an understanding on types of pollution and ways to protect the environment<br>9) Learn about various strategies on Global environmental management systems</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td colspan="2">Humans and the Environment</td><td>Assignment</td><td>Data Collection</td><td colspan="4">01 class</td></tr>
<tr><td colspan="9">Topics: The man-environment interaction: Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment.<br><br>Self-learning topics: Humans as hunter-gatherers; Industrial revolution and its impact on the environment; Environmental Ethics and emergence of environmentalism.</td></tr>
<tr><td>Module 2</td><td colspan="2">Natural Resources and Sustainable Development</td><td>Assignment</td><td></td><td colspan="4">03 Classes</td></tr>
<tr><td colspan="9">Topics:<br>Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. Water resources: Types of water resources- fresh water and marine resources;</td></tr>
</table>

**Soil and mineral resources**: Important minerals; Mineral exploitation Soil as a resource and its degradation.

**Energy resources**: Sources of energy and their classification, renewable and non-renewable sources of energy; Advantages and disadvantages.

***Self- learning topics:*** Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges.; Environmental problems due to extraction of minerals and use; Sustainable Development Goals (SDGs)- targets, indicators, and challenges for SDGs.

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| **Module 3** | **Environmental Issues: Local, Regional and Global** | Case study | | **02 Classes** |

**Topics:**
**Environmental Pollution**: Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans-boundary air pollution; Acid rain; Smog.

**Land use and Land cover change**: land degradation, deforestation, desertification, urbanization. Global change: Ozone layer depletion; Climate change

***Self -learning topics:*** Environmental issues and scales

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| **Module 4** | **Conservation of Biodiversity and Ecosystems** | Assignment | | **02 Classes** |

**Topics:**
**Biodiversity-**Introduction, types, Species interactions, Extinct, endemic, endangered and rare species, Threats to biodiversity: Natural and anthropogenic activities.

**Self-learning topics:** Mega-biodiversity, Hot-spots, Major conservation policies. Biodiversity loss: past and current trends, impact.

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|---|---|---|---|---|
| **Module 5** | **Environmental Pollution and Health** | Case study | | **03 Classes** |

**Topics:**
Pollution, Definition, point and nonpoint sources of pollution, **Air pollution**- sources, major air pollutants, health impacts of air pollution.

**Water pollution**– Pollution sources, adverse health impacts on human and aquatic life and mitigation, Water quality parameters and standards.

**Soil pollution and solid waste**- Soil pollutants and their sources, solid and hazardous waste, Impact on human health.

**Self-learning topics:** Noise pollution, Thermal and radioactive pollution.

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| **Module 6** | **Climate Change: Impacts, Adaptation and Mitigation** | Assignment/case | | **02 Classes** |

**Topics:**
**Understanding climate change**: Natural variations in climate; Projections of global climate change with special reference to temperature, rainfall and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Impacts

**Vulnerability and adaptation to climate change**: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems;

Impacts on forests and natural ecosystems; Indigenous knowledge for adaptation to climate change.

**Self-learning topics:** Mitigation of climate change: Synergies between adaptation and mitigation measures; National and international policy instruments for mitigation.

| **Module 7** | **Environmental Management** | Case study | Data analysis | **02 Classes** |
|---|---|---|---|---|

**Topics:**
Environmental management system: ISO 14001; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability.

**Self-learning topics:** Environmental audit and impact assessment; Eco labeling /Eco mark scheme

| **Module 8** | **Environmental Treaties and Legislation** | Case study | Data analysis | **01 Classes** |
|---|---|---|---|---|

**Topics**:
Major International Environmental Agreements: Convention on Biological Diversity (CBD), Major Indian Environmental Legislations: Environmental Protection Act, Forest Conservation Act, Public awareness.

**Self-learning topics:** Paris Agreement, Conference of the Parties (COP), India's status as a party to major conventions: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act.

**List of laboratory tasks : Any eight experiments will be conducted**

1. Determination of total alkalinity of a water sample (knowledge)
2. Estimation of water hardness by EDTA method and its removal (by zeolite/ ion exchange method) (Comprehensive)
3. Estimation of copper from industrial effluents by colorimetric method (Comprehensive)
4. Estimation of iron from industrial effluents by titrimetric method/potentiometric method (Comprehensive)
5. Estimation of nickel from industrial effluents by titrimetric method (Comprehensive)
6. Estimation of chloride in drinking water by titrimetric method (Comprehensive)
7. Estimation of fluoride in ground water by colorimetric method (Comprehensive)
8. Determination of calcium in aqueous solution (Comprehensive)
9. Determination of Total Dissolved Salts, conductivity and pH of a water samples (Knowledge)
10. Determination of Chemical oxygen demand in the industrial effluent. (Comprehensive)
11. Biological oxygen demand of waste water sample (Comprehensive)
12. Determination of dissolved oxygen of an industrial effluent (Comprehensive)
13. Quality monitoring analysis of a soil sample (knowledge)
14. Flame photometric estimation of Sodium and potassium (Application)
15. Gas Chromatographic analysis of volatile organic compounds (Application)

**Targeted Application & Tools that can be used:**
Application areas are Energy, Environment and sustainability
**Tools:** Statistical analysis of environmental pollutants using excel, origin etc.

**Project work/Assignment:**

**Assessment Type**

- **Midterm exam**

- **Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screenshot accessing the digital resource.)**
- **Lab evaluation/Assignment**
- **End Term Exam**
- **Self-learning**

**Assignment 1: Write a Statement of Environment report of your town/city/state/country**

**Assignment 2:** Individual students will carry out the analyses of polluted solid, liquid, and gaseous samples and propose suitable mitigation measures. A detailed and in-depth report needs to be submitted for each case. This may include preparation of reagents, sample preparation (extraction), chemical analysis carried out, instruments and tools used, data collected and processed, inferences made and conclusions arrived at. Necessary support is given in the form of lab manual and reference links to e-books.

**Text Book**

2. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
3. Krishnamurthy, K.V. (2003) Text book of Biodiversity, Science Publishers, Plymouth, UK.
4. Jackson, A.R. & Jackson, J.M. (2000), Environmental Science: The natural environment and human impact, Pearson Education.

**Reference Books**

7. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
8. William P. Cunningham and Mary Ann Cunningham (2017), Principles of Environmental Science: Inquiry & Applications, 8th Edition, McGraw-Hill Education, USA.
9. Sinha N., (2020) Wild and Wilful. Harper Collins, India.
10. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/
11. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
12. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

**E-resources:**

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_18126
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_8761
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAJ_1_02082022_3333
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3063
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_20719
6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_16824
7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3954
8. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_491

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| 9. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_488<br>10. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_583<br>11. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER_INDEST_1_171<br>12. https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle&_t=1687427221129<br>13. https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labelling&_t=1687427279979<br>14. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TEXTBOOK_LIBRARY01_06082022_395&xIndex=4<br>15. https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf |
| **Topics relevant to Skill Development:**<br>Industrial revolution and its impact on the environment, Environmental impact of over-exploitation of water resources, pollution and ill effects, lab experiments for Skills development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.<br><br>All topics in theory component are relevant to Environment and Sustainability. |

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| **Catalog prepared by** | Faculties of Department of Chemistry |
| **Recommended by the Board of Studies on** | PU/SOE/CHE/BOS-07/2022-23<br>9th BOS held on 10/07/23 |
| **Date of Approval by the Academic Council** | 21st Academic council dated: 6th September 2023 |

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|---|---|---|---|---|---|
| **Course Code:** **CIV1008** | **Course Title:** **Basic Engineering Sciences**<br>**Type of Course:** **Theory Only** | **L-P-C** | 2 | 0 | 2 |
| **Version No.** | 2.0 | | | | |
| **Course Pre-requisites** | **NIL** | | | | |
| **Anti-requisites** | **NIL** | | | | |
| **Course Description** | This basic course on engineering science is designed to introduce students to the fields of civil, mechanical and petroleum engineering. Student will be exposed to various fields in civil engineering and different manufacturing techniques in addition to machinery for power production and consumption. Additionally, students will be getting an overview of various sectors of oil & gas industries. This course acquaints students to basics of Industry 4.0and Construction 4.0. The course aims to enable students to appreciate | | | | |

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| | the multidisciplinary nature of engineering design and operations in the current era with mechanization and digitization transforming every aspect of engineering. | | | |
| **Course Objective** | The objective of the course is skill development of student by using Participative Learning techniques. | | | |
| **Course Outcomes** | On successful completion of this course the students shall be able to:<br>1]Recognize the significance of various disciplines in Civil Engineering<br>2] Discuss the recent evolutions in Civil Engineering<br>3]Explain various energies, energy generating machineries and energy consumption machineries<br>4] Describe the fundamental concept and terminology associated with the Petroleum Industry<br>5]Distinguish between conventional and modern manufacturing techniques. | | | |
| **Course Content:** | | | | |
| **Module 1** | **Introduction to various fields in Civil Engineering** | Assignment | Case studies on different Civil Engineering Projects | **6 Sessions** |
| Topics: Introduction to Civil Engineering: Definition, scope and branches of Civil Engineering, Role of Civil Engineer, Overview of Infrastructure. | | | | |
| **Module 2** | **Current Trends and Evolution in Civil Engineering** | Assignment | Article Review | **6 Sessions** |
| Topics: Mechanization in Construction, Application of Digital Technologies in Planning, Design, execution, monitoring and maintenance of Construction. Overview of Smart Cities. | | | | |
| **Module 3** | **Power Production and Consumption Machinery** | Assignment & Quiz | Data Collection | **6 Sessions** |
| Topics: Energy and its types, Engines and their applications, Pumps-Compressors and their applications. | | | | |
| **Module 4** | **Overview of Petroleum Engineering** | Assignment & Quiz | Article Review | **6 Sessions** |
| Overview of the Petroleum Industry, Importance of Petroleum Engineering, lifecycle of Petroleum products, Classifications of E&P activities: Key difference between Offshore and Onshore, Onshore facilities, offshore platforms, Digitization of petroleum engineering | | | | |
| **Module 5** | **Industry 4.0** | Assignment & Quiz | Data Collection | **6 Sessions** |
| Topics: Conventional manufacturing process: Metal forming, metal removal and metal joining process.<br>Modern Manufacturing process: 3D Printing / Additive Manufacturing. | | | | |
| **Targeted Application & Tools that can be used:**<br>Application Areas include design and implementation of Smart City projects, Infrastructure maintenance, Power production, IC engines, Electric vehicles, onshore and offshore exploration and production activities | | | | |
| **Project work/Assignment:** | | | | |

Assignment 1: Collect data and prepare report on various Mega Projects in Civil Engineering
Assignment 2: Review Articles on current evolutions in Civil Engineering.
Assignment 3: Collect data related to renewable energy generation (Wind, Solar)
Assignment 4: Prepare an energy consumption chart for a compressor or pumps.
Assignment 5: Prepare a report on role of 3D printing across various industries.
Assignment 6: Prepare an assignment on geopolitical influence on oil and gas industries.

**Text Book:**

T1. Elements of Civil and Mechanical Engineering, L.S. Jayagopal & R Rudramoorthy, Vikas Publishers

T2. Elements of Mechanical Engineering, by VK Manglik

T3. Fundamentals of Oil & Gas Industry for Beginners by Samir Dalvi, Notion Press; 1st edition

**References**


1. K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters and Publishers Pvt Ltd, Mumbai.
2. Nontechnical Guide to Petroleum Geology, Exploration, Drilling & Production by Norman J. Hyne, PennWell Books; 3rd Revised edition


**Web-resources:**

1. Basic Civil Engineering
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2706932&site=ehost-live
2. Post-parametric Automation in Design and Construction
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site=ehost-live
3. Smart Cities : Introducing Digital Innovation to Cities
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live
4. Innovation Energy: Trends and Perspectives or Challenges of Energy Innovation
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2323766&site=ehost-live
5. Mechanical Engineering
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO106_REDO_1705
6. Additive Manufacturing: Opportunities, Challenges, Implications
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live
7. Society of Petroleum Engineers (SPE)
https://www.spe.org/en/
8. PetroWiki: A comprehensive online resource created by the Society of Petroleum Engineers that provides information on various aspects of petroleum engineering.
https://petrowiki.spe.org/PetroWiki
9. Rigzone: A resource for news and information about the oil and gas industry, including job postings and industry trends.

https://www.rigzone.com/

**Topics relevant to the development of SKILLS:**

Engines-Turbines and their applications.
Mechanization in Construction.
Digitization in Petroleum Industries

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| **Catalogue prepared by** | Mr. Gopalakrishnan N/ Mr. Muralidhar/ Mr. Ajay H A/ Mr. Narendar Singh Tomar/Mr. Bhairab Jyoti Gogoi / Dr. Abhinav Kumar |
| **Recommended by the** | 18th BOS held on 05/07/2024 |

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| **Board of Studies on** | |
| **Date of Approval by the Academic Council** | Academic Council Meeting No. 24, Dated 03/08/24 |

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| **Course Code:** **MEC1006** | **Course Title:** **Engineering Graphics**<br>**Type of Course:** **1] Professional Core Course** **2] Theory** | **L-T-P- C** | 2 | 0 | 0 | 2 |
| **Version No.** | 1.2 | | | | | |
| **Course Pre-requisites** | **NIL** | | | | | |
| **Anti-requisites** | CAMD | | | | | |
| **Course Description** | The course is designed with the objective of giving an overview of engineering drawing with the help of software tools. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings with computerized drafting tools. Computerized drafting provides accurate and easily modifiable graphic entities, easy data storage, easy retrieval facility and it enhances creativity. It will expose students to the concept of engineering drawing and teach them to draw different views of planes and solids in different orientations. The course will teach students to use AutoCAD to produce engineering drawings. They will learn to create drawing layouts, dimensioning, the theory of projection, orthographic projection of points, lines, planes and solids, isometric projection and be introduced to the development of surfaces. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of " **Engineering Graphics** " and attain **SKILL DEVELOPMENT** through Problem solving methodologies. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>**(**1) Describe competency of Engineering Graphics as per BIS conventions and standards.<br>(2) Illustrate the theory of projection for drawing projections of Points, Lines and Planes under different conditions.<br>(3) Prepare multiview orthographic projections of Solids by visualizing them in different positions.<br>(4) Prepare pictorial drawings using the principles of isometric projections to visualize objects in three dimensions. | | | | | |

<table>
<tr><td colspan="5">Course Content</td></tr>
<tr><td>Module 1</td><td>Introduction to Drawing</td><td>Assignment</td><td>Standard technical drawing</td><td>4 sessions</td></tr>
<tr><td colspan="5">Topics:<br>Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Line conventions, dimensioning, Selection of drawing sheet size and scale.<br><br>[02 Hours: Comprehension Level]</td></tr>
<tr><td>Module 2</td><td>Orthographic projections of Points, Straight Lines and Plane Surfaces</td><td>Assignment</td><td>Projection methods Analysis</td><td>10 sessions</td></tr>
<tr><td colspan="5">Topics:<br>Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points in all 4 quadrants.<br>Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only.<br>[10 Hours: Application Level]</td></tr>
<tr><td>Module 3</td><td>Orthographic Projections of Solids</td><td>Assignment</td><td>Multi-view drawing Analysis</td><td>8 sessions</td></tr>
<tr><td colspan="5">Topics: Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different positions (Problems resting on HP only and First angle projection).<br>[8 Hours: Application Level]</td></tr>
<tr><td>Module 4</td><td>Isometric Projections of Solids (Using isometric scale only)</td><td>Assignment</td><td>Spatial Visualization</td><td>8 sessions</td></tr>
<tr><td colspan="5">Topics: Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects. [8 Hours: Application Level]</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:</td></tr>
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| Application Area is in understanding and interpreting an object in various positions and converting it into a technical drawing which can be universally accepted.<br>Professionally Used Software: AutoCAD |
| **Text Book:**<br>1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd**.** |
| **References:**<br>1. K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore.<br>2. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall.<br>3. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill.<br>4. Engineering Graphics Manual provided by Instructor in charge.<br>**Webresources :**<br>Knimbus - Your Library. Anywhere, Anytime. |
| **Topics relevant to "SKILL DEVELOPMENT":** Projection in first and third angle for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout. |

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| **Catalogue prepared by** | Mr. Yeshwanth D |
| **Recommended by the Board of Studies on** | BOS NO: 15th BOS held on 27/08/2022 |
| **Date of Approval by the Academic Council** | Academic Council Meeting No. 18, Dated 03/08/2022. |

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|---|---|---|---|---|---|---|
| **Course Code: EEE1007** | **Course Title: Basics of Electrical and Electronics Engineering.**<br>**Type of Course: Professional Core - Theory &Integrated Laboratory** | **L-T-P-C** | 3 | 0 | 2 | 4 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | **NIL** | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This is a fundamental Course which is designed to know the use of basics of electrical and electronics engineering principles occurs in various fields of Engineering. The course emphasises on the | | | | | |

<table>
<tr><td></td><td colspan="4">characteristics and applications of electrical and electronic devices. The course also emphasizes on the working, analysis and design of electrical circuits using both active & passive components. Additionally, this course creates a foundation for the future courses such as Electrical machines, power system, power electronics Linear Integrated Circuits, Analog Communication and Digital Communication etc.<br>The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to visualize the real system performance, using both hardware and simulation tools.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Basics of Electrical and Electronics Engineering and attain Skill Development through Experiential Learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of this course the students shall be able to:<br>1. Apply basic laws of Electrical Engineering to compute voltage, currents and other parameters in the circuits.<br>2. Discuss the performance characteristics and applications of various electrical Machines.<br>3. Discuss various fundamental parameters appearing in the characteristics of semiconductor devices and their applications.<br>4. Summarize the operations of different biasing configurations of BJTs and amplifiers.<br>5. Demonstrate the working of electrical machines to observe performance characteristics<br>6. Demonstrate the working of electronic circuits to obtain the V-I Characteristics of various semiconductor devices.<br>7. Sketch the characteristics and waveforms relevant to standard electrical and electronic circuits</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Electrical Circuits</td><td>Assignment/ Quiz</td><td>Numerical solving Task</td><td>10 Sessions</td></tr>
<tr><td colspan="5">DC Circuits: Concept of Circuit and Network, Types of elements, Network Reduction Techniques- Series and parallel connections of resistive networks, Star–to-Delta Transformations, Mesh Analysis, Nodal Analysis, Numerical examples.<br>AC Circuits: Fundamentals of single phase circuits - Series RL, RC and R-L-C Circuits, Concept of active power, reactive power and Power factor, Numerical examples.<br>Introduction to three phase system and relation between line and phase values in Star & Delta connection, Numerical examples.</td></tr>
<tr><td>Module 2</td><td>Fundamentals of Electrical Machines</td><td>Assignment/ Quiz</td><td>Numerical solving Task</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Electrical Machines: Single phase transformers: principle of operation and EMFequation, Numerical examples. DC Motor: principle of operation, Back EMF, torque equation, Numerical examples. AC Motor: Principle operation of Induction Motors and its Applications.<br>Special Machines: Introduction to special electrical machines and its applications.</td></tr>
<tr><td>Module 3</td><td>Semiconductor and Diode applications</td><td>Assignment/ Quiz</td><td>Memory Recall based Quizzes</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Mass Action Law, Charge densities in a semiconductor, Types of SC, Junction diodes -Ideal and practical behaviour, Modelling the Diode Forward Characteristic, and Diode applications</td></tr>
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| like rectifiers, Clipping and clamping circuits. Zener diode, characteristics and its applications like voltage regulator. | | | | |
| **Module 4** | **Transistors and its Applications** | Assignment/ Quiz | Memory Recall-based Quizzes | **10 Sessions** |
| Transistor characteristics, Current components, BJT Configurations (CB, CC, CE configurations) and their current gains. Operating point, Biasing & stabilization techniques: Fixed Bias, Voltage divider bias and its stability factor and load line analysis. Single and multistage amplifier, Darlington pair.<br>JFET (Construction, principal of Operation and Volt –Ampere characteristics). Pinch- off voltage, Comparison of BJT and FET. MOSFET (Construction, principal of Operation and symbol), MOSFET characteristics in Enhancement and Depletion modes. | | | | |
| **List of Laboratory Tasks:**<br>**Experiment No 1:**Verification of KVL and KCL for a given DC circuit.<br>**Level 1:**Study and Verify KVL and KCL for the given electrical Circuit.<br>**Level 2:** For the same circuit considered in level 1, perform the simulation usingNI LabVIEW/Multisim/MATLAB.<br>**Experiment No 2:** Analyse AC series circuits – RL, RC and RLC .<br>**Level 1:**Conduct an experiment to perform and verify the impedance, current and power of Series RL and RC circuits<br>**Level 2:** Conduct an experiment to perform and verify the impedance and current of RLC series circuits.<br>**Experiment No 3:** Calculation of power and power factor of the given AC Circuit.<br>**Level 1:**Conduct an experiment to measure the power and power factor for given resistive load.<br>**Level 2:**Conduct an experiment to measure the power and power factor for given inductive load.<br>**Experiment No 4:**Perform the experiments on given Transformer.<br>**Level 1:** Verify the EMF equation of a transformer and compute the voltage transformation ratio.<br>**Level 2:** Study the effect of load on the secondary side of the transformer and verify the EMF equation under load conditions.<br>**Experiment No 5:**Load test on DC shunt motor<br>**Level 1:**Conduct load test on DC shunt motor and find its efficiency at different loads<br>**Level 2:**Conduct load test on DC shunt motor and plot the performance characteristics.<br>**Experiment 6:** Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions.<br>**Level 1:**Carry out an experiment to plot VI Characteristics and hence find the cut-in voltage on forward characteristics for the Silicon P-N Junction diode.<br>**Level 2:** Carry out an experiment to plot VI Characteristics of Zener diode and hence find the zener voltage on reverse characteristics for the Silicon P-N Junction zener diode.<br>**Experiment No. 7:** To observe the output waveform of half wave and full wave rectifier circuit and compute ripple factor and efficiency<br>**Level 1:**Identify the components required for a rectifier circuit, rig up the circuit, and sketch the output waveforms without filter.<br>**Level 2:** Rig up the rectifier circuit with RC filter, observe the output waveforms, determine the efficiency and ripple factor.<br>**Experiment 8:** To construct clipping and clamping circuits for different reference voltages and to verify the responses.<br>**Level 1:**Identify the components required for building a Clipper / Clamper circuit. Rig up the circuit according to the circuit diagram given and sketch the output waveform. | | | | |

**Level 2:** Given a sinusoidal input of 10 V p-p, implement a positive / negative clipper with output clipped at 2 V.

**Experiment 9:** To calculate various parameters of emitter follower circuit using BJT

**Level 1:** Identify the components required to implement an emitter follower circuit. Rig up the circuit and observe the variations in output waveform with respect to the variations in input waveform.

**Level 2:** Determine the values of $Z_{in}$ input impedance and $Z_{out}$ output impedance for Emitter Follower.

**Experiment 10:** To Implement RC Coupled amplifier using a BJT and sketch the frequency response.

**Level 1**: Identify the components required to implement an RC coupled amplifier circuit. Rig up the circuit and sketch the frequency response.

**Level 2**: From the frequency response curve determine the value of the mid band gain and the bandwidth.

**Targeted Application & Tools that can be used:**

**Targeted Applications:** Application Area includes all electrical and electronic circuits (power supply unit, regulator unit, embedded devices, hardware electronics etc.). The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: Multisim/ PSpice

Besides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis..

**Project Work/ Assignment:**

**1. Article review:** At the end, of course an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format.

**3. Presentation:** There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

**4. Case Study**: - At the end of the course students will be given a 'real-world' application based circuits like Power Amplifier, Signal/Function Generator etc. as a case study. Students will be submitting a report which will include Circuit Diagrams, Design, Working Mechanism and Results etc. in appropriate format

**Text Book(s):**


1. Kothari D. P. & Nagrath I. J., "Basic Electrical and Electronics Engineering", Tata McGraw-Hill
2. Education
3. Theraja B.L. and Theraja A.K., "A Textbook of Electrical Technology: Basic Electrical Engineering" in S.I. System of Units, 23rd ed., New Delhi: S. Chand, 2002.
4. A.P.Malvino, Electronic Principles,7thEdition, Tata McGraw Hill,2007
5. J. Millman, C. C. Halkias and C. D. Parikh, "Millman's Integrated Electronics", McGraw Hill Education, 2nd Edition.
6. Basics of Electrical & Electronics Laboratory Manual.


**Reference Book (s):**


1. John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011
2. Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.
3. K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" IK International publishing house Pvt. Ltd

4. R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India 7th Edition.
5. A K. Maini, V. Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition
6. A.S Sedra, K. C. Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition

**Online Resources (e-books, notes, ppts, video lectures etc.):**

1. https://presiuniv.knimbus.com/user#home
2. https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"
3. Seminar Topic: https://nptel.ac.in/courses/108/105/108105153/ "Electrical Measurements"
4. Video lectures on "Electronic Devices" by Prof. Dr. A. N. Chandorkar, IIT Bombay http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html
5. Video lectures on "Analog Electronics" by Prof. S.C. Dutta Roy, IIT Delhi https://nptel.ac.in/courses/108/102/108102095/
6. Video lectures on "Diodes", by Prof. Chitralekha Mahanta, IIT Guwahati, https://nptel.ac.in/courses/117/103/117103063/

**E-content:**

1. "Introduction to Electrical Machines https://nptel.ac.in/courses/108/102/108102146/" M. -Y. Kao, H. Kam and C. Hu, "Deep-Learning-Assisted Physics-Driven MOSFET Current Voltage Modeling," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 974-977, June 2022, doi: 10.1109/LED.2022.3168243 https://ieeexplore-ieee-org-resiuniv.knimbus.com/document/9758727
2. F. Bonet, O. Aviñó-Salvadó, M. Vellvehi, X. Jordà, P. Godignon and X. Perpiñà, "Carrier Concentration Analysis in 1.2 kV SiC Schottky Diodes Under Current Crowding," in IEEE Electron DeviceLetters, vol. 43, no. 6, pp. 938-941, June 2022, doi: 10.1109/LED.2022.3171112. https://ieeexplore-ieeeorg-presiuniv.knimbus.com/document/9764749
3. M. Chanda, S. Jain, S. De and C. K. Sarkar, "Implementation of Subthreshold Adiabatic Logic for Ultralow-Power Application," in IEEE Transactions on Very Large Scale Integration (VLSI) Systems, vol. .23, no. 12, pp. 2782-2790, Dec. 2015. https://ieeexplore.ieee.org/document/7018053
4. R. Raut and O. Ghasemi, "A power efficient wide band trans-impedance amplifier in submicron CMOS integrated circuit technology," 2008 Joint 6th International IEEE Northeast Workshop on Circuits and Systems and TAISA Conference, 2008, pp. 113-116, doi: 0.1109/NEWCAS.2008.4606334. https://ieeexplore.ieee.org/document/4606334

**Topics relevant to "SKILL DEVELOPMENT":** Performing suitable experiments to compute the electric circuit parameters, performance operation of machines, and operation of semiconductor devices for **Skill Development** through **Experiential Learning techniques.** This is attained through assessment component mentioned in course plan.

| | |
|---|---|
| **Catalogue prepared by** | Mr Sunil Kumar and Dr Ashutosh Anand |
| **Recommended by the Board of Studies on** | 19th Bos held on 3rd July 2024 |
| **Date of Approval by the Academic Council** | 24th Academic Council Meeting held on 03/08/2024 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code: CSE1004** | **Course Title: Problem Solving Using C**<br>**Type of Course: School Core Lab Integrated.** | | | **L-T-P-C** | 1 | 0 | 4 | 3 |
| **Version No.** | 1.0 | | | | | | | |
| **Course Pre-requisites** | **NIL** | | | | | | | |
| **Anti-requisites** | **NIL** | | | | | | | |
| **Course Description** | The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future. | | | | | | | |
| **Course Object** | The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies. | | | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Write algorithms and to draw flow charts for solving problems<br>2. Demonstrateknowledgeanddevelopsimpleapplicationsin Cprogrammingconstructs<br>3. Develop and implement applications using arrays and strings<br>4. Decompose a problem into functions and develop modular reusable code<br>5. Solve applications in C using structures and Union<br>6. Design applications using Sequential and Random Access File Processing. | | | | | | | |
| **Course Content:** | | | | | | | | |
| **Module1** | Introduction to C Language | Quiz | Problem Solving | **9Hrs.** | | | | |
| Topics: Introduction to Programming – Algorithms – Pseudo Code -Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping. | | | | | | | | |
| **Module2** | Introduction to Arrays and Strings | Quiz | Problem Solving | **9Hrs.** | | | | |
| Topics: **Arrays:** Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs –Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs– Matrix operations. **Strings:** Introduction– Declaring and Initializing String Variables–Reading Strings from Terminal–Writing String to Screen– String Handling Functions. | | | | | | | | |
| **Module3** | Functions and Pointers | Quiz | ProblemSolving | **9Hrs.** | | | | |
| Topics: **Functions:** Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. **Pointers:** Introduction – Declaring Pointer Variables–Initialization of Variables – Pointer Operators–Pointer Arithmetic–Arrays and Pointers–Parameter Passing: Pass by Value, Pass by Reference. | | | | | | | | |
| **Module4** | Structures and Union | Quiz | Problem Solving | **9Hrs.** | | | | |

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|---|---|---|---|---|
| Topics: **Structures:** Introduction–Defining a Structure–Declaring Structure Variable–Accessing Structure Members –Array of Structures –Arrays within Structures–**Union:** Introduction–Defining and Declaring Union–Difference Between Union and Structure. | | | | |
| **Module5** | File handling | Case Study | Problem Solving | **9Hrs.** |
| Topics: Files: Defining and Opening a File –Closing a File–Input/ Output Operation File –Random Access Files | | | | |
| **List of Practical** –Tasks Lab Sheet<br>1(Module I)<br>Programs using IO Statements, Conditional Statements and Looping Statements<br>Lab Sheet 2(Module II)<br>Programs using Arrays and Strings<br>LabSheet3(ModuleIII)<br>Programs using Functions and Pointers<br>Lab Sheet4(ModuleIV)<br>Programs using Structures and Unions<br>Lab Sheet5(ModuleV)<br>Programs using Files | | | | |
| TextBook(s):<br>1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0. | | | | |
| ReferenceBook(s):<br>1. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.<br>2. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.<br>3. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015<br>4. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.<br>5. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014. | | | | |
| **WebLinksandVideoLectures:**<br>**1. https://nptel.ac.in/courses/106/105/106105171/**<br>**2. https://archive.nptel.ac.in/courses/106/104/106104128/** | | | | |
| **Catalogue prepared by** | **Dr S Hasan Hussain** | | | |
| **Recommended by the Board of Studies on** | BOSNO :SOCSE 2nd BOSheldon10/07/23 | | | |
| **Date of Approval by the Academic Council** | AcademicCouncilMeetingNo21,Dated 06/09/2023 | | | |

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|---|---|---|---|---|---|---|
| **Course Code: CSE1006** | **Course Title:** Problem Solving using JAVA<br>**Type of Course: Integrated** | **L-T- P-C** | 1 | 0 | 4 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | CSE1004 – Problem Solving Using C | | | | | |
| **Anti-requisites** | Nil | | | | | |

<table>
<tr><td>Course Description</td><td colspan="4">This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVAand attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:<br>CO1: Describe the basic programming concepts. [Understand]<br>CO2:Apply the concept of classes, objects and methods to solve problems. [Application]<br>CO3: Apply the concept of arrays and strings. [Appy]<br>CO4: Implement inheritance and polymorphism building secure applications. [Apply]<br>CO5: Apply the concepts of interface and error handling mechanism. [Apply]</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Basic Concepts of Programming and Java</td><td>Assignment</td><td>Problem Solving</td><td>15 Sessions (L3 + P12)</td></tr>
<tr><td colspan="5">Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.</td></tr>
<tr><td>Module 2</td><td>Classes, objects, methods and Constructors</td><td>Assignment</td><td>Problem Solving</td><td>17 Sessions (L3 + P14)</td></tr>
<tr><td colspan="5">Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods.<br>Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.</td></tr>
<tr><td>Module 3</td><td>Arrays, String and String buffer</td><td>Assignment</td><td>Problem Solving</td><td>13 Sessions (L3 + P10)</td></tr>
<tr><td colspan="5">Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.</td></tr>
<tr><td>Module 4</td><td>Inheritance and Polymorphism</td><td>Assignment</td><td>Problem Solving</td><td>17 Sessions (L3 + P14)</td></tr>
<tr><td colspan="5">Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.</td></tr>
<tr><td>Module 5</td><td>Input & Output Operation in Java</td><td>Assignment</td><td>Problem Solving</td><td>13 Sessions (L3 + P10)</td></tr>
<tr><td colspan="5">Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.</td></tr>
</table>

P1: Programming Exercises on Basic Concepts.

LEVEL 1: Discuss about datatypes and variables.

LEVEL 2: Demonstrate a simple java program

P2: Programming Exercises on Basic Concepts.

LEVEL 1: Discuss about datatypes and variables.

LEVEL 2: Demonstrate a simple java program

P3: Programming Exercises on operators, expressions based on a given scenario.

LEVEL 1: Explain operators, expressions.

LEVEL 2: Demonstrate operators

P4: Programming Exercises Command Line Arguments based on a given scenario.

LEVEL 1: Explain command line arguments

LEVEL 2: Demonstrate command line arguments

P5: Programming Exercises on basic Input/ Output functions and Control Statements: Branching

LEVEL 1: Explain Input/ Output functions

LEVEL 2:Demonstrate Control Statements: Branching

P6: Programming Exercises on Control Statements: Looping

LEVEL 1: Explain various loops.

LEVEL 2:Demonstrate Control Statements: Looping

P7: Programming Exercises on Creating Objects, classes on a given scenario.

LEVEL 1: Illustrate class, object and methods.

LEVEL 2: Execute java program using class and objects

P8: Programming Exercises on Adding methods and Constructors to the class based on a given scenario.

LEVEL 1: Illustrate methods and constructors

LEVEL 2: Execute java program using methods and constructors

P9: Programming Exercises on methods based on a given scenario.

LEVEL 1: Illustrate method overloading

LEVEL 2: Apply method overloading for the given scenario.

P10: Programming Exercises on methods based on a given scenario.

LEVEL 1: Illustrate constructors overloading

LEVEL 2: Apply constructor overloading for the given scenario

P11: Programming Exercises on methods for static members bassed on a given scenario.

LEVEL 1: Benefits of usage static members

LEVEL 2: Usage of Static Members for the given scenario

P12: Programming Exercises on static methods based on a given scenario.

LEVEL 1: Benefits of usage static methods

LEVEL 2: Usage of Static Methods for the given scenario.

P13: Programming Exercises on nested Classes based on a given scenario.

LEVEL 1: Benefits of usage nested classes

LEVEL 2: Apply the concept of usage of nested classes for the given scenario

P14: Programming Exercises on Arrays and its built-in functions based on a given scenario.

LEVEL 1: Illustrate one dimensional arrays and its functions.

LEVEL 2: Demonstrate programs with single-dimensional arrays and operations.

P15: Programming Exercises on Arrays and its built-in functions based on a given scenario.

LEVEL 1: Illustrate multi dimensional arrays and its functions.

LEVEL 2: Demonstrate programs with multi-dimensional arrays and operations.

P16: Programming Exercises on String Class and its built-in functions based on a given scenario.

LEVEL 1: Explain about String class and String methods.

LEVEL 2: Execute simple java applications for String and StringBuffer operations

P17: Programming Exercises on String Buffer Class and its built-in functions based on a given scenario.

LEVEL 1: Explain about StringBuffer class and String methods.

LEVEL 2: Execute simple java applications for String and StringBuffer operations

P18: Programming Exercises on String Builders and its built-in functions based on a given scenario.

LEVEL 1: Explain about String Builders.

LEVEL 2: Execute java applications for String Builders

P19: Programming Exercises on single, multi level Inheritance and super keyword based on given scenario.

LEVEL 1: Explain single and multi level inheritance.

LEVEL 2: Demonstrate simple applications for the different types of inheritance

P20: Programming Exercises hierarchical Inheritance and super keyword based on given scenario.

LEVEL 1: Explain hierarchical inheritance.

LEVEL 2: Demonstrate simple applications for hierarchical inheritance

P21: Programming Exercises on Overriding.

LEVEL 1: Differentiate method overloading and method overriding.

LEVEL 2: Demonstrate simple program with dynamic method dispatch.

P22: Programming Exercises on Final based on given scenario.

LEVEL 1: Implement programs using concept of final.

LEVEL 2: Use final keyword for the given problem

P23: Programming Exercises on Abstract keyword based on given scenario.

LEVEL 1: Implement programs using concept of Abstract.

LEVEL 2: Use abstract keyword for the given problem

P24: Programming Exercises on Interface based on a given scenario.

LEVEL 1: Differentiate abstract class about interface

LEVEL 2: Implement interfaces in the given problem

P25: Programming Exercises on Exception Handling based on a given scenario.

LEVEL 1: Explain exception handling

LEVEL 2: Solve the given problem using exception handling mechanism.

P26: Programming Exercises on Character Stream Classes based on a given scenario.

LEVEL 1: Explain Character Stream Classes

LEVEL 2: Solve the given problem using Character Stream Class.

P27: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.

LEVEL 1: Explain Read/Write Operations with File Channel

LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.

P28: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.

LEVEL 1: Explain Read/Write Operations with File Channel

LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.

P29: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.

LEVEL 1: Explain Read/Write Operations with File Channel

LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.

P30: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.

LEVEL 1: Explain Read/Write Operations with File Channel

LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.

**Targeted Application & Tools that can be used :** JDK /eclipse IDE/ net Beans IDE.

**Text Book**

**T1** Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education, 11th Edition,2019.

**References**

R1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.

R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.

R3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

**E book link R1:** **http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf**

**E book link R2:**Java(tm) Design Patterns: A Tutorial( [PDF] [7qmsenjl97t0] (vdoc.pub)

Web **resources**

ps://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q

ps://puniversity.informaticsglobal.com:2229/login.aspx

**Topics relevant to development of "Skill Development":**

1. Static Polymorphism
2. Method overloading, constructors
3. constructor overloading
4. this keyword
5. static keyword and Inner classes
6. Inheritance and Polymorphism.

for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

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| **Catalogue prepared by** | |
| **Recommended by the Board of Studies on** | |
| **Date of Approval by the Academic Council** | |

| **Course Code: ECE2010** | **Course Title: Innovative Projects using Arduino** | **L- T-P- C** | 0 | 0 | 0 | 1 |
|---|---|---|---|---|---|---|
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | NIL | | | | | |
| **Anti-requisites** | NIL | | | | | |

<table>
<tr><td>Course Description</td><td colspan="4">This course is designed to provide an in-depth understanding of Arduino microcontrollers and their application in various real time projects involving sensors. Throughout the course, students will learn the fundamentals of Arduino programming and gain hands-on experience with a wide range of sensors. Students will explore how to connect and interface sensors with Arduino boards, read sensor data, and use it to control various output devices This course is suitable for beginners who are interested in exploring the world of electronics and developing practical applications using Arduino and sensors.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is Employability Skills of student by using PARTICIPATIVE LEARNING techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of the course the students shall be able to<br>1) Explain the main features of the Arduino prototype board<br>2) Demonstrate the hardware interfacing of the peripherals to Arduino system.<br>3) Understand the types of sensors and its functions<br>4) Demonstrate the functioning of live projects carried out using Arduino system.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Basic concepts of Arduino</td><td>Hands-on</td><td>Interfacing Task and Analysis</td><td>4 Sessions</td></tr>
<tr><td colspan="5">Topics:<br>Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, API’s , Introduction to Embedded C and Arduino platform, Arduino Datatypes and variables, Arduino i/o Functions, Arduino Communications, Arduino IDE, Various Cloud Platforms.</td></tr>
<tr><td>Module 2</td><td>Sensory Devices</td><td>Hands-on</td><td>Interfacing Task and Analysis</td><td>4 Sessions</td></tr>
<tr><td colspan="5">Arduino Sensors: Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor, Connecting Switches and actuators, sensor interface with Arduino.<br>Introduction to 3D Printer: 3D Printer technology and its working Principles, Applications.<br>Introduction to online Simulators: Working with Tinkercad Simulator.</td></tr>
<tr><td colspan="5">Topics: Types of Arduino boards, sensors, 3D Printer</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:</td></tr>
</table>

**Application Area:**

Home Automation, Environmental Monitoring, Agriculture and Farming, Industrial Automation, Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education and Learning.These are just a few examples of the many application areas where Arduino and sensors can be applied. The flexibility and affordability of Arduino, combined with the wide range of sensors available, allow for endless possibilities in creating innovative projects.

**Professionally Used Software:** students can use open SOURCE Softwares Arduino IDE and Tincker CAD

**Project work/Assignment:**

**1. Projects: At the end of the course students will be completing the project work on solving many real time issues.**

**2. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format.**Presidency University Library Link **.**

**3. Presentation: There will be a presentation from interdisciplinary students group, where the students will be given a project on they have to demonstrate the working and discuss the applications for the same**

**Textbook(s):**

**Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition**

**References**

**Reference Book(s)**

**1. Neerparaj Rai "Arduino Projects for Engineers" BPB publishers,first edition, 2016.**

**2. Ryan Turner "Arduino Programming " Nelly B.L. International Consulting Ltd. first edition,2019.**

**Online Resources (e-books, notes, ppts, video lectures etc.):**

1. Arduino trending Projects <https://www.https://projecthub.arduino.cc/>
2. Introduction to Arduino <https://onlinecourses.swayam2.ac.in/aic20_sp04/preview>
3. Case studies on Wearable technology<https://www.hticiitm.org/wearables>

**E-content:**

1. Cattle Health Monitoring System Using Arduino and IOT (April 2021| IJIRT | Volume 7 Issue 11 | ISSN: 2349-6002)

2. M H Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, Pragya Singh"IOT BASED SMART SECURITY SYSTEM USING ARDUINO" 2021 JETIR August 2021, Volume 8, Issue 8.

3. R. Maheswar, P. Jayarajan, S. Vimalraj, G. Sivagnanam, V. Sivasankaran and I. S. Amiri, "Energy Efficient Real Time Environmental Monitoring System Using Buffer Management Protocol," 2018, pp. 1-5, doi: 10.1109/ICCCNT.2018.8494144. **https://ieeexplore.ieee.org/document/8494144**.
4. Yaser S Shaheen,Hussam., " Arduino Mega Based Smart Traffic Control System ," December 2021 Asian Journal of Advanced Research and Reports 15(12): 43-52, 2021(15(12): 43-52, 2021):15(12): 43-52, 2021.

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|---|---|
| **Topics relevant to development of "SKILL":** System design for achieving Sustainable Development Goals. | |
| **Catalogue prepared by** | Dr. Divya Rani/Dr Ashutosh Anand |
| **Recommended by the Board of Studies on** | BOS NO: 17Th BoS meeting held on 5th July 2023 |
| **Date of Approval by the Academic Council** | Academic Council Meeting No. 21 dated on _____ |

**Professional Core courses**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code:** EEE2500 | **Course Title:** Electric Circuit Analysis<br>Type of Course: Professional Core & Theory only | L-T- P-C | 3 | 1 | 0 | 4 |
| Version No. | 2.0 | | | | | |

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|---|---|---|---|---|
| Course Pre-requisites | MAT1001-Calculus and Linear Algebra | | | |
| Anti-requisites | NIL | | | |
| Course Description | This Course aims at obtaining the solutions to problems in electrical networks using various network reduction techniques and theorems. The course is both conceptual and analytical in nature and uses the basic knowledge on mathematics to analyse electrical circuits. | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Electric Circuit Analysis and attain Skill Development through Problem Solving methodologies | | | |
| Course Out Comes | On successful completion of the course the students shall be able to:<br>1] Explain various network reduction techniques to reduce the complexity of circuits<br>2] Summarize various network theorems<br>3] Explain the behavioural and RC circuits for DC and AC excitation.<br>4] Outline the parameters of two port network and relation between Voltage, current and power in poly phase circuits. | | | |
| Course Content: | | | | |
| Module1 | Module:1<br>Network Reduction Techniques: | Assignment | Quiz | 9L+3T Sessions |
| Topics: Types of electric circuit elements and sources, Source transformation, mesh analysis, Nodal analysis | | | | |
| Module2 | Module: 2<br>Network theorems: | Assignment | Simulation | 12L+4T Sessions |
| Topics: Statement of all Network Theorems, Explanation of Super position theorem, Thevenin's theorem, Maximum power transfer theorem and numerical examples on these theorems (DC &AC) | | | | |
| Module3 | Module:3TransientAnalysis and Resonance | Assignment | Programming/Simulation | 12L+4T Sessions |
| Topics: Initial conditions, transient analysis of RL, RC circuits, Laplace transforms of RL, RC circuits with step input, Concept of Resonance and frequency response for sinusoidal input. | | | | |
| Module4 | Module:4<br>Two port networks | Assignment | Quiz | 12L+4T Sessions |
| Topics: Introduction, Z parameters-parameters, ABCD parameters and h-parameters. Analysis of Poly Phase circuits: Voltage, Current and Power relations in a balanced Star band Delta connected load. | | | | |
| Targeted Application & Tools that can be used:<br>Application Area is Electrical appliances used in residential properties, DC and AC circuits for Power electronic converters, Spark plug in automobiles, Battery Management system in Electric Vehicles.<br><br>Professionally Used Software: Multisim, MATLAB Simulink | | | | |
| Textbooks<br>1. Ravish.R.Singh,"ElectricalNetworks",McgrawHillcompany,2009<br>2. Charles K Alexander and Matthew NO Sadiku" Fundamentals of Electric Circuits ($4^{th}$) Edition | | | | |
| References | | | | |

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| 1. VanValkenberg,"NetworkAnalysis",PrenticeHall,1974.PHI<br>2. J.A.Edminister,"Theory and Problemsof ElectricCircuits",Schaum'sOutlineSeries,4thEdition.<br>Online resources<br>1. https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&queryText=electric%20circuit%20analysis<br>2. https://www.tutorialspoint.com/network_theory/index.htm<br>3. https://nptel.ac.in/courses/108/105/108105159/<br>4. CaseStudyhttps://www.scribd.com/document/420348012/Case-Study<br>5. E book: Electric Circuits: A Primer, Olivier, J. C , 2018<br>https://presiuniv.knimbus.com/user#/home |
| Topics relevant to "SKILL DEVELOPMENT": Network Reduction Techniques and Source transformation for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in Course Plan. |

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|---|---|
| Catalogue prepared by | Ms. Ragasudha C P& Mr. Bishakh Paul |
| Recommended by the Board of Studies on | BoS No: 15th BoS held on 27/7/22 |
| Date of Approval by the Academic Council | 18th Academic Council Meeting, dated on 3/8/2022 |

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|---|---|---|---|---|---|---|
| Course Code: EEE2009 | Course Title: Analog Electronics Circuits<br>Type of Course: Professional Core and Theory only | L- T-P-C | 3 | 0 | 0 | 3 |
| Version No. | 2.0 | | | | | |
| Course Pre-requisites | NIL | | | | | |
| Anti-requisites | NIL | | | | | |
| Course Description | This course discusses the importance of analog electronics and to develop the basic abilities of understanding and analysing the analog circuits. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical computation. The course develops the critical thinking and analytical skills and enhances the simulation and programming abilities through assignments. | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Analog Electronics and attain Skill Development through Problem Solving methodologies. | | | | | |
| Course Outcomes | On successful completion of this course the students shall be able to:<br>1. Explain the characteristics of diodes and transistors.<br>2. Summarize the working of feedback amplifiers.<br>3. Relate various types, characteristics and modes of FETs<br>4. Summarize the operation of power amplifiers and the working of various Oscillators | | | | | |
| Course Content: | | | | | | |

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| Module 1 | Introduction to Diodes and Transistors | Assignment | Case study | 09 Sessions |
| Topics: Clippers, clampers, rectifiers, zener diode, Transistor, transistor at low frequencies, H-parameters equivalent circuit. | | | | |
| Module 2 | Amplifier circuits | Assignment | Simulation task | 09Sessions |
| Topics: RC coupled amplifier, two cascaded CE and multistage CE amplifiers, Feedback amplifiers, Voltage-Series and Current-Series Feedback, Current-Shunt and Voltage-Shunt Feedback. | | | | |
| Module 3 | Field Effect Transistors. | Test | Quiz | 08 Sessions |
| Topics: JFET, MOSFET, Equivalent circuits and biasing of JFET's & MOSFET's | | | | |
| Module 4 | Oscillators | Assignment | Simulation task | 09Sessions |
| Topics: Sinusoidal Oscillators, Barkhausen's Criterion, RC Phase-shift oscillator, analysis and derivation of frequency of oscillation of phase shift oscillator, Colpitts and Hartley Oscillators, Crystal Oscillator, Power Amplifiers, Frequency stability. | | | | |
| Targeted Application & Tools that can be used:<br>Application Area is amplifying speech or music, TV broadcasting and displaying, cell phone, satellite communications, computers, remote control, home automation, traffic light control etc.,<br><br>Professionally Used Software: PSpice/ Multisim/ Logisim/ MATLAB/HDL | | | | |
| TextBooks<br>1. Integrated Electronics: Analog and Digital Circuits and Systems, L/e, Jaccob Millman, Christos Halkias and Chethan D. Parikh, Tata McGraw-Hill Education, India, 2nd edition, 2017.<br>2. Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, 11th Edition, Pearson Education | | | | |
| References<br>1. Electronic Devices and Circuits, Jimmy J Cathey, Schaum's outline series.<br>2. Anil K. Maini, Varsha Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition<br>Online resources:<br>1. Ebook:http://presiuniv.knimbus.com:2232/cgi-bin/koha/opac-detail.pl?biblionumber=3800&query_desc=kw%2Cwrdl%3A%20Integrated%20Electronics<br>2. Case study:<br>http://presiuniv.knimbus.com:2232/cgi-bin/koha/opac-detail.pl?biblionumber=8072&query_desc=kw%2Cwrdl%3A%20Electronic%20Devices%20and%20Circuits<br>3. https://edge.edx.org/courses/MITx/6.002x-temp/Circuits_And_Electronics/about<br>4. Seminar topic: https://www.electronics-tutorials.ws/ | | | | |
| Topics relevant to "SKILL DEVELOPMENT": Numerical associated with Diodes and Transistors, Power amplifier, Colpitts oscillator forSkill Developmentthrough Problem Solving methodologies. This is attained through assessment component mentioned in Course Plan. | | | | |
| Catalogue prepared by<br>Updated by | Dr. Sumit Kumar Jha | | | |

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| Recommended by the Board of Studies on | BoS No: 15th BoS held on 27/07/22 |
| Date of Approval by the Academic Council | 18th Academic Council Meeting held on 03/08/2022 |

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|---|---|---|---|---|---|---|
| Course Code: EEE2015 | Course Title: Digital Electronics<br>Type of Course: Professional Core<br>Theory only | L-T- P-C | 3 | 0 | 0 | 3 |
| Version No. | 2.0 | | | | | |
| Course Pre-requisites | NIL | | | | | |
| Anti-requisites | NIL | | | | | |
| Course Description | The purpose of this course is to understand the importance of digital electronics and to develop the basic abilities of understanding and analysing the digital circuits. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical computation. The course develops the critical thinking and analytical skills. The course also enhances the simulation and programming abilities through assignments. | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Digital Electronics and attain Skill Development through Problem Solving methodologies. | | | | | |
| Course Outcomes | On successful completion of this course the students shall be able to:<br>1] Explain the concepts of number systems, Boolean algebra, and logic gates<br>2] Apply minimization techniques to simplify Boolean expressions.<br>3] Demonstrate the Combinational circuits for a given logic.<br>4] Illustrate the Sequential logic circuits | | | | | |
| Course Content: | | | | | | |
| Module 1 | Fundamentals of Number systems-Boolean algebra and digital logic | Assignment | Simulation task | 09 Sessions | | |
| Topics:<br>Review of Number systems, Number base conversions, complements of numbers, Binary Codes, Boolean theorems and Boolean algebra, Boolean functions- canonical and standard forms, Digital logic gates. | | | | | | |
| Module 2 | Boolean function simplification | Assignment | Simulation task | 11 Sessions | | |
| Topics:<br>Introduction, two, three, four variable K-Maps, utilizing Don't care conditions, Quine McClusky Method for simplification. Universal Gates (NAND & NOR) Implementations. | | | | | | |
| Module 3 | Combinational Logic circuits. | Test | Quiz | 12 Sessions | | |
| Topics: | | | | | | |

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| Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders | | | | |
| Module 4 | Sequential Logic Circuits | Test | Quiz | 13 Sessions |
| Topics:<br>Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters | | | | |
| Targeted Application & Tools that can be used:<br>Application Area is in computers, remote control, home automation, traffic light control etc.,<br>Professionally Used Software: PSpice/ Multisim/ Logisim/ MATLAB/HDL | | | | |
| Text Book<br>1 Digital Design, 5/e, Morris Mano and Michael D. Cilette, Pearson.<br>2.Jain, R. P., "Modern Digital Electronics", McGraw Hill Education (India). | | | | |
| References<br>1. Roth, Charles H., Jr and Kinney Larry L., "Fundamentals of logic Design", Cengage Learning.<br>2. Digital Principles, 3/e, Roger L. Tokheim, Schaum's outline series.<br>Online Resources:<br>1. https://edge.edx.org/courses/MITx/6.002x-temp/Circuits_And_Electronics/about<br>2. https://www.electronics-tutorials.ws/<br>3. https://presiuniv.knimbus.com/user#/home<br>4. https://www.academia.edu/22542562/Foundations_of_Analog_and_Digital_Electronic_Circuits<br>5. Ebook: Basic Digital Electronics by M. V. Subramanyam, Bhupesh Bhatia, Second edition. New Delhi : Laxmi Publications Pvt Ltd. 2017. https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=0&sid=78146d72-6f9f-4dd9-97df-eef3b22b8fc5%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=3103309&db=nlebk<br>5. case study topic:<br>https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&queryText=digital%20electronics | | | | |
| Topics relevant to "SKILL DEVELOPMENT": K-Map, Storage elements: latches and flip flops, registers, counters for Skill Development through Problem Solving Methodologies. This is attained through assessment component mentioned in Course Plan. | | | | |
| Catalogue updated by | Ms. Ragasudha C P | | | |
| Recommended by the Board of Studies on | BoS No: 15$^{th}$BoSheld on 27/7/22 | | | |
| Date of Approval by the Academic Council | 18$^{th}$ Academic Council meeting held on 3/8/2022 | | | |

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|---|---|---|---|---|---|---|
| Course Code: EEE2501 | Course Title: Signals and Systems<br>Type of Course: Professional Core Theory only | | L-T- P-C | 3 | 1 | 0 | 4 |
| Version No. | 2.0 | | | | | |
| Course Pre-requisites | MAT1001-Calculus and Linear Algebra | | | | | |
| Anti-requisites | NIL | | | | | |
| Course Description | The purpose of this course is to familiarize with the importance of signals and signal processing systems and to develop the basic abilities of understanding and analysing the types of signals, systems and filters. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops analytical and logical thinking skills. The course also enhances the programming abilities through assignments. | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Signals and Systems and attain Skill Development through Problem Solving methodologies | | | | | |
| Course Out Comes | On successful completion of the course the students shall be able to:<br>1. Identify different types of signals and systems based on their properties<br>2. Summarize the behaviour of LTI systems to periodic and aperiodic signals using Fourier Transforms.<br>3. Discuss the transform- domain signal and frequency response using DFT<br>4. Classify techniques of dealing with discrete systems using the z-transform. | | | | | |
| Course Content: | | | | | | |
| Module 1 | Introduction to Signals and Systems | Assignment | Programming | 15L+5T Sessions | | |
| Topics:<br>Representation of Continuous and Discrete-time Signals, Classification of signals, Transformation of Independent Variables –Time Shifting, Time Scaling and Time Reversal, Representation of Continuous and Discrete Time Systems. Classification of systems. | | | | | | |
| Module 2 | Analysis of LTI System | Assignment / Quiz | Programming | 15L+5T Sessions | | |
| Topics:<br>Impulse Response of Continuous and Discrete Time LTI Systems, Convolution, Fourier Series Representation of Continuous Time and Discrete-time periodic signals, Properties of Fourier Series, | | | | | | |
| Module 3 | Analysis of Continuous and Discrete LTI Systems | Assignment | Programming | 15L+5T Sessions | | |
| Topics:<br>Sampling Theorem, Effects of Sampling and Aliasing. Sampling of Continuous Time Signals, Review of Laplace Transform, Region of Convergence, Mapping of s-plane to z-plane. | | | | | | |
| Targeted Application & Tools that can be used: | | | | | | |

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| Signals and signal processing is a branch of electrical engineering and finds its applications in different professional fields such as audio signal processing, digital image processing, video compression, speech recognition, control systems, research and development, digital communications, digital synthesizers, radar, sonar, financial signal processing, seismology and biomedicine.<br>Professionally used tools: MATLAB / Python | |
| Textbooks<br>1. Signals and Systems by Alan V. Oppenhein, Alan S. Willsky and S. Hamid, 2nd edition, Pearson 2016.<br>2. John G. Proakis, D.G. Manolakis and D.Sharma, "Digital Signal Processing Principles, Algorithms and Applications", 4th edition, Pearson Education, 2012. | |
| References<br>1. B.P. Lathi, "Signals, Systems & Communications" BS Publications, 5th Reprint, 2008.<br>2. Nagrath I J, Sharan S N, Ranjan Rakesh & Kumar S, "Signals & Systems", TMH, 2001.<br>3. Oppenhiem V.A.V and Schaffer R.W, "Discrete – time Signal Processing", 3rd edition, Pearson new international edition, 2014.<br>4. Digital Signal Processing, P Ramesh Babu, Pearson Education.<br>Online Resources:<br>1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/<br>2. https://nptel.ac.in/courses/117/101/117101055/<br>3. https://www.youtube.com/results?search_query=signals+and+systems<br>4. https://puniversity.informaticsglobal.com | |
| Topics relevant to "SKILL DEVELOPMENT": Mapping of s-plane to z-plane are the topics for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in Course Plan. | |
| Catalogue prepared by | Mr. Bishakh Paul |
| Recommended by the Board of Studies on | BoS No: 13th, held on 27/12/2021 |
| Date of Approval by the Academic Council | 18th Academic Council meeting held on 03/08/2022 |

| Course Code: EEE2502 | Course Title: Electromagnetic Fields<br>Type of Course: Professional Core& Theory only | L-T- P- C | 3 | 1 | 0 | 4 |
|---|---|---|---|---|---|---|
| Version No. | 2.0 | | | | | |
| Course Pre-requisites | MAT1001:Calculus and Linear Algebra. | | | | | |
| Anti-requisites | NIL | | | | | |
| Course Description | The purpose of this course is to provide a basic knowledge about Electromagnetic Fields. It uses the mathematical concepts of vector calculus for analysing the fields. The course enhances the ability to visualize the electric and magnetic fields by using simulation tools like MATLAB and Ansys etc. | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Electromagnetic Theory and attain Skill Development through Problem Solvingmethodologies | | | | | |
| Course Outcomes | On successful completion of this course the students shall be able to:<br>1. Select the suitable coordinating system for Electromagnetic field systems.<br>2. Explain the concept of electrostatics fields.<br>3. Describe the principles of magneto statics fields.<br>4. Summarize the static and time varying field equations. | | | | | |
| Course Content: | | | | | | |
| Module 1 | Introduction to vector analysis and coordinate systems | Assignment | Task on choosing the proper coordinate system for Analysis in various applications | 12L+4T Sessions | | |
| Topics:Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Del Operator, Gradient, Divergence, Curl – Differential length, area and volume in different coordinate systems. | | | | | | |
| Module 2 | Electrostatic fields | Assignment | Virtual lab | 12L+4T Sessions | | |
| Topics:Coulomb's law, Gauss's law, Electric potential, Electric dipole and flux lines, Energy density in electrostatic field, Boundary conditions, Poisson's and Laplace's equation. | | | | | | |
| Module 3 | Magneto Static Fields | Project work | Programming Task / Hardware model | 12L+4T Sessions | | |
| Topics:Lorentz Force, Biot–Savart's Law, Ampere's Circuit Law, Magnetic Potential, Boundary Conditions, Inductor, Magnetic Energy. | | | | | | |
| Module 4 | Time Varying Electric and Magnetic Fields | Project work | Hardware model | 9L+3T Sessions | | |
| Topics:<br>Faraday's law, Displacement current, Maxwell's four equations in integral form and differential form. Poynting Vector and the flow of power, Power flow in a co-axial cable, Instantaneous, Average and Complex Poynting Vector. Wave Equation from Maxwell's equation | | | | | | |
| Targeted Application & Tools that can be used:<br>Application Area is in the operation of electrical systems, transmission lines, communication systems, Magnetic Levitation Trains, transformers and electrical machines.<br>Professionally Used Software: MATLAB, ANSYS,Vlab. | | | | | | |
| Textbooks:<br>1. Sadiku, Mathew N. O. and Kulkarni, S. V. "Principles of Electromagnetics", 6th Edition, Oxford University Press, Latest Version.<br>2. W H Hayt Jr, J A Buck, and M Jaleel Akhtar . "Engineering Electromagnetics \| Ninth Edition, TMH Publications. | | | | | | |
| References:<br>1. Cheng, David K., "Field & Wave Electromagnetics", 2nd Edition, Pearson Education, 2014.<br>2. Pramanik, Ashutosh, "Electromagnetism – Theory and Applications", 2nd Edition, Prentice-Hall of India Private Limited, New Delhi, 2009. | | | | | | |
| Online Learning Resources: | | | | | | |

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| 1. https://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-and-energy-spring-2008/<br>2. https://nptel.ac.in/courses/117/103/117103065/<br>3. Case study: https://iopscience.iop.org/article/10.1088/1742-6596/1826/1/012081/meta<br>4. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live | |
| Topics relevant to "SKILL DEVELOPMENT": Electric Field Intensity due to different charge distributions, Magnetic field Intensity due to current carrying conductor for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in Course Plan. | |
| Catalogue prepared by | Mr. K Sreekanth Reddy<br>Mr. Bishakh Paul |
| Recommended by the Board of Studies on | BoS NO: 12th , held on 27/7/2021 |
| Date of Approval by the Academic Council | 16th Academic Council Meeting held on 23/10/21 |

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| **Course Code: EEE2503** | **Course Title: DC Electrical Machines & Special Electrical Machines**<br>**Type of Course: Program Core& Theory only** | **L- T- P- C** | **3** | **0** | 0 | **3** |
| **Version No.** | **1.0** | | | | | |
| **Course Pre-requisites** | **EEE1007 Basic Electrical and Electronics Engineering** | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This course provides a thorough introduction to DC machines and special electrical machines, focusing on their real-world applications. Students will learn about the speed-torque characteristics and performance of these machines under various conditions. The course develops analytical skills to assess and optimize machine performance. Through hands-on assignments and mini projects, students will gain practical experience and enhance their ability to use modern tools for machine analysis. By the end, students will be equipped to solve problems related to the operation and control of DC and special electrical machines in diverse industries. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of **DC Electrical Machines & Special Electrical Machines** and attain **SkillDevelopment** through **Problem Solving**methodologies. | | | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1. **Explain** the performance of dc generator<br>2. Chose the dc motor for an application<br>**3.** Explain the construction, principle of operation of switched reluctance motor and stepper motor<br>**4. Summarize the** working principle andcharacteristics of BLDC and PMS Motors. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Energy Conversion and DC Generator | Assignment | Application of DC Machines | **11 Sessions** | | |
| **Topics:** Principles of Energy conversion –. DC Generator – construction, principle of operation – emf equation – types of Characteristics commutation - armature reaction. losses and efficiency, condition for maximum efficiency. Applications | | | | | | |

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| **Module 2** | DC Motor | Assignment | Simulation task | **11 Sessions** |
| **Topics:** DC motor – principle of operation – torque equation – types –starting – speed control – various testing – braking, Testing of dc machines, Applications | | | | |
| **Module 1** | **Switched Reluctance Motor and Stepper Motor** | **Assignment** | **Applications of Stepper motors** | **10 Sessions** |
| **Switched Reluctance Motor**<br>Construction, Principle of operation, design of stator and rotor pole arc, power converter for switched reluctance motor.<br>**Stepper Motors**<br>Construction, principle of operation-theory of torque production, Types of stepping motor. | | | | |
| **Module 2** | **Permanent Magnet Brushless D.C. Motors and Permanent Magnet Synchronous Motors** | **Miniproject** | **Simulation task/ Prototype development** | **10 Sessions** |
| **Permanent Magnet Brushless D.C. Motors**<br>Construction, principle of operation ,EMF and Torque equations , Torque speed characteristics , Sensor less motors , Motion control<br>**Permanent Magnet Synchronous Motors**<br>Construction, Principle of operation , EMF and torque equations, Starting, Rotor configurations, Dynamic model | | | | |

**Targeted Application & Tools that can be used:**

- The course subject finds it application in many major areas of technologies like **Locomotives, Elevators, Excavators, Steel Mills, robotic applications, Rolling Mills and many more.**

**Text Book**

1. Dr. P.S. Bhimbra, 'Electrical Machinery', Khanna Publications, 7th Edition, 2007.
2. VenkataRatnam K, Special Electrical Machines, CRC Press, 2009.

**References**


1. Arthur Eugene Fitzgerald and Charles Kingsley, 'Electric Machinery', Tata McGraw Hill Education Publications, 6 th Edition, 2002.
2. Vincent Del Toro, 'Electrical Engineering Fundamentals', 2nd Edition, Prentice hall Publications, 2003.
3. Parkar Smith, N.N., 'Problems in Electrical Engineering', 9th Edition, CBS Publishers and Distributers, 1984.
4. Kenjo, T., and Sugawara, A., Stepping Motors and their Microprocessor Controls, Oxford Science Publications, 1984.
5. Miller, T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Oxford Science Publications, 1989


**Online learning resources:**

1. Case study: chrome extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ijarcce.com/upload/2016/may-16/IJARCCE%20246.pdf
2. Ebook: https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp
3. newsearch=true&queryText=Digital%20signal%20processing%20applications.
4. https://nptel.ac.in/courses/108/102/108102156/
5. https://www.youtube.com/watch?v=DMDTkXeFkb8

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| 6. Case study: https://www.researchgate.net/publication/342360681_Economic_Benefits_of_Energy-Efficient_Electrical_Machines_A_Case_Study | |
| **Topics relevant to "SKILL DEVELOPMENT" :** DC Motor control and Operation of PMSM at various load conditions for **Skill Development through Problem Solving methodologies.** This is attained through assessment component mentioned in course handout. | |
| **Catalogue prepared by** | Dr Joshi Manohar |
| **Recommended by the Board of Studies on** | |
| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2504** | **Course Title: AC Machines**<br>**Type of Course: Program Core and Theory only** | **L- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | Basics of Electrical Engineering, Electrical Circuit Analysis, and Electromagnetic Fields | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This course provides the basics of AC machinery fundamentals and machine parts and helps to gain the skills for controlling AC machines. It highlights the use of mathematical tools for analyzing the performance of machines. The course also inculcates the ability to analyze the performance of Induction and Synchronous Machines in industrial and domestic applications. Mini project and Assignments enhancethe ability to visualize the real-world applications using tools like MATLAB/Simulink, Caspoc software, etc. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of AC machines and attain **Skill Development** through **Problem Solving methodologies**. | | | | | |
| **Course Out Comes** | On successful completion of the course, the students shall be able to:<br>1. Analyze single & three-phase transformers and their performance through testing.<br>2. Analyze the performance of the single & three-phase induction motors using the phasor diagrams and equivalent circuits.<br>3. Examine the operation of the synchronous generator & analyze its performance characteristics.<br>4. Explain the principle of operation of synchronous motors. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Transformers | Assignment | Study of transformers used in substations | **13 Sessions** | | |
| Topics: | | | | | | |

**Single-phase transformers:** working principle, types, constructional details, EMF equation, operation on no load and on load, phasor diagrams, and applications, equivalent circuit, losses and efficiency, tests on transformer, All day efficiency.
**Poly-phase transformers:** Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Scott connection and Applications.

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| **Module 2** | Induction motors | Industrial Visit | Study of motors used in various sections of the industry | **13 Sessions** |

Topics:
**Poly-phase induction motors:** construction, principle and types, no-load and load characteristics, no-load and blocked rotor test, equivalent circuit, circle diagram, starting and speed control methods.
**Single-phase induction motors:** construction, principle and types, double-revolving field theory, equivalent circuit.

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| **Module 3** | Synchronous generators | Industrial visit | Study of alternators used in various power generation plants | **10Sessions** |

Topics: construction, principle and types, armature reaction, load characteristics, voltage regulation, two-reaction theory, parallel operation.

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| **Module 4** | **S**ynchronous motors | Assignment | Industrial applications of synchronous motor | **09 Sessions** |

Topics: principle of operation, synchronous machines on infinite bus bars, phasor diagram,V and inverted-V curves, hunting and its suppression, starting methods.

**Targeted Application & Tools that can be used:**
The course subject finds its application in many major areas of technologies like power generation, transmission and distribution sectors, motion control equipment, medical instruments, automobiles, and many more.

**Text Book**

1. Dr. P.S. Bhimbra, 'Electrical Machinery', Khanna Publications, 7th Edition, 2007.
2. Nagrath, I.J. and Kothari, D.P., 'Electrical Machines', Tata McGraw Hill Education Private Limited Publishing Company Ltd., 4th Edition, 2010.

**References**

1. J. B. Gupta, 'Theory & Performance of Electrical Machines', S.K. Kataria & Sons, 15th 2015 edition, 2024.
2. Arthur Eugene Fitzgerald and Charles Kingsley, 'Electric Machinery', Tata McGraw Hill Education Publications, 6th Edition, 2002.
3. Miller, T.J.E., 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
4. Parkar Smith, N.N., 'Problems in Electrical Engineering', CBS Publishers and Distributers, 9th Edition, 1984
5. M. G. Say, 'Performance and Design of Alternating Current Machines', CBS Publishers & Distributors Pvt. Ltd., New Delhi, 3rd Edition, 2002.

**Online learning resources**

1. https://presiuniv.knimbus.com/user#/home
2. https://onlinecourses.nptel.ac.in/noc25_ee27/preview
3. https://z-lib.gs/book/3496322/3715c3/electrical-machines-fundamentals-of-electromechanical-energy-conversion.html?dsource=recommend
4. https://www.youtube.com/playlist?list=PLp6ek2hDcoNCANsWM2mw3qi0387BhfLyV

**Topics relevant to development of "SKILL DEVELOPMENT":**Performing the testing on AC machines and analyzing their performance for**Skill Development**through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course hand-out.
**Topics relevant to "ENVIRONMENT & SUSTAINABILITY":**Operation of the transformer, induction motor, and synchronous machines.

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| **Catalogue prepared by** | **Dr. Markala Karthik** |
| **Recommended by the Board of Studies on** | |
| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| Course Code: EEE2505 | Course Title: Op-amps and Linear Integrated Circuits<br>Type of Course: Professional Core and Theory only | L-T- P- C | 3 | 0 | 0 | 3 |
| Version No. | 2.0 | | | | | |
| Course Pre-requisites | EEE2500- Electric Circuit Analysis , EEE2009-Analog Electronics circuits | | | | | |
| Anti-requisites | NIL | | | | | |
| Course Description | This course provides the basics knowledge of Linear ICs such as Op-amp, Regulators and Timers. It highlights the use of mathematical tools for analysis of such circuits and devices. The project assignment helps to validate the concepts taught in theory as well as to enhances the ability to visualize the real-world problems to provide a solution using various simulation tools like Ps spice, Multisim etc. | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Op-amps and Linear Integrated Circuits and attain Skill Development through Experiential Learning techniques. | | | | | |
| Course Outcomes | On successful completion of this course the students shall be able to:<br>1. Explain the block diagram and characteristics of OP-AMPs.<br>2. Classify linear and nonlinear applications of OP-AMPs.<br>3. Calculate the values of circuit components used for building various signal generators and multivariates.<br>4. Demonstrate the working of A/D & D/A converters and the function of application specific ICs such as Voltage regulators.<br>5. Interpret the practical experiment results with theoretical concepts of OP-AMPs | | | | | |
| Course content: | | | | | | |
| Module 1 | Introduction to Op-amps | Assignment | Data collection and analysis task(data sheet parameters) | 12 Sessions | | |
| Operational amplifiers: Introduction, Block diagram representation of a typical Op-amp, Schematic symbol, Characteristics of an Op-amp, Ideal op-amp, Equivalent circuit, Ideal voltage transfer curve, Open loop configuration, Differential amplifier, Inverting & non – inverting amplifier. | | | | | | |
| Module 2 | Applications of op-amps | Assignment | Simulation based tasks | 12 Sessions | | |
| General Linear Applications: concept of virtual ground, Inverting and Non-inverting Amplifiers, Summing amplifiers, Difference amplifiers, Differentiator, Integrator<br>Active filters: First & Second order high pass & low pass Butterworth filters<br>Non Linear Applications: Precision Half Wave and Full wave rectifiers | | | | | | |
| Module 3 | Waveform generators & 555 timer circuits | Mini Project | Hands on project using op-amps/555 timer | 9 Sessions | | |
| Comparators & Converters: Basic comparator, Zero crossing detector, Inverting & noninverting Schmitt trigger circuit<br>Signal generators: Triangular / rectangular wave generator, RC Phase shift oscillator. | | | | | | |

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| IC 555 Timer: 555 Timer Functional block diagram and description, Monostable operation, Applications | | | | |
| Module 4 | Voltage regulators & converters | Assignment | Data collection based assignments | 12 Sessions |
| Voltage regulator IC's: Basics of Voltage Regulators, Line regulation, Load Regulation, Ripple rejection, Adjustable voltage regulators using LM317<br>D & D/A Converters: Basics, Analysis of binary weighted DAC 3bit, Analysis of 3 bit R-2R DAC, successive approximation ADC, Flash ADC. | | | | |
| Targeted Application & Tools that can be used:<br>Application Area includes: Consumer and industrial devices, Industrial instrumentation, Communication and Signal processing circuits, Space and defense applications<br>Professionally Used Software: Ps- spice/Multisim/Matlab | | | | |
| Textbooks<br>1. Gayakwad Ramakant A. "Op-Amps and Linear Integrated Circuits", 4th edition, Pearson.<br>2. David A Bell,"Operational Amplifiers and Linear ICs", 3rd edition, PHI. | | | | |
| References<br>1. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", New Age International, New Delhi, 2010<br>2. B. Somanthan Nair, "Linear Integrated Circuits; Analysis, Design and Applications", Wiley India 2013<br>3. Maheshwari L. K. and Anand M. M. S., "Analog Electronics", PHI<br><br>Online resources:<br>1. https://nptel.ac.in/courses/108/108/108108111/<br>2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/lecture-20/<br>3. case study: https://assignmentpoint.com/case-study-operational-amplifier/<br>4. https://presiuniv.knimbus.com/user#/home | | | | |
| Topics relevant to "SKILL DEVELOPMENT": All the experiments which are listed are for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in Course Plan. | | | | |
| Catalogue prepared by | Ms. Ragasudha C P | | | |
| Recommended by the Board of Studies on | BoS No: 15th BoS held on 27/07/2022 | | | |
| Date of Approval by the Academic Council | 18th Academic Council meeting dated 03/08/2022 | | | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2506** | **Course Title: Microprocessor and Microcontrollers**<br>**Type of Course: Program Core and Theory** | **L-T- P- C** | **3** | **0** | 0 | **3** |
| **Version No.** | **3.0** | | | | | |
| **Course Pre-requisites** | EEE2015:Digital Electronics | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | The course introduces the microcontrollers' architecture, programming, interfacing and as well as their applications. The course requires the fundamental understanding of digital circuits and Assembly and C programming. The course extends the experimental understanding of the same which enables the students to develop programming and interfacing skills. | | | | | |

<table>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Microprocessor and Microcontrollers and attain SKILL DEVELOPMENT through Participative Learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:<br>1. Describe the architectural features of microprocessors and microcontrollers.<br>2. Explain the addressing modes, instruction set and I/O port programming of microcontroller.<br>3. Explain the programming and Interfacing of peripheral devices with microcontroller.<br>4. Summarize the various timers/ counter operations.<br>5. Outline the interfacing of the microcontroller experimentally to control the various applications.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Microprocessor and Microcontroller</td><td>Assignment</td><td>Data Analysis</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics: Introduction to microprocessor and microcontroller, Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.</td></tr>
<tr><td>Module 2</td><td>8051 Instruction Set</td><td>Assignment</td><td>Programming</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, and Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.</td></tr>
<tr><td>Module 3</td><td>8051 Stack, I/O Port Interfacing and Programming</td><td>Assignment</td><td>Programming</td><td>8 Sessions</td></tr>
<tr><td colspan="5">Topics: 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops.</td></tr>
<tr><td>Module 4</td><td>8051 Timers and Serial Port</td><td>Assignment</td><td>Programming</td><td>8 Sessions</td></tr>
<tr><td colspan="5">Topics: 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. 8051 Serial Communication-</td></tr>
<tr><td>Module 5</td><td>8051 Interrupts and Interfacing Applications</td><td>Assignment</td><td>Programming</td><td>8 Sessions</td></tr>
<tr><td colspan="5">Topics: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:<br>The course subject finds it application in many major areas of technologies like Consumer Electronics Products, Instrumentation and Process Control, equipment, Medical Instruments, Communication, Multimedia Application, Automobiles and many more.<br>The tools that are used in this course are 8051 programming and interfacing Kit, interfacing devices, PIC microcontroller kit.</td></tr>
<tr><td colspan="5">Text Book<br>1.M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, “The 8051Microcontroller and Embedded Systems: Using Assembly and C”,Pearson Education, 2007.<br>2.K. J. Ayala, “8051 Microcontroller”, Delmar Cengage Learning, 2004.</td></tr>
<tr><td colspan="5">References<br>1.D. V. Hall, “Microprocessors & Interfacing”, McGraw Hill Higher Education, 1991.<br>2.R. S. Gaonkar, “, Microprocessor Architecture: Programming and Applications with the 8085”, Penram International Publishing, 1996</td></tr>
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| 3. Raj Kamal ,"Microcontrollers: Architecture, Programming, Interfacing and System Design " Pearson 1st Edition, 2012<br>4. Datasheets of microcontrollers<br>**Online learning resources:**<br>1. EBook:https://presiuniv.knimbus.com/user#/home<br>2. Seminar:https://www.electronicsforu.com/resources/difference-between-microprocessor-and-microcontroller<br>3. Case Study: https://microcontroller.com/<br>4. https://www.pdfdrive.com/the-8051-microcontroller-and-embedded-e952238.html |
| **Topics relevant to 'SKILL DEVELOPMENT':** Definition of embedded systems and their characteristics, the role of microcontrollers in embedded systems and Programming.<br>Topics relevant to 'ENVIRONMENT AND SUSTAINABILITY': 8051 timers and counters – operation and assembly language programming to generate a pulse using Mode 1 and a square wave using Mode 2 on a port pin. 8051 serial communication." |

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| **Catalogue prepared by** | Dr. Ravi V Angadi |
| **Recommended by the Board of Studies on** | BoS No: _____ BoS held on _____ |
| **Date of Approval by the Academic Council** | XX$^{th}$ Academic Council Meeting No_____., Dated _____ |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2507** | **Course Title: Control Systems Engineering**<br>**Type of Course: Program core and Theory only** | **L-T-P- C** | 3 | 1 | 0 | 4 |
| **Version No.** | 3.0 | | | | | |
| **Course Pre-requisites** | EEE2501: Signals and Systems | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The purpose of this course is to explore the importance of control system engineering and to develop the basic abilities of modelling and analyzing the control system. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming and simulation abilities through assignments | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Control Systems Engineering and attain **Skill Development** through **Problem Solving** methodologies | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1]Interpret the transfer function for a variety of Electrical, Mechanical, Electromechanical systems using Signal Flow graphs.<br>2] Summarize the time domain specifications for various test input signals and stability conditions based on zeros and poles of transfer function.<br>3] Apply different stability analysis techniques in time domain and frequency domain to know the nature of stability of the system.<br>4] Apply the compensation networks to improve the stability.<br>5] Explain about the controllability and observability of the given state model | | | | | |
| **Course Content:** | | | | | | |

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| **Module 1** | System Components and their representation | Assignment | | **10L+ 4T Sessions** |
| Topics:<br>Introduction to control systems, mathematical models of physical systems-differential equations of physical systems, Mechanical systems, Electrical systems,Block diagrams and signal flow graphs. | | | | |
| **Module 2** | Time Response Analysis | Assignment, Quiz | Programming / Simulation | **10L+ 4T Sessions** |
| Topics:<br>Unit step response of first and second order system, time response specifications, time response specifications of second order systems, steady state errors and error constants. | | | | |
| **Module 3** | Stability Analysis | Simulation | Programming | **11L+ 4T Sessions** |
| Topics:<br>Concept of stability, Routh stability criterion, Root locus concept-rules for sketching root locus, Introduction, Frequency domain specifications -Bode diagrams, Stability Analysis from Bode Plots, Concept of relative stability. Introduction to Nyquist stability criteria | | | | |
| **Module 4** | Compensation Techniques | Case study | Simulation | **4 Sessions** |
| Topics:<br>Lead, Lag, lead-lag compensating networks | | | | |
| **Module 5** | State space model | Assignment | Simulation | **10L+3T Sessions** |
| Concept of State, State variables & State model, Concepts of controllability and observability. | | | | |

**Targeted Application & Tools that can be used:**

Control Systems are used in domestic applications, traffic light control, general industry, military and virtually every modern vehicle in the world, robotics. Modern industrial plants utilized robots for manufacturing temperature controls, pressure controls, speed controls, position controls, etc. In chemical process, control field is an area where automations play an important role.

Professionally used tools: MATLAB/Simulink, Scilab, Octave.

**Project work/Assignment: Mention the Type of Project /Assignment proposed for this course**

**Assignment:**

1. Modeling of a second order system: Construct a Simulink diagram to calculate the response of the Mass-Spring system. The input force increases from 0 to 8 N at t = 1 s. The parameter values are M = 2 kg, K= 16 N/m, and B =4 N.s/m.
2. Using an m-file script, determine the close-loop transfer function of a given control system.
3. Identifying the system stability using Root locus technique by executing a programming code.
4. Open loop and closed loop time response of a second order system with different test inputs in MATLAB.
5. Using an m-file script, analyze the Frequency response of a system using Bode plot.
6. Implementation of controller (P/PI/PID) using aurdino.

**Text Book**

[1]. Nagrath I. J. and M. Gopal, Control Systems Engineering, New Age International (P) Ltd, 5th ed, 2007.

[2]. K. Ogata, 'Modern Control Engineering', Pearson Education Asia / PHI, 4th Edition.

**References**

[1] Benjamin Kuo, 'Automatic Control Systems', PHI, 7th Edition.

[2] Hasan Saeed, automatic control Systems with MATLAB programs, S K Kataria and sons, Latest ed.

**Online Learning Resources:**

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| 1. Ebook:https://presiuniv.knimbus.com/user#/home<br>2. Case study: https://people.disim.univaq.it/~costanzo.manes/Didattica_Teoria_dei_Sistemi/System_Theory_Web_Resources.html<br>3. https://nptel.ac.in/courses/107/106/107106081/ | |
| **Topics relevant to "SKILL DEVELOPMENT":** Mathematical modelling, Stability analysis, Compensators **Skill Development** through **Problem Solving methodologies.** This is attained through assessment component mentioned in course handout. | |
| **Catalogue prepared by** | Mr. K Sreekanth Reddy<br>Mr. Ravi V Angadi |
| **Recommended by the Board of Studies on** | BoS No: 17th BoS held on 06/7/2023 |
| **Date of Approval by the Academic Council** | 21stAcademic Council meeting dated 06/09/2023 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2508** | **Course Title: Electrical and Electronics Measurements and Instrumentation**<br>**Type of Course: Program Core and Theory only** | **L- T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | **2.0** | | | | | |
| **Course Pre-requisites** | Fundamentals of various electrical elements, components and its characteristics, Basics of Digital and Analog devices. | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This course provides an introduction to the principles, tools, and techniques used in electrical and electronics measurements. The course focuses on the measurement of electrical and electronic quantities, as well as the instrumentation used to acquire and process these measurements. Students will learn how to effectively use a variety of measuring instruments and understand their limitations, accuracy, and precision in practical applications. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Electrical and Electronics Measurements and Instrumentation laboratory and attain **Skill Development** through **Experiential Learning techniques** | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1.Describe the importance of measurement systems in industries<br>2.Explain different types of measuring instruments, their construction, operation and characteristics.<br>3.Distinguish the instruments suitable for typical measurements.<br>4.Apply the knowledge about transducers and Instrument transformers to use them effectively. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Concepts of Measurements | Quiz | Data Analysis task | 08 Sessions | | |

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| | and its statistical Analysis | | | |
| Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration - Principle and types of analog and digital voltmeters, ammeters. | | | | |
| **Module 2** | Functional concepts of various Electromechanical Instruments & Characteristics | Group Discussion | Data Collection | 08 Sessions |
| Galvanometers, DC Ammeter and DC voltmeter -Permanent Magnet moving Coil Instrument-Moving iron instrument, EMMC instrument-Multi range ammeter and voltmeter-Calibration - Bridges for computation of R,L and C, Q factor. | | | | |
| **Module 3** | Electrical and Electronic Instruments | Assignment | Programming Task | 08 Sessions |
| Cathode Ray oscilloscope (CRO)-Digital Storage oscilloscope(DSO)-Digital Voltmeter (DVM)-Digital Multimeter (DMM)-Construction and characteristics of Current Transformers and Potential Transformers. Construction and working of energy meters, Trivector meters, Bi-directional Energy meters. | | | | |
| **Module 4** | Transducers and Data Acquisition systems | Assignment | Data Collection and Analysis | 08 Sessions |
| Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Function Generators, Spectral and Harmonic Distortion analyzers, Smart sensors and Telemetry. | | | | |
| **Targeted Application & Tools that can be used:**<br>Power System Load flow studies, protection and stability for real time test systems. Professionally Used Software: LabVIEW, MATLAB & Simulink | | | | |
| **Text Book**<br>1. A. K. Sawhney, "Electronics and Electrical Measurements", Dhanpat Rai& Sons. | | | | |
| **References**<br>1. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill.<br>2. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press / PHI.<br>**online learning resources**<br>1.https://nptel.ac.in/courses/108/105/108105153/<br>2.https://www.youtube.com/watch?v=xLjk5DrScEU&list=PLt5syl71JKf0IacRzLI-02Q_udP4nJiJg<br>3. https://www.researchgate.net/figure/Results-of-1-kHz-electrical-measurements-on-case-study-core-plugs-using-reservoir-brine_tbl2_264898895<br>4.https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d2706929%26site%3dehost-live | | | | |
| **Topics relevant to development of "SKILL DEVELOPMENT":** Construction and working of energy meters, Trivector meters, Bi-directional Energy meters**Skill Development**through **Experiential Learning techniques**. This is attained through assessment component mentioned in course hand-out. | | | | |
| **Catalogue prepared by** | **Mr. Bishakh Paul** | | | |
| **Recommended by the Board of Studies on** | | | | |

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| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| Course Code: EEE2509 | Course Title: Transmission and Distribution<br>Type of Course: Professional Core& Theory only | L-T- P-C | 3 | 1 | 0 | 4 |
| Version No. | 2.0 | | | | | |
| Course Pre-requisites | EEE1007 (Basics of Electrical and Electronics Engineering), EEE2500 (Electrical Circuit Analysis) | | | | | |
| Anti-requisites | Nil | | | | | |
| Course Description | This course covers power transmission and distribution. This course covers common transmission and distribution systems; line parameters including inductances and capacitances; overhead line performance studies; and regulation and efficiency calculations using comparable models. The course also teaches modelling and evaluating transmission and distribution systems; mechanical transmission line design; and sag/tension calculations and stringing charts. The course improves analysis. Assignments employing Mi Power/ETAP/MATLAB/PSCADA/Power World Simulator/PSSE improve programming skills. | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of power transmission and distribution and attain **Skill Development** through **Problem Solvingmethodologies.** | | | | | |
| Course Out Comes | On successful completion of the course the students shall be able to:<br>1. Explain the basic structure of Transmission and Distribution System.<br>2. Solve the numerical examples of computation of performance of a transmission line.<br>3. Summarize the several of types Insulators and the concept of Corona.<br>4. Explain the use of Under Ground Cables for Power Transmission.<br>5. Summaries different distributions systems. | | | | | |
| Course Content: | | | | | | |
| Module 1 | Introduction to Power System | Assignment | Data Collection | 5L+1T Sessions | | |
| Topics: Structure of the power system- generation, transmission and distribution, Types of AC and DC distributors, Basic Aspects of AC Power Transmission, Concepts of Power in AC Transmission Systems. Advantages of higher voltage transmission. | | | | | | |
| Module 2 | Transmission Line Parameters | Assignment | Programming | 10L+4T Sessions | | |
| Topics: Introduction to line parameters- resistance, inductance and capacitance. Basic Concepts of Computation of Line Inductances and various types of line configurations, Concepts of Computation of Line Capacitance and various types of line configurations. Skin effect, Conductor Types, bundled Conductors. | | | | | | |
| Module 3 | Transmission Line Performance Analysis | Assignment | Simulation | 9L+3T Sessions | | |
| Topics: Introduction, Classification of lines, Short Transmission lines Modeling, Medium Transmission Line Modeling, ABCD constants of transmission lines and Numerical Examples on Performance of Transmission Lines. | | | | | | |
| Module 4 | Overhead Transmission Lines | Assignment/Case Study | Programming/Simulation/Data Collection/ | 10L+4T Sessions | | |
| Topics: Overhead Transmission Lines: Introduction, Types of supporting structures and line conductors used. Sag calculation- supports at same level and at different levels. Effect of wind and ice, Sag at erection, Stringing chart. Over Head Insulator: Introduction, Insulator Materials, Types of Insulators, Potential Distribution over a string of suspension insulator, String Efficiency and methods of Increasing string efficiency, Corona: Phenomena of Corona, Disruptive and visual critical voltages, Power Loss due to Corona, Factors affecting Corona Loss & Aspects of Corona on Real Life AC Transmission. | | | | | | |
| Module 5 | Introduction to Distribution System | Assignment/Case Study | Data Collection | 10L+4T Sessions | | |

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| Introduction, Classifications of distribution system- A.C and D. C Systems, Connection Schemes of Distribution System, Requirements of a Distribution System and Design Considerations in Distribution System. Computation of voltage drop and power loss in the feeder line for different configurations and numerical examples. |
| Targeted Application & Tools that can be used:<br>Application Area is Power System Data collection, Electricity Transmission and Distributed companies, Power Grid and State Electricity Boards. Professionally Used Software: Mi Power/ ETAP/ MATLAB/PSCADA/Power World Simulator/PSSE. |
| Text Book<br>1. A. Chakrabarti, M.L. Soni and P.V. Gupta, "Power System Engineering", Dhanpat Rai and Co. New Delhi. |
| References<br>1. S. N. Singh, "Electrical Power Generation, Transmission and Distribution", PHI<br>2. D.P. Kothari, I.J. Nagrath, "Modern Power System Analysis", TMH<br>3. V.K.Mehta, Rohit Mehta "Principles of Power System", S. Chand Publishers.<br>4. IEEE 1863-2019 - IEEE Guide for Overhead AC Transmission Line Design |
| Online Resources:<br>1. EBook: https://puniversity.informaticsglobal.com/<br>2. Seminar: https://nptel.ac.in/courses/108/102/108102047/<br>3. Case Study: http://www.digimat.in/nptel/courses/video/108102047/L01.html<br>4. https://www.youtube.com/watch?v=Od0k9nqtoCM (Underground Cable Laying-by Power Sector Skill Council)<br>5. https://www.youtube.com/watch?v=Z2cELqtxysA (Overhead Line erection- by Power Sector Skill Council)<br>6. https://www.youtube.com/watch?v=LPN1NZBz810 (Conductor Sag Demonstration- by Power Sector Skill Council)) |
| Topics relevant to "SKILL DEVELOPMENT": Various types Transmission line Modelling and applications of various transmission lines for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in Course Plan.<br>Topics related to development of "HUMAN VALUES and PROFESSIONAL ETHICS" : Concepts of Economical Conductor Size in a Cable &Permissible Current Loading of cable as an assignment. |

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| Catalogue prepared by | Mr. Ravi V Angadi. |
| Recommended by the Board of Studies on | BoS No: 15th BoS held on 27/7/22 |
| Date of Approval by the Academic Council | 18th Academic Council Meeting held on 03/08/22 |

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| **Course Code: EEE2510** | **Course Title: Electrical Power Generation and Economics.**<br>**Type of Course: Program Core & Theory only** | **L- T- P- C** | 2 | 0 | 0 | 2 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE1007 (Basics of Electrical and Electronics Engineering). | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This course covers the principles of electrical power generation concepts and phenomenon of different sources of Power Generation. Elaborate discussion on Site Selection factors, Working, Plant layout, Power equations, etc. of various power plants like Hydroelectric, Thermal, Nuclear, Renewable energy sources etc. and the power generation economic factors, different tariff methods and consumption of electrical energy. It aims to equip students with the knowledge required to understand the technical and economic aspects of power systems, aligning with current industrial requirements. The course improves analysis. Assignments employing Mi Power/ ETAP/ MATLAB/ PSCADA/Power World Simulator/PSSE improve programming skills. | | | | | |

<table>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Electrical Power Generation and Economics and attain Skill Development through PARTICIPATIVE LEARNING methodologies.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:<br>1. Explain the basic principles of electrical energy generation from different sources.<br>2. Describe the operational mechanisms and benefits of each power generation source, such as hydro, thermal, solar and wind power plant.<br>3. Apply the definitions of economic terms to solve problems related to system operation and performance.<br>4. Solve numerical examples involving the cost of generating stations and appropriate tariff for different types of consumers.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction & Sources of Electric Power generation</td><td>Assignment</td><td>Data Collection</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics:(a). Introduction & Sources of Electric Power generation: Introduction to electrical energy generation and sources like Hydel, Thermal, Nuclear, Solar, Wind, Fuel Cell, Tidal, Gas and etc.<br>(b). Hydro Power Generation: Selection of Site, Classification of Hydro Electric Power Plant, Arrangement of Hydro Electric Power Plant, Operation of Hydro Electric Power Plant, Hydro Electric Power Plant Structure & Control.</td></tr>
<tr><td>Module 2</td><td>Thermal Power Generation</td><td>Assignment/ Case Study</td><td>Analysis of real-world power generation projects</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics: (a). Thermal Power Generation: Introduction, Selection of Site, Main parts of a thermal plant, working, Plant Layout.<br>(b) Nuclear Power Station: Introduction, Pros & Cons of Nuclear Power Generation, Selection of Site & Cost, Main parts of a nuclear power plant working, Plant Layout.</td></tr>
<tr><td>Module 3</td><td>Solar and Wind Power Generation</td><td>Assignment</td><td>Programming/Simulation</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics: (a). Solar Power plant: Introduction, Selection of Site, Main parts of a solar plant, working, Plant Layout. Advantages and disadvantages.<br>(b). Wind Power Plant: Introduction, Selection of Site, Main parts of a wind power plant, working, Plant Layout. Advantages and disadvantages. .</td></tr>
<tr><td>Module 4</td><td>Economic Aspects and Electric Power Tariff</td><td>Assignment/Case Study</td><td>Programming/Simulation/Data Collection/</td><td>8 Sessions</td></tr>
<tr><td colspan="5">Topics: (a). Economic Aspects: Introduction, Terms commonly used in System Operation, Diversity factor, Load factor, Plant Capacity factor, Definition & Problems, Plant use factor, Plant Utilization factor, Loss factor & Load duration curve, Numerical examples.<br>Topics: (b). Electric Power Tariff: Cost of Generating Station, factors influencing the rate of tariff designing. Tariff, Types of Tariff, Numerical Examples.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:<br>Application Area is Power System Data collection, Electricity Power Generation companies, Power Grid and State Electricity Boards. Professionally Used Software: Mi Power/ ETAP/ MATLAB/PSCADA/Power World Simulator/PSSE.</td></tr>
<tr><td colspan="5">Text Book<br>1. A. Chakrabarti, M.L. Soni and P.V. Gupta, “Power System Engineering”, Dhanpat Rai and Co. New Delhi.</td></tr>
</table>

**References**


1. Geoffrey S. Rothwell and Tomas Gomez, "Electricity Economics: Production Functions with Electricity", Wiley Publisher.
2. Allen J. Wood and Bruce F. Wollenberg, "Power Generation, Operation, and Control", Wiley Publisher.
3. Godfrey Boyle, "Renewable Energy: Power for a Sustainable Future", Oxford University Press.
4. S. N. Singh, "Electrical Power Generation, Transmission and Distribution", PHI
5. D.P. Kothari, I.J. Nagrath, "Modern Power System Analysis", TMH
6. V.K.Mehta, Rohit Mehta "Principles of Power System", S. Chand Publishers.


**Online Resources:**

1. Book: https://presiuniv.knimbus.com/user#/home
2. Seminar: https://nptel.ac.in/courses/108/102/108102047/
3. Case Study: http://www.digimat.in/nptel/courses/video/108102047/L01.html
4. http://www.eols.net/sample-chapters/c05/6-39a-06-02.pdf
5. https://www.youtube.com/watch?v=Od0k9nqtoCM

Topics relevant to "SKILL DEVELOPMENT": Various types of power generating station working and constructional features, Load curve and load duration curve for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course plan.

**Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS":** Concepts of economics of power generation as an assignment.

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| **Catalogue prepared by** | Dr. Ravi V Angadi. |
| **Recommended by the Board of Studies on** | BoS No: 19thBoS held on 03/07/2024 |
| **Date of Approval by the Academic Council** | 24th Academic Council Meeting held on 16/07/2024 |

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|---|---|---|---|---|---|---|
| Course Code: EEE2511 | Course Title: Power Electronics<br>Type of Course: Professional Core Theory only | L-T- P-C | 3 | 0 | 0 | 3 |
| Version No. | 2.0 | | | | | |
| Course Pre-requisites | EEE2500 Electric Circuit Analysis | | | | | |
| Anti-requisites | NIL | | | | | |
| Course Description | This course is a very important and fundamental course for the conversion, control and monitoring of electric energy using power converters. The course uses the fundamentals of mathematics, modelling and software tools and enhance the process of learning. The course is both conceptual and analytical in nature and imparts the basic skills of developing the Simulink models, Programming and hardware interfacing through assignments and mini projects. | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Power Electronics and attain Skill Development through Problem Solving methodologies. | | | | | |
| Course Outcomes | On successful completion of this course the students shall be able to:<br>1) Select the suitable semiconductor switching device in the design of power converters | | | | | |

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| | 2) Apply the phase-controlled technique in control of AC-DC converters with different loads<br>3) Demonstrate the operation of Choppers and AC Voltage controllers<br>4) Explain the operation and control of Inverters | | | |
| Course Content: | | | | |
| Module 1 | Power Semiconductor Switching Devices | Assignment | Data sheet collection and Analysis task | 10Sessions |
| Topics: Silicon Controlled Rectifiers (SCR's) - BJT - Power MOSFET - Power IGBTs - Basic theory of operation of SCR – Static and Dynamic characteristics of SCR -Salient points. Two transistor analogy of SCR –Firing circuits of SCR –Numerical problems | | | | |
| Module 2 | Phase Controlled Rectifiers (AC-DC controllers) | Hands on Task | Simulation and Arduino based controller for 12V dc motor | 10 Sessions |
| Topics: Phase control technique - Single phase and three phase Line commutated converters - Half wave and fully controlled converters with different loads. Average load voltage and current- Numerical Problems. | | | | |
| Module 3 | Choppers and AC Voltage Regulators | Assignment | Development of Simulink model and Analysis | 15 Sessions |
| Choppers: Time ratio control and Current limit control strategies – Step up and step down choppers- Load voltage and currents different loads-Numerical problems<br>Switch Mode Power Converters: Basics of switch mode converters- Buck converter, Boost converter -Buck-Boost converters<br>AC Voltage Controllers: AC voltage controllers – Single phase two SCR's in anti-parallel with R and RL loads - RMS load voltage, current and power factor- wave forms , Numerical problems,<br>Cycloconverters: Introduction to Cycloconverters- Types of cycloconverters-working-Applications of Cycloconverters | | | | |
| Module 4 | Inverters(DC-AC converters) | Assignment | Simulation using Scilab and Analysis | 10 Sessions |
| Inverters – Single phase inverter – bridge inverter, 3 phase inverter – Waveforms, Voltage control techniques for inverters- Pulse width modulation techniques – Numerical problems. | | | | |
| Targeted Application & Tools that can be used:<br>The application of power electronic converters in the fields of sustainable energy technologies such as wind energy, solar power, wave energy, and fuel cells are described. Furthermore, industrial applications like electric drives, Electric Vehicles and induction heating as well as application of power electronics for power transmission, harmonics control and voltage stability issues.<br>Professionally Used Software: MATLAB/PSIM/Scilab | | | | |
| Text Books<br>1. M.H.Rashid, "Power Electronics Power Electronics Devices, Circuits and Applications ,Fourth Edition , Pearson,2017<br>2. Dr P S Bimbhra , "Power Electronics" ,Khanna Publishers, Fifth Edition,1990<br>References<br>1. M.D. Singh and Khanchandani K.B, "Power Electronics", T.M.H. Second edition, 2017<br>Online resources<br>1. Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical Engineering,IIT Bombay. For more details on NPTEL visithttp://nptel.ac.in<br>2. https://www.pdfdrive.com/fundamentals-of-power-electronics-e5904858.html<br>3. https://ieeexplore.ieee.org/document/9545403 (case study)<br>4. https://springerplus.springeropen.com/articles/10.1186/2193-1801-2-370<br>5. https://presiuniv.knimbus.com/user#/home | | | | |

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| **Topics relevant to "SKILL DEVELOPMENT":** Fundamentals of switching devices, Control parameters to vary average and RMS value of output voltage of power converters for **Skill Development** through **Problem Solving methodologies.** This is attained through **assessment** component mentioned in Course Plan.<br>**Topics relevant to "ENVIRONMENT and SUSTAINABILITY":** Power converters and semiconductor devices. | |
| **Catalogue prepared by** | Dr Joshi Manohar V &<br>Ms. Ragasudha C P |
| **Recommended by the Board of Studies on** | BoS No: 14th BoS heldon 22/02/2022 |
| **Date of Approval by the Academic Council** | 18th Academic Council Meeting held on 03/08/2022 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3058** | **Course Title: Electrical Drives**<br>**Type of Course: Professional Core and Theory Only** | **L- T-P-C** | 3 | 1 | 0 | 4 |
| **Version No.** | **2.0** | | | | | |
| **Course Pre-requisites** | EEE2503 DC Machines and Special Machines<br>EEE2504 AC Machines<br>EEE2511 Power Electronics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The course intends to provide a basic understanding of various power converters fed electrical motordrives. It gives insight into electric drive systems to analyze the steady-state and dynamic characteristics of speed and torque characteristics of ac & dc drives used in the modern industry. The course also develops the critical thinking abilities to apply in the area of variable-speed drives and energy conservation which are used in various industrial, domestic, and traction applications. Mini projects and Assignments enhance the ability to visualize real-world applications using tools like MATLAB, caspoc software etc. | | | | | |
| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of Electrical Drives and attain **Skill Development** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes** | On successful completion of this course the students shall be able to:<br>1. Explain the dynamics of Electric Drives and multi-quadrant operation<br>2. Select the power converter in control of d.c drive systems.<br>3. Apply suitable control method in induction motor drives<br>4. Choose the proper Electric Drive system for energy conservation and industrial applications | | | | | |
| **Course Content:** | | | | | | |
| | Introduction to Electrical Drives and its dynamics | Assignment | Data collection and Data analysis task | 11L+4T Sessions | | |
| Topics: Fundamentals of Electrical Drives-Power converters used in modern electrical motor drives; analyze the steady-state and dynamic characteristics of commonly used drives in the modern industry–Multi-quadrant operation. Numerical problems. | | | | | | |

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| **Module2** | Operation & Analysis of D.C Drives | Assignment | Handson& Programming task.[Arduino based four quadrant operation of converter/ chopper fed 24V dc motor drive for food Processing industry] | 11L+ 4T Sessions |
| Topics: Single phase and three phase rectifier fed dc motor drives. Analysis of chopper fed dc motor drives-Numerical Problems. | | | | |
| **Module3** | Operation and Analysis of Induction Motor Drives | Assignment | Simulation task | 11L+ 4T Sessions |
| Topics: Control of Induction motor drives,. Stator voltage control: Variable voltage and variable frequency control, rotor resistance control, slip power recovery-Numerical Problems | | | | |
| **Module4** | Operation of Synchronous motordrives and IndustrialDrives | Assignment | Simulation task [using Caspoc software and Analysis] | 11L+ 4T Sessions |
| Topics: Synchronous motor drives, Energy efficient drives, losses in electrical drive system, Energy conservation in electric drives. Traction Drives, industrial drives – paper mills, rolling mills, textile mills, and cement mills | | | | |

**Targeted Application & Tools that can be used:** The applications are as of Electrical Drives are: Industrial operations such as in rolling mills, textile mills, cement mills, processing plants. Professionally Used Software: MATLAB/Caspoc

**Text Books**

1. G.K DUBEY, "Fundamentals of Electrical Drives", Second edition, Narosa publishing house,2001
2. W. Shepherd, L. N. Hulley and D. T. Liang, "Power Electronics and motor control", Second Edition, Cambridge University Press, 1995.

**References**

1. N.K De and P.K. Sen, "Electrical Drives", PHI.
2. S.K Pillai, "A First Course on Electric Drives", Wiley Eastern Ltd.
3. Bimal K Bose, "Modern Power Electronics and AC Drives" Pearson, 2015

**Online learning resources:**

1. noc19-ee65-lec01 - YouTube(NPTEL Video Lectures)
2. Dynamic Simulation of Electrical Machines and Drive Systems Using MATLAB GUI | IntechOpen
3. PDF⋙ Advanced Electric Drive Vehicles (Energy, Power Electronics, and Machines) –DonnamiraTTookMrs
4. www.sciencedirect.com/science/article/abs/pii/S1364032111004308
5. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live

**Topics relevant to "SKILL DEVELOPMENT":**

1. Rectifier fed DC Motor control at various torque conditions
2. Inverter fed AC Motors control at various torque conditions

For **Skill Development**through**Problem Solving methodologies**. This is attained through assessment component mentioned in Course Plan.

**Topics relevant to "ENVIRONMENT AND SUSTAINABILITY":**

Energy conservation and saving in Electrical Drives

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| **Catalogue prepared by** | Dr Joshi Manohar V |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/21 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3057** | **Course Title: Power System Analysis**<br>**Type of Course: Program Core and Theory only** | **L- T- P- C** | 3 | 1 | 0 | 4 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2509: Transmission and Distribution. | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This course introduces Representation of Power System Components, discusses Symmetrical Components, analysis of Symmetrical & Unsymmetrical Faults in the Power System. It deals with various methods to solve the power flow. It also discusses stability concept and contingency analysis. The course develops critical thinking and analytical skills. The course also enhances the programming and simulation skills through modern tools such as MATLAB, MiPower and etc., | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Power System Analysis and attain **Skill Development** through **Problem Solving methodologies**. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>5. Model the network of power system components.<br>6. Apply GS and NR methods to compute the load flow for given power system netbook.<br>7. Analyze the fault current in power system for different types of faults.<br>8. Illustrate the concept of stability of power system.<br>9. Analyse the concept of contingency of power system. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Representation of Power System Components: | Assignment | Programming/Simulation | **10L+4T Sessions** | | |
| Topics: Basic Concepts of Network Modelling of power system- Equivalent circuit of Transmission line, Transformer, Synchronous Generators, Concepts of per Unit Systems, Formation of Network Matrices. | | | | | | |
| **Module 2** | Load Flow Studies | Assignment | Programming/Simulation | **10L+4T Sessions** | | |
| Topics: Concepts of Load Flow Model, Development of Load Flow Model, and Solution of Load flow Equations, Numerical Examples, Practical Applications of Load Flow Solutions. | | | | | | |
| **Module 3** | Fault Analysis | Case Study | Programming/Simulation | **10L+4T Sessions** | | |

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| Topics: Basic Concepts of Fault Analysis in power systems, Types of Faults, Symmetrical Fault Analysis Method, Asymmetrical Fault Analysis Method, and Numerical Examples. | | | | |
| **Module 4** | Power system Stability | Case Study | Programming/Simulation | **10L+3T Sessions** |
| Topics: Basic Concepts of Power System Stability, Angle In stability, Voltage Instability, Development of Mathematical models for static and transient stability analysis and solutions. Voltage stability analysis methods. | | | | |
| **Module 5** | Introduction to Contingency Analysis | Case Study | Simulation | **5 Sessions** |
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| Topics: Concept of contingency analysis, types of contingency analysis, importance of contingency analysis power system, Case Studies. | | | | |
| **Targeted Application & Tools that can be used:** Power System Load flow studies, protection and stability for real time test systems. Professionally Used Software: Mi Power/ ETAP/ MATLAB/PSCADA/Power World Simulator/PSSE. | | | | |
| **Text Book**<br>3. A Modern Power system Analysis – by I.J.Nagrath&D.P.Kothari: Tata McGraw–Hill Publishing Company, 2nd edition.<br>4. Power System Analysis by Hadi Saadat – TMH Edition. | | | | |
| **References**<br>1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.<br>2. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.<br>3. Power System Analysis and Design by J.Duncan Glover, M.S.Sarma, T.J.Overbye – CengageLearning publications.<br>**online learning resources**<br>5. EBook:https://puniversity.informaticsglobal.com<br>6. Seminar: https://onlinecourses.nptel.ac.in/noc19_ee62/<br>7. Case Study: http://www.eolss.net/sample-chapters/c05/e6-39a-06-02.pdf.<br>8. https://www.ebookmela.co.in/download/power-system-analysis-operation-and-control-by-abhijit-chakrabarti | | | | |
| **Topics relevant to development of "SKILL DEVELOPMENT":** Performing the load flow analysis for **Skill Development** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course hand-out.<br>**Topics related to development of "HUMAN VALUES and PROFESSIONAL ETHICS":** Performing the load flow analysis as per the IEEE standards by giving case study. | | | | |
| **Catalogue prepared by** | **Mr. Ravi V Angadi** | | | |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/21 | | | |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/21 | | | |

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|---|---|---|---|---|---|---|
| Course Code: EEE2561 | Course Title: Analog and Digital Electronics Laboratory<br>Type of Course: Laboratory | L-T- P-C | 0 | 0 | 2 | 1 |
| Version No. | 1.0 | | | | | |
| Course Pre-requisites | EEE2009 Analog Electronics Circuits<br>EEE2015: Digital Electronics | | | | | |
| Anti-requisites | NIL | | | | | |

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| Course Description | The purpose of this course is to enable the students to develop the basic abilities of analysing the analog and digital circuits. The course is practical laboratory based wherein students get an opportunity to validate the concepts taught in theory and enhances the ability to visualize the real system performance. The course develops the critical thinking and analytical skills. |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Analog and Digital Electronics Laboratory experiments and attain Skill Development through Experiential Learningtechniques. |
| Basic skill sets required for the laboratory: | |
| | The students shall be able to develop:<br>1. An attitude of enquiry.<br>2. Confidence and ability to tackle new problems.<br>3. Ability to interpret events and results.<br>4. Ability to work as a leader and as a member of team.<br>5. Assess errors and eliminate them.<br>6. Observe and measure physical phenomenon.<br>7. Write Reports.<br>8. Select suitable equipment, instrument and materials.<br>9. Locate faults in systems.<br>10. Manipulative skills for setting and handling equipment.<br>11. The ability to follow standard test procedures.<br>12. An awareness of the need to observe safety precautions.<br>13. To judge magnitudes without actual measurement. |
| Course Outcomes | On successful completion of this course the students shall be able to:<br>1. Sketch the characteristics and waveforms relevant to standard electronic circuits.<br>2. Demonstrate the working of electronic circuits to obtain the V-I Characteristics.<br>3. Implement various combinational logic circuits using gates.<br>4. Construct combinational logic circuits and sequential circuits |
| Course Content: | |

List of Laboratory Tasks:

Experiment No 1: Conduct an experiment on rectifiers to determine the ripple factor and efficiency with and without filters.

Level 1: To observe the output waveform of half wave and full wave rectifier with and without filter and to compute ripple factor and efficiency.

Level 2: Verify the experimental results of half wave and full wave rectifiers using Multisim Software.

Experiment No. 2: Conduct experiment to test diode clipping and clamping circuits.

Level 1 : To construct clipping and clamping circuits for different reference voltages and to verify the theoretical response with experimental response.

Level 2 : Verify the experimental results with Simulink.

Experiment No. 3: Conduct an experiment on series voltage regulator using Zener Diode to find the regulation characteristics.

Level 1 : To Sketch characteristic curve and to compute various parameters of Zener diode

Level 2 : Select the values and comment on shunt and series resistance to maintain a constant voltage.

Experiment No. 4: Conduct on experiment to analyse the characteristics of Transistor
Level 1 : To obtain input and output characteristics of a transistor and to calculate input resistance and current gain using h parameters.

Experiment No. 5: Conduct an experiment RC Coupled Amplifier to find the frequency response
Level 1 : To analyze RC coupled amplifier and to sketch frequency response curve.

Experiment No. 6:Verify the Logic Gates truth table
Level 1: Verify basic logic gates on Digital Logic Trainer kit.
Level 2: Construct basic logic gates using universal gates and verify using Digital Logic Trainer kit

Experiment No. 7: Verify the Boolean Function and Rules
Level 1: By using Digital Logic Trainer kit
Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

Experiment No. 8: Design and Implementations of HA/FA
Level 1: By using basic logic gates and Trainer Kit
Level 2: By using Universal logic gates and Trainer Kit

Experiment No. 9:Construct and verify the HS/FS logic circuits
Level 1 :By using basic logic and XOR gates and Trainer Kit connected to input of second FF.
Level 2:By using Universal logic gates and Trainer Kit

Experiment No. 10:Study of Flip flops
Level 1: Verify the operation of SR and D Flip-Flops on Digital Logic Trainer kit
Level 2: Study of JK Flip-flop from the specifications given in the form of Truth table

Targeted Application & Tools that can be used:
Application Area is amplifying speech or music, TV broadcasting and displaying, cell phone, satellite communications, computers, remote control, home automation, traffic light control etc.,

Professionally Used Software: PSpice/ Multisim/ Logisim/ MATLAB/HDL

Text Books

1. Integrated Electronics: Analog and Digital Circuits and Systems, L/e, JaccobMillman, Christos Halkias and Chethan D. Parikh, Tata McGraw-Hill Education, India, 2nd edition, 2017.
2. Analog and Digital Electronics Laboratory Manual by Presidency University

References

1. Electronic Devices and Circuits, Jimmy J Cathey, Schaum's outline series.
2. Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, 11th Edition, Pearson Education
3. Digital Principles, 3/e, Roger L. Tokheim, Schaum's outline series.

Online resources:

6. https://presiuniv.knimbus.com:2232/cgi-bin/koha/opac-detail.pl?biblionumber=3800&query_desc=kw%2Cwrdl%3A%20Integrated%20Electronics
7. https://presiuniv.knimbus.com:2232/cgi-bin/koha/opac-detail.pl?biblionumber=8072&query_desc=kw%2Cwrdl%3A%20Electronic%20Devices%20and%20Circuits
8. https://edge.edx.org/courses/MITx/6.002x-temp/Circuits_And_Electronics/about
9. https://www.electronics-tutorials.ws/
10. https://www.academia.edu/22542562/Foundations_of_Analog_and_Digital_Electronic_Circuits

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| Topics relevant to "SKILL DEVELOPMENT":All the experiments which are listed are for Skill Development through Experiential Learning Techniques. This is attained through the assessment component mentioned in Course Plan. | |
| Catalogue prepared by Updated by | Dr.Sumit Kumar Jha |
| Recommended by the Board of Studies on | BoS No: 15thBoS held on 27/7/22 |
| Date of Approval by the Academic Council | 18th Academic Council Meeting held on 03/08/2022 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2560** | **Course Title: Signal and systems Laboratory**<br>**Type of Course: Laboratory** | **L-T-P-C** | 0 | 0 | 2 | 1 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2501 Signals and Systems | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The course aims at developing practical understanding of the generation and simulation of basic signals, using standardized environments such as MATLAB. Experiments cover fundamental concepts of basic operation on matrices, generation of various signals and sequences, operation on signals and sequences, convolution, autocorrelation and cross correlation between signals and sequences. The objective of this laboratory is to develop analytical skills and learn basic signals, and system responses. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of experiments in signals and systems laboratory and attain **Skill Development** through **Experiential Learning** techniques. | | | | | |
| **Basic skill sets required for the laboratory:** | | | | | | |
| | **The students shall be able to develop:**<br>1. An attitude of enquiry.<br>2. Confidence and ability to tackle new problems.<br>3. Ability to interpret events and results.<br>4. Ability to work as a leader and as a member of team.<br>5. Assess errors and eliminate them.<br>6. Observe and measure physical phenomenon.<br>7. Write Reports.<br>8. The ability to follow standard test procedures.<br>9. An awareness of the need to observe safety precautions.<br>10. To judge magnitudes without actual measurement. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Analyzevarioustypesofsignalsandsystems.<br>2. Validate the concept of various signals and system operations.<br>3. Understand the plotting of pole-zero in s plane and z plane.<br>4. Analyze the spectrum of signals using Fourier transform. | | | | | |

| **Course Content:** | |
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**List of Laboratory Tasks:**

**Experiment No 1:** Generations of Various Signals and sequences (periodic and Aperiodic), such as
Unit impulses, unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc.
**Level 1:** Write the MATLAB code, debug and run it to get the desired output
**Level 2:** ToAnalysethe output andtomodifythe parameters inthe code to Understandvariousconcepts (likevaryingthe amplitude or frequency) on signalgeneration.

**Experiment No 2:** Operation on Signals and sequences such as addition, Multiplication, Scaling, Shifting, Folding, Computation of energy and average power

**Level 1:** Write the MATLAB code, debug and run it to get the desired output
**Level 2:** ToAnalysethe output and to understandvariousconceptsonOperationsonsignalsand write codeformixed operations.

**Experiment No 3:** Convolution between Signals and Sequences.

**Level 1:** Write the MATLAB code, debug and run it to get the desired output (using in built commands) and sketch the output waveform.
**Level 2:** To Analyse the output and to understand various concepts of convolution and to write the code without using the in-built convolution function.

**Experiment No 4:** Verification of linearity and time invariance properties of a given continuous/discrete system.

**Level 1:** Write the MATLAB code, Debug and run it to get the desired output for given systems operations.
**Level 2:** To analyse the output and to understand various concepts of linearity and time invariance property by modifying the code and checking for different systems.

**Experiment No 5:** Computation of unit samples, unit step and sinusoidal response of the given LTI system and verifying its physical replicability and stability properties.

**Level 1:** Write the MATLAB code, Debug and run it to get the desired standard signal shapes.
**Level 2:** To Analyse the output and to understand the system response and write code for other
elementary signal response.

**Experiment No 6:** Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.

**Level 1:** Write the MATLAB code, Debug and run it to get the desired output.
**Level 2:** To Analyse the output and to find Fourier Transform for elementary signals and to verify the same theoretically.

**Experiment No 7:** Wave form synthesis using Laplace Transforms.

**Level 1:** Write the MATLAB code, Debug and run it to get the desired output for the given time-domain function.
**Level 2:** To Analyse the output and to understand various concepts by verifying problems similar to those taught in theory.

**Experiment No 8:** Locating the zeros and poles and plotting the pole-zero maps in S-plane and Z- plane for the given transfer function.

**Level 1:** Write the MATLAB code, Debug and run in to get the desired output.
**Level 2:** To Analyse the output and to understand various concepts on stability.

**Experiment No 9:** To compute auto correlation and cross correlation between signals and sequences.

**Level 1:** Write the MATLAB code, Debug and run in to get the desired output.
**Level 2:** To Analyze the correlation of various signals and measure the degree to which the two signals are similar.

**Experiment No 10:** To calculate distribution and density functions of standard random variables.

**Level 1:** Write the MATLAB code, Debug and run in to get the desired output.
**Level 2:** To Analyze the distribution and density function of standard random variables.

**Targeted Application & Tools that can be used:**
Signals and systems are a branch of electrical engineering and finds its applications in different professional fields such as audio signal processing, digital image processing, video compression, speech recognition, control systems, research and development, digital communications, digital synthesizers, radar, sonar, financial signal processing, seismology and biomedicine.
**Professionally used tools:**MATLAB / Python

**Course Material**
1. Signals and systems Lab Manual, Presidency University, Bengaluru.

**TextBooks:**
1. Signals and Systems by Alan V. Oppenhein, Alan S. Willsky and S. Hamid, 2nd edition, Pearson 2016.
2. John G. Proakis, D.G. Manolakis and D.Sharma, "Digital Signal Processing Principles, Algorithms and Applications", 4th edition, Pearson Education, 2012.

**Reference Books:**
1. B.P. Lathi, "Signals, Systems & Communications" BS Publications, 5th Reprint, 2008.
2. Nagrath I J, Sharan S N, Ranjan Rakesh & Kumar S, "Signals & Systems", TMH, 2001.
3. Oppenhiem V.A.V and Schaffer R.W, "Discrete – time Signal Processing", 3rd edition, Pearson new international edition, 2014.
4. Digital Signal Processing, P Ramesh Babu, Pearson Education.

**Onlineresources:**
1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
2. https://nptel.ac.in/courses/117/101/117101055/
3. https://www.edx.org/course/signals-and-systems-part-1
4. https://www.tutorialspoint.com/signals_and_systems/index.htm
5. https://presiuniv.knimbus.com/user#/home

**Topics relevant to "SKILL DEVELOPMENT":** All the experiments which are listed for **Skill Development** through **Experiential Learning Techniques**. This is attained through assessment component mentioned in Course Plan.

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| **Catalogue prepared by** | Dr. Sumit Kumar Jha |
| **Recommended by the Board of Studies on** | BoS No: 15th BoS held on 27/7/22 |
| **Date of Approval by the Academic Council** | 18th Academic Council Meeting held on 03/08/22 |

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|---|---|---|---|---|---|---|
| **Course Code:** **EEE2562** | **Course Title: Dc machines and Special Electrical Machines laboratory** **Type of Course: Program Core Laboratory Only** | **L-T P- C** | **0** | 0 | 2 | 1 |
| **Version No.** | **1.0** | | | | | |
| **Course Pre-requisites** | EEE2503 DC Machines and Special Machines | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This laboratory course enhances the ability of validating the methods of controlling various DC Machines and special electrical machines. The laboratory sessions will likely achieve the goals of visualizing and analyzing the working of widely used rotating machines at various loading conditions, improving teamwork abilities and practical skills. The course is intended to develop critical and analytical thinking abilities to control and analyze the fundamentals of DC Machines and special electrical machines. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Dc machines and Special Electrical Machines laboratory and attain **Skill Development** through **Experiential Learning** techniques | | | | | |
| **Basic skill sets required for the laboratory:** | | | | | | |
| | **The students shall be able to develop:**<br>1. An attitude of enquiry.<br>2. Confidence and ability to tackle new problems.<br>3. Ability to interpret events and results.<br>4. Ability to work as a leader and as a member of team.<br>5. Assess errors and eliminate them.<br>6. Observe and measure physical phenomenon.<br>7. Write Reports.<br>8. Select suitable equipment, instrument and materials.<br>9. Locate faults in systems.<br>10. Manipulative skills for setting and handling equipment.<br>11. The ability to follow standard test procedures.<br>12. An awareness of the need to observe safety precautions.<br>13. To judge magnitudes without actual measurement. | | | | | |
| **Course Outcomes** | On successful completion of this course the students shall be able to:<br>1. Demonstrate the performance characteristics of DC machines by conducting various tests.<br>2. Identify the parameters to control the speed the of DC motor.<br>3. Analyse the performance of Special Electrical machines<br>4. Interpret the results to obtain meaningful conclusions | | | | | |
| **Course Content:** | | | | | | |
| **List of Laboratory Tasks:** | | | | | | |

**Experiment No.1**.Magnetization characteristics of a d.c. shunt generator.
**Experiment No.2.**Load test on a DC shunt generator
**Experiment No.3.**Load test on DC shunt motor
**Experiment No.4.**Speed Control of DC Shunt Motor
**Experiment No. 5:**Hopkinson's test on
**Experiment No. 6:**Swinburne's Test
**Experiment No. 7:** Simulation of the Output Characteristics of a Switched Reluctance Motor (SRM) Using MATLAB/Simulink

**Experiment No. 8:** Simulation of Performance Characteristics of a Stepper Motor Using MATLAB/Simulink

**Experiment No. 9:**Simulation of the dynamic characteristics of Permanent Magnet Synchronous Motor using MATLAB
**Experiment No. 10:**Simulation of the dynamic characteristics of BLDC Motor using MATLAB

**Targeted Application & Tools that can be used:**
The application of electrical machines has been extensively employed in industrial applications such as electric vehicles and battery-powered devices such as wheelchairs, power tools, guided vehicles, welding equipment, X-ray and tomographic systems, and computer numerical control (CNC) machines, robotic applications
Professionally Used Software: MATLAB/PSIM

**Textbooks:**
1. Electric Machinery", Fitzgerald, Kingslay, Umans, Tata McGraw-Hill.
2. Venkata Ratnam K, Special Electrical Machines, CRC Press, 2009.
3. DC Machines & Special Electrical Machines Laboratory Manual by Presidency University

**References:**
1. Electric Machinery, P.S.Bimbhra, Khanna Publishers.
2. Basic Electric Machines, Vincent Deltoro, Prentice Hall
3. Kenjo, T., and Sugawara, A., Stepping Motors and their Microprocessor Controls, Oxford Science Publications, 1984.
4. Miller, T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Oxford Science Publications, 1989

**Online learning resources**
1. https://youtu.be/D4RFFnzRdkk?si=SgnaT9GfSpatfqM3http
2. https://youtu.be/Nn1V9KLrtX4?si=ifcW2s5FQ3HFQLB6
3. https://www.mdpi.com/journal/machines/special_issues/388U663WBR(case study)

**Topics relevant to "SKILL DEVELOPMENT":** All the experiments which are listed are for developing for **Skill Development** through **Experiential Learning Techniques**. This is attained through the assessment component mentioned in course handout.

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| **Catalogue prepared by**<br>**Updated by** | Dr V Joshi Manohar |
| **Recommended by the Board of Studies on** | |
| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|
| **Course Code: EEE2563** | **Course Title: AC Machines Laboratory**<br>**Type of Course: Program core & Laboratory** | **L-P- C** | 0 | 2 | 1 |
| **Version No.** | 2.0 | | | | |
| **Course Pre-requisites** | EEE2504 AC Machines | | | | |
| **Anti-requisites** | NIL | | | | |
| **Course Description** | This laboratory course enhances the ability to perform various experiments and analyses on AC machines, thereby predicting their expected performance correctly through different methods and calculations, which also enhances teamwork, and hands-on practical and analytical skills. | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of experiments on AC and DC machines and attain **Skill Development** through **Experiential Learning** techniques. | | | | |
| **Basic skill sets required for the laboratory:** | The students shall be able to develop:<br>1. **An attitude of enquiry.**<br>2. **Confidence and ability to tackle new problems.**<br>3. **Ability to interpret events and results.**<br>4. **Ability to work as a leader and as a member of the team.**<br>5. **Assess errors and eliminate them.**<br>6. Observe and measure physical phenomenon.<br>7. **Write Reports.**<br>8. The ability to follow standard test procedures.<br>9. An awareness of the need to observe safety precautions.<br>10. To judge magnitudes without actual measurement. | | | | |
| **Course Outcomes** | **On successful completion of the course, the students shall be able to:**<br>1. Evaluate uncertainties involved in any measurement from experimental results.<br>2. Demonstrate the working principle of various electrical machines.<br>3. Analyse the behaviour of various AC machines.<br>4. Calculate the unknown parameters using various experimental setups. | | | | |
| **Course Content:** | | | | | |

**List of Laboratory Tasks:**

**Experiment No 1:** Open circuit and short circuit test of single-phase transformer
**Experiment No 2**: Load test on single-phase transformer
**Experiment No 3**: Sumpner's test on a pair of single-phase transformers
**Experiment No 4:** Parallel operation of two single-phase transformers
**Experiment No 5:** Scott connection
**Experiment No 6:**No load and blocked rotor test on three-phase induction motor
**Experiment No 7**: Load test on three-phase induction motor
**Experiment No 8:** No load and blocked rotor test on single-phase induction motor
**Experiment No 9:** Load test on single-phase induction motor
**Experiment No 10**: Regulation of a three-phase alternator by synchronous impedance &m.m.f. methods
**Experiment No 11:** 'V' and 'Inverted V' curves of a three-phase synchronous motor

**Targeted Application & Tools that can be used:**

The application of electrical machines has been extensively employed in industrial applications such as electric vehicles and battery-powered devices such as wheelchairs, power tools, guided vehicles, welding equipment, X-ray and tomographic systems, and computer numerical control (CNC) machines.
Professionally used tools: MATLAB/PSIM

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| **Course Material**<br>1.Electrical Machines-II Lab Manual, Presidency University, Bengaluru.<br>**Textbooks**<br>1. "Electric Machinery", Fitzgerald, Kingslay, Umans, Tata McGraw-Hill.<br>2. "Electric Machinery Fundamentals", Chapman, McGraw-Hill Higher Education.<br>3. "Electric Machines", Nagrath and Kothari, Tata McGraw-Hill. |
| **Reference Books:**<br>1. Electric Machinery and Transformer, Guru, Hiziroglu, Oxford University press.<br>2. Electric Machinery, P.S.Bimbhra, Khanna Publishers.<br>3. Basic Electric Machines, Vincent Deltoro, Prentice Hall.<br>**Online resources**<br>1. https://www.youtube.com/playlist?list=PL5TKV1tzb09lx62sPBmho6WJZX5WWFzUr<br>2. https://www.youtube.com/playlist?list=PLp6ek2hDcoNCANsWM2mw3qi0387BhfLyV<br>3. https://www.youtube.com/playlist?list=PLMYtBmvT7X7Sjw9T4Z3oef_grv8GFUHE6<br>4. https://www.youtube.com/playlist?list=PLs5_Rtf2P2r5YY5b23uDGrtpo42ezMmGp<br>5. https://ieeexplore.ieee.org/abstract/document/8820546<br>6. https://ieeexplore.ieee.org/document/6436061 (case study) |
| **Topics relevant to "SKILL DEVELOPMENT":**All the experiments which are listed are for **SkillDevelopment**through **Experiential Learning Techniques**. This is attained through the assessment component mentioned in the course handout. |

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| **Catalogue prepared by** | Dr. Markala Karthik |
| **Recommended by the Board of Studies on** | |
| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2564** | **Course Title: Microprocessor and Microcontroller Laboratory**<br>**Type of Course: Program core & Laboratory** | **L-T-P-C** | 0 | 0 | 2 | 1 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE2506 Microprocessor and Microcontrollers | | | | | |
| **Anti-requisites** | NIL | | | | | |
| **Course Description** | This Laboratory course gives an opportunity to learn hands-on experience in programming and interfacing microprocessors and microcontrollers. Students will learn to write assembly and C programs, develop hardware-software integration skills, and implement real-time applications. Also, covers practical exercises on microcontroller peripherals, interfacing sensors, actuators, and communication modules, with a focus on debugging, testing. The course intents to develop critical and analytical thinking abilities. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of experiments on microprocessors and microcontrollers, and to facilitate **skill Development** through **Experiential Learning** techniques. | | | | | |

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| **Basic skill sets required for the Laboratory** | The students shall be able to develop:<br>**1) An attitude of enquiry.**<br>**2) Confidence and ability to tackle new problems.**<br>3) Ability to interpret events and results.<br>**4) Ability to work as a leader and as a member of team.**<br>**5) Assess errors and eliminate them.**<br>6) Observe and measure physical phenomenon.<br>**7) Write Reports.**<br>**8) Select suitable equipment, instrument and materials.**<br>9) Locate faults in systems.<br>**10) Manipulative skills for setting and handling equipment.**<br>11) The ability to follow standard test procedures.<br>12) An awareness of the need to observe safety precautions.<br>13) To judge magnitudes without actual measurement. |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Apply assembly language programming techniques to perform basic arithmetic operations such as addition, subtraction, multiplication, and array manipulation.<br>2. Implement sorting algorithms to organize data arrays in ascending and descending order using assembly language.<br>3. Utilize microcontroller instruction sets to design delay routines and counters for applications like digital watches.<br>4. Interface Digital-to-Analog Converters (DACs) with microcontrollers to generate various waveforms (e.g., sine, square, and triangular) and modify their amplitude and frequency.<br>5. Develop assembly and embedded C programs to control stepper and DC motors for clockwise and anti-clockwise rotation using microcontroller interfaces. |
| **Course Content:** | |

**List of Laboratory Tasks:**

Experiment No 1: Write an assembly language program to perform arithmetic operation

Level 1: Write a Program to carry out the arithmetic operations of addition.

Level 2: Write a Program to carry out the subtract operations of addition.

Experiment No. 2: Write an assembly language program to perform Multiplication operation.

Level 1: Write a Program to carry out the 8 bit multiplication.

Level 2: Write a Program to carry out the 16 bit multiplication

Experiment No. 3: Write an assembly language program to identify the largest number given in an array.

Level 1: Write an assembly language program to find the largest element in a given string of N=4 bytes at location 8100h.

Level 2: Write an assembly language program to find the smallest element in a given string of N=4 bytes at location 8100h

Experiment No. 4: Write an assembly language program to sort an array of N bytes of data in ascending/descending order, stored in external location.

Level 1: Write an assembly language program to sort an array of N bytes of data in descending order, stored from location 8100h.

Level 2: Write an assembly language program to sort an array of N bytes of data in ascending order, stored from location 8100h.

Experiment No. 5: Write an assembly language program to convert packed ASCII to BCD and BCD to ASCII numbers.

Level 1: Write an assembly language program to convert packed BCD to two ASCII numbers.

Level 2: Write an assembly language program to convert ASCII numbers to BCD.

Experiment No. 6: Choose a microcontroller, write Delay and counter program using its instruction set.

Level 1: Write a Program to generate a delay.
Level 2: Write a program to generate a delay and enumerate a counter that emulates digital watch.
Experiment No. 7: Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
Level 1: To interface DAC and to write a C program to generate triangle waveforms.
Level 2: To interface DAC and to write a C program to generate Sine waveforms.
Experiment No. 8: Interfacing of Stepper Motor to microcontroller.
Level 1: Write a program to interface stepper to rotate the motor in clockwise direction interface to 8051
Level 2: Write a program to interface stepper to rotate the motor in anti-clockwise direction interface to 8051
Experiment No. 9: Interfacing of DC Motor to microcontroller.
Level 1: Write a program to interface DC Motor to rotate the motor in clockwise direction interface to 8051
Level 2: Write a program to interface DC Motor to rotate the motor in anti-clockwise direction interface to 8051

**Targeted Application & Tools that can be used:**
The Microprocessors and Microcontrollers Laboratory targets applications like embedded systems, sensor interfacing, IoT, and motor control. It emphasizes hands-on learning with programming in Embedded C/Assembly and debugging using oscilloscopes and logic analyzers.
Professionally Used Software: Keil uVision, Flip, Proteus

**Textbooks**

1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, "The 8051Microcontroller and Embedded Systems: Using Assembly and C",Pearson Education, 2007
2. Microprocessors and Microcontrollers Laboratory Manual by Presidency University.

**References**

1. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning,2004.
2. Raj Kamal ,"Microcontrollers: Architecture, Programming, Interfacing and System Design "
   Pearson 1st Edition, 2012

**Online resources**

5. EBook:https://presiuniv.knimbus.com/user#/home
6. Seminar:https://www.electronicsforu.com/resources/difference-between-microprocessor-and-microcontroller
7. Case Study: https://microcontroller.com/
6. https://www.pdfdrive.com/the-8051-microcontroller-and-embedded-e952238.html

**Topics relevant to "SKILL DEVELOPMENT":** Laboratory experiments on various arithmetic operations, organizing data arrays, designing routines and counters for applications, interfacing Digital-to-Analog Converters, and controlling stepper and DC motors are conducted for **Skill Development** through **Experiential Learning Techniques**. This is achieved through the assessment components mentioned in the course handout.

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| **Catalogue prepared by** | Dr Ravi V Angadi & Dr. Jisha L K |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/07/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2565** | **Course Title: Measurement and Instrumentation Laboratory**<br>**Type of Course: Program core & Laboratory** | **L-T-P-C** | 0 | 0 | 2 | 1 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | NIL | | | | | |
| **Anti-requisites** | NIL | | | | | |
| **Course Description** | The Measurement and Instrumentation Laboratory is a hands-on course designed to provide students with practical experience in the use of a variety of electrical and electronic measurement tools and instruments. Through a series of experiments, students will learn to measure, record, and analyze electrical parameters such as voltage, current, resistance, power, and frequency. The course focuses on the application of the theoretical concepts introduced in Measurement and Instrumentation by allowing students to perform real-world measurements and data analysis using industry-standard equipment. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of experiments on Power Electronics and attain **SkillDevelopment** through **Experiential Learning** techniques. | | | | | |
| **Basic skill sets required for the laboratory:** | The students shall be able to develop:<br>➢ **An attitude of enquiry.**<br>➢ **Confidence and ability to tackle new problems.**<br>➢ Ability to interpret events and results.<br>➢ **Ability to work as a leader and as a member of team.**<br>➢ **Assess errors and eliminate them.**<br>➢ Observe and measure physical phenomenon.<br>➢ **Write Reports.**<br>➢ **Select suitable equipment, instrument and materials.**<br>➢ Locate faults in systems.<br>➢ **Manipulative skills for setting and handling equipment.**<br>➢ The ability to follow standard test procedures.<br>➢ An awareness of the need to observe safety precautions.<br>➢ To judge magnitudes without actual measurement. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1 Estimate uncertainties involved in any measurement from experimental results.<br>2 Demonstrate and train the students in the calibration and use of different measuring instruments.<br>3 Demonstrate the function of Data acquisition cards<br>4 Apply Signal Analysis and Interpretation | | | | | |
| **Course Content:** | | | | | | |
| **Experiment No 1:Familiarization with virtual instrumentation using Lab-VIEW Software**<br><br>**Experiment No 2: Calibration and Measurement of unknown resistance using Wheatstone Bridge**<br><br>**Experiment No 3: Measurement of unknown inductance using Maxwell's inductance bridge.**<br><br>**Experiment No 4:Measurement of component values and voltage drop across the series combination of given resistors using NI ELVIS II+ workstation.** | | | | | | |

**Experiment No 5:Measurement of phase difference and power factor of a series R-L and R-C circuit using NI ELVIS II+ workstation**

**Experiment No 6:Measurement of 3 phase active power and reactive power using 2 wattmeter method.**

**Experiment No 7:Measurement of Voltage sag, swell and THD of supply from electricity board using Power Quality Analyzer.**

**Experiment No 8: Measurement of amplitude, frequency, THD of an external signal using NI myDAQ and Lab-VIEW.**

**Targeted Application & Tools that can be used:**
In a Measurement and Instrumentation Laboratory, various instruments, tools, and software are used to perform precise measurements, data acquisition, signal analysis, and error analysis across a wide range of electrical and electronic systems.
Professionally Used Software: LabVIEW and MATLAB

**Textbooks**

1. Measurements and Instrumentation Laboratory Manual by Presidency University

**References**

7. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill.
8. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press / PHI

**Online resources**

9. https://nptel.ac.in/courses/108/105/108105153/
10. 2.https://www.youtube.com/watch?v=xLjk5DrScEU&list=PLt5syl71JKf0IacRzLI-02Q_udP4nJiJg
11. 3. https://www.researchgate.net/figure/Results-of-1-kHz-electrical-measurements-on-case-study-core-plugs-using-reservoir-brine_tbl2_264898895
12. 4.https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d2706929%26site%3dehost-live

**Topics relevant to "SKILL DEVELOPMENT":** Laboratory experiments for analyzing various signals **Skill Development**through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.

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| **Catalogue prepared by** | Mr Bishakh Paul |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/07/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2566** | **Course Title: Control Systems Engineering Laboratory**<br>**Type of Course: Laboratory** | **L- T- P- C** | 0 | 0 | 2 | 1 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE2507 - Control systems Engineering | | | | | |
| **Anti-requisites** | **Nil** | | | | | |

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| **Course Description** | The purpose of this course is to provide an opportunity to validate the concepts taught in the course control system engineering and enhances the ability to visualize the real system performance by conducting the experiments through hardware and software The course develops critical thinking and analytical skills of the student. The course also enhances the student's programming and simulation abilities |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Control Systems Engineering Laboratory experiments and attain **Skill Development** through **Experiential Learning** techniques. |
| **Basic skill sets required for the laboratory:** | |
| | **The students shall be able to develop:**<br>14) An attitude of enquiry.<br>15) Confidence and ability to tackle new problems.<br>16) Ability to interpret events and results.<br>17) Ability to work as a leader and as a member of team.<br>18) Assess errors and eliminate them.<br>19) Observe and measure physical phenomenon.<br>20) Write Reports.<br>21) Select suitable equipment, instrument and materials.<br>22) Locate faults in systems.<br>23) Manipulative skills for setting and handling equipment.<br>24) The ability to follow standard test procedures.<br>25) An awareness of the need to observe safety precautions.<br>26) To judge magnitudes without actual measurement. |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Summarize the time domain specifications for second order system.<br>2. Explain the behaviour of lag, lead and lag - lead compensating networks<br>3. Analyze the performance of P, PI, and PID controllers.<br>4. Analyze the stability of LTI system using Root locus and Bode plots |
| **Course Content:** | |

**List of Laboratory Tasks:**

**Experiment N0 1: Time Response of Second Order System.**

**Level 1: To determine the time response characteristics of a second order system to a step input when the system is underdamped, over damped and critically damped and evaluation of time response specifications.**

**Level 2: To comment on the effect of additional poles and zeros on time response of second order system in MATLAB**

**Experiment No. 2: RC Lead Compensating Network.**

**Level 1: To implement a passive RC lead compensating network for the given specifications and to obtain its frequency response.**

**Level 2: To implement a passive RC lead compensating network for the given specifications and to obtain its frequency response using MATLAB software.**

**Experiment No. 3:RC Lag Compensation Network.**

**Level 1: To project a passive RC lag compensating network for the given specifications and to obtain its frequency response.**

**Experiment No. 4:RC Lag-Lead Compensation.**

**Level 1: To study the Frequency Response of a given Lead-Lag Compensating Network.**

**Level 2: To study the Frequency Response of a given Lead-Lag Compensating Network using NI Lab.**

**Experiment No. 5:Effect of P, PI and PID on a Second Order System**
**Level 1: To study the steady state performance of an analog P, PI & PID controller using PID controller kit.**
**Level 2: To simulate the effect of P, PI, PD and PID Controllers on a given second order system for a unit step input by developing a MATLAB Code.**

**Experiment No. 6:Characteristics of Servo Motor.**
**Level 1:To study the Speed-Torque and Speed-Back e.m.f. characteristics of AC Servomotor.**

**Experiment No. 7:Stability Analysis (Bode, Root Locus) of LTI System using MATLAB.**
**Level 1:To analyse frequency response of a system by plotting Root locus, bode plot using**
**MATLAB software.**

**Experiment No. 8:DC Position control System using MATLAB**
**Level 1: To simulate a DC position control system using MATLAB and obtain its step response.**

**Targeted Application & Tools that can be used:**
Control Systems are used in domestic applications, traffic light control, general industry, military and virtually every modern vehicle in the world, robotics. Modern industrial plants utilized robots for manufacturing temperature controls, pressure controls, speed controls, position controls, etc. In chemical process, control field is an area where automations play an important role.
Professionally used tools: MATLAB/Simulink, Scilab, Octave.

**Course Material**
**4.** Control Systems Lab Manual, Presidency University, Bengaluru.
**Text Book:**
**5.** Nagrath I. J. and M. Gopal, Control Systems Engineering, New Age International (P) Ltd, 5th ed, 2007.
**Reference Books:**
1. K. Ogata, 'Modern Control Engineering', Pearson Education Asia / PHI, 4th Edition.
2. Benjamin Kuo, 'Automatic Control Systems', PHI, 7th Edition.
3. Hasan Saeed, automatic control Systems with MATLAB programs, S K Kataria and sons, Latest ed.
**Online Resources:**
1. https://puniversity.informaticsglobal.com
2. Ebook: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-2011/unit-2-signals-and-systems/designing-control-systems/
3. Case study: https://nptel.ac.in/courses/107/106/107106081/

**Topics relevant to "SKILL DEVELOPMENT":** Computing and performing the stability of the given system and assessing the stability by using theoretically and practically arefor**SkillDevelopment**through**Experiential Learning**techniques. This is attained through assessment component mentioned in Course Plan.

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| **Catalogue prepared by** | Ms. Jisha L K |
| **Recommended by the Board of Studies on** | BoS No: 12$^{th}$BoS held on 27/7/2021 |
| **Date of Approval by the** | 16$^{th}$ Academic Council Meeting held on 23/10/2021 |

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| **Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2567** | **Course Title: Electrical Cad Laboratory**<br>**Type of Course: Laboratory** | **L-T- P-C** | 0 | 0 | 2 | 1 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE2503 DC Machines and Special Machines<br>EEE2504 AC Machines<br>EEE2509 Transmission and Distribution | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This course introduces computer applications in electrical engineering and practical expertise in The course develops an understanding of DC and AC machine windings; single line diagrams of generating stations and substations' covering; incoming circuits; electrical machine assembly drawings (Transformer, DC Machine, and Alternator) using design data, sketches, or both; and simple domestic and commercial wiring drawings/sketches as per standards using AUTO CAD Software. Critical thinking and analysis are also taught. Modern tool training improves drawing skills (AUTOCAD). | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Electrical Cad Laboratory experiments and attain **Skill Development** through **Experiential Learning** techniques. | | | | | |
| **Basic skill sets required for the laboratory:** | | | | | | |
| | The students shall be able to develop:<br>➢ **An attitude of enquiry.**<br>➢ **Confidence and ability to tackle new problems.**<br>➢ Ability to interpret events and results.<br>➢ **Ability to work as a leader and as a member of team.**<br>➢ **Assess errors and eliminate them.**<br>➢ Observe and measure physical phenomenon.<br>➢ **Write Reports.**<br>➢ **Select suitable equipment, instrument and materials.**<br>➢ Locate faults in systems.<br>➢ **Manipulative skills for setting and handling equipment.**<br>➢ The ability to follow standard test procedures.<br>➢ An awareness of the need to observe safety precautions.<br>➢ To judge magnitudes without actual measurement. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1) Develop the armature winding of both DC and AC Machine.<br>2) Develop the layout of Generating Stations and Substations Covering, Incoming Circuits.<br>3) Develop the sectional views of transformers, DC machine and alternator.<br>4) Develop the plan/layout of domestic/commercial wiring. | | | | | |
| **Course Content:** | | | | | | |
| **List of Laboratory Tasks:** | | | | | | |

**Experiment No 1: Develop a DC Armature winding diagram for the given data;**

**Level 1:** Winding Diagrams of D.C. Machines Simplex/ Double Layer Lap Windings (By using Auto CAD Software).

**Level 2:**Winding Diagrams of D.C. Machines Simplex/ Double Layer Wave Windings (By using Auto CAD Software).

**Experiment No 2: Develop a single line diagram of Substation.**

**Level 1:** Single Line Diagrams of Generating Stations and Substations Covering Incoming Circuits, Outgoing Circuits, Busbar Arrangements (Single bus bar) Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Surge or Lightning Arresters, Communication Devices (Power Line Carrier) and Line Trap.

**Level 2:** Single Line Diagrams of Generating Stations and Substations Covering Incoming Circuits, Outgoing Circuits, Busbar Arrangements (Double bus bar), Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Surge or Lightning Arresters, Communication Devices (Power Line Carrier) and Line Trap

**Experiment No 3: Develop a AC Armature winding diagram for the given data;**

**Level 1:** Winding Diagrams of A. C. Machines Simplex/ Double Layer Lap Windings (By using Auto CAD Software).

**Level 2:** Winding Diagrams of A. C. Machines Simplex/ Double Layer Wave Windings (By using Auto CAD Software).

**Experiment No 4: Develop a Transformers Assembly Drawings Using Design Data, Sketches or Both.**

**Level 1:** Transformers - Sectional Views of Single and Three Phase Core Transformers.

**Level 2:** Transformers - Sectional Views of Single and Three Phase Shell Type Transformers.

**Experiment No 5: Develop a DC Machines Assembly Drawings Using Design Data, Sketches or Both.**

**Level 1:** DC Machine- Sectional Views of Yoke with Poles, Armature.

**Level 2:** DC Machine- Sectional Views of Yoke with Poles, Armature and Commutator.

**Experiment No 6: Develop an Alternator Assembly Drawings Using Design Data, Sketches or Both.**

**Level 1:** Alternator- Sectional Views of star connected Stator and Rotor.

**Level 2:** Alternator- Sectional Views of Delta connected Stator and Rotor.

**Experiment No 7: Develop an Alternator Assembly Drawings Using Design Data, Sketches or Both.**

**Level 1:** Alternator- Sectional Views of star connected Stator and Rotor.

**Level 2:** Alternator- Sectional Views of Delta connected Stator and Rotor.

**Experiment No 8: Develop a domestic and commercial wiring.**

**Level 1:** Domestic wiring- Sketch the domestic wiring layout plan.

**Level 2:** Commercial wiring- Sketch the commercial wiring layout plan.

**Targeted Application & Tools that can be used:**

Application Area is design and development of electrical machines for various applications. Professionally Used Software: AUTOCAD/ Suitable CAD software can be used for drawings.

**Course Material**

1. Electrical Cad Laboratory Manual, Presidency University, Bengaluru.

**Text Book:**


1. A. K. Sawhney, " A course in Electrical Machine design", DhanpatRai, 6th, Edition, 2013
2. V. N. Mittle, "Design of Electrical Machines", N.C. Jain Publishers.
3. D M. Yogesh, B.S Nagaraja, N. Nandan, "Computer Aided Electrical Drawing", PHI


**Reference Books:**


1. K. L. Narang , "Electrical Engineering Drawing", SatyaPrakashan, 2014.
2. K.M. Vishnu Murthy, "Computer-Aided Design of Electrical Machines", B S Publications.


**Online resources:**

6. https://puniversity.informaticsglobal.com/
7. https://www.autodesk.in/solutions/electrical-design
8. https://elecdes.com/electrical-cad-software/elecdes-electrical-cad-software
9. https://ieeexplore.ieee.org/document/9782226/

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| **Topics relevant to "SKILL DEVELOPMENT":** All the experiments which are listed are for **Skill Development** through **Experiential Learning Techniques**. This is attained through the assessment component mentioned in Course Plan. | |
| **Catalogue prepared by** | Mr. Ravi V Angadi |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/21 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE2568** | **Course Title: Power Electronics Laboratory**<br>**Type of Course: Professional Core Laboratory** | **L- T-P-C** | 0 | 0 | 2 | 1 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2511 Power Electronics. | | | | | |
| **Anti-requisites** | NIL | | | | | |
| **Course Description** | This laboratory course gives an opportunity in validating the methods of controlling various power converters and analysing the characteristics of power semiconductor devices. The laboratory sessions will likely achieve the goals of visualizing and analysing the working of power converters at various conditions, improving teamwork abilities and practical skills. The course intents to develop critical and analytical thinking abilities to control the power converters. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of experiments on Power Electronics and attain **Skill Development** through **Experiential Learning** techniques. | | | | | |
| **Basic skill sets required for the laboratory:** | The students shall be able to develop:<br>**1) An attitude of enquiry.**<br>**2) Confidence and ability to tackle new problems.**<br>3) Ability to interpret events and results.<br>**4) Ability to work as a leader and as a member of team.**<br>**5) Assess errors and eliminate them.**<br>6) Observe and measure physical phenomenon.<br>**7) Write Reports.**<br>**8) Select suitable equipment, instrument and materials.**<br>9) Locate faults in systems.<br>**10) Manipulative skills for setting and handling equipment.**<br>11) The ability to follow standard test procedures.<br>12) An awareness of the need to observe safety precautions.<br>13) To judge magnitudes without actual measurement. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1.Demonstrate the characteristics of SCR, MOSFET, and IGBT by experimentation.<br>2.Illustrate operation of power converters for various loads.<br>3.Analyse the firing circuits for converters.<br>4.Demonstrate the speed control of machines using converters | | | | | |
| **Course Content:** | | | | | | |
| **List of Laboratory Tasks:**<br><br>Experiment No 1: To plot the static characteristics of the SCR. | | | | | | |

Level 1: To obtain the V-I characteristics of SCR and determine holding current and forward break over voltage.
Level 2: For a given SCR, comment on how the magnitude of forward break over voltage changes with increasing of gate current.

Experiment No. 2: To plot the static characteristics of Power MOSFET/ Power IGBT

Level 1: To plot the drain and trans conductance characteristics of power MOSFET
Level 2: To study V-I characteristics of IGBT and hence determine the output resistance and trans-conductance.

Experiment No. 3: To study SCR RC triggering circuit for a single-phase rectifier.

Level 1: To turn on the SCR using RC triggering circuit for single phase half wave rectifier and to observe the waveforms across R load by varying the width of firing pulses
Level 2: To study the performance and waveforms of full wave rectifier using RC triggering circuit.

Experiment No. 4: To study the operation of single phase semi converter (half controlled bridge rectifier) with different loads

Level 1: To study the performance and waveforms of single-phase half-controlled rectifier with R load
Level 2: To use single phase semi converter for controlling the speed of a separately excited DC motor

Experiment No. 5: To study the triggering of SCR using digital triggering

Level 1: To study SCR digital triggering circuit for a single-phase controlled rectifier
Level 2: To Simulate and validate the relationship between load voltage and firing angle for single phase-controlled rectifier using MATLAB/PSIM

Experiment No. 6: To control the speed of universal motor by AC voltage controller

Level 1: To control speed of universal motor using AC Voltage Controller and to plot the speed V/S firing angle graphically
Level 2: To Simulate and validate the above results using MATLAB/PSIM

Experiment No. 7:To study the AC voltage control by using TRIAC – DIAC combination

Level 1: To study AC voltage controller using TRIAC – DIAC combination connected to lamp load and to plot load voltage (rms) Vs firing angle.
Level 2: To study AC voltage controller using TRIAC – DIAC combination connected to R-L load and compare the results with that of resistive load.

Experiment No. 8: To obtain speed control of a separately excited d.c motor using Type A chopper.

Level 1: To obtain speed control of a separately excited d.c motor using an IGBT/ MOSFET Type A chopper and to plot output voltage & speed vs duty cycle
Level 2: verify the relationship between output voltage and firing angle for the above chopper theoretically

Experiment No. 9: To study single phase fully controlled rectifier with RL load

Level 1: To identify the difference between the conduction angles In case of single phase fully controlled rectifier with R and R-L loads.
Level 2: To understand the effect of freewheeling diode in case of fully controlled rectifier with R-L load.

Experiment No. 10: To obtain speed control of stepper motor using motor logic controller circuit

Level 1: To obtain speed control of stepper motor using motor logic controller circuit and at the same time verify the truth table for full step mode
Level 2: To obtain speed control of stepper motor and verify the truth table for half step mode

**Targeted Application & Tools that can be used:**

The application of power electronic converters in the fields of sustainable energy technologies such as wind energy, solar power, wave energy, and fuel cells are described. Furthermore, industrial applications like electric drives, Electric Vehicles and induction heating as well as application of power electronics for power transmission, harmonics control and voltage stability issues.

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| Professionally Used Software: MATLAB/PSIM/Scilab |
| **Textbooks**<br>1 M.H.Rashid, "Power Electronics Power Electronics Devices, Circuits and Applications ,Fourth Edition , Pearson,2017<br>2. Power Electronics Lab Manual by Presidency University |
| **References**<br>1. M.D. Singh and Khanchandani K.B, "PowerElectronics",T.M.H. Second edition, 2017<br>2. Dr P S Bimbhra , "Power Electronics" ,Khanna Publishers, Fifth Edition,1990<br>**Online resources**<br>13. Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical Engineering,IIT Bombay. For more details on NPTEL visit http://nptel.ac.in<br>14. https://www.pdfdrive.com/fundamentals-of-power-electronics-e5904858.html<br>15. https://ieeexplore.ieee.org/document/9545403 (case study)<br>16. https://springerplus.springeropen.com/articles/10.1186/2193-1801-2-370<br>17. https://puniversity.informaticsglobal.com |
| **Topics relevant to "SKILL DEVELOPMENT":**Laboratory experiments for controlling various power converters and analysing the characteristics of power semiconductor devices for **Skill Development** through **Experiential Learning techniques**. This is attained through assessment component mentioned in Course Plan. |

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| **Catalogue prepared by** | Dr Joshi Manohar V &<br>Ms. Ragasudha C P |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/07/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3560** | **Course Title: Power System Simulation Laboratory**<br>**Type of Course: Professional Core & Laboratory** | **L-T-P-C** | 0 | 0 | 2 | 1 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE3057 Power System Analysis | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This course introduces computer applications in power system engineering and provides practical knowledge. MATLAB/Mipower fundamentals, power system analysis like load flow, short circuit, and D analysis, economic load dispatch, and contingency analysis will be simulated and studied in this lab. The course improves critical thinking and analysis. Through current tools, the course improves programming and Simulink modelling. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Power System Simulation laboratory experiments and attain **Skill Development** through **Experiential Learning** techniques. | | | | | |
| **Basic skill sets required for the laboratory:** | | | | | | |
| | The students shall be able to develop:<br>**1) An attitude of enquiry.**<br>**2) Confidence and ability to tackle new problems.**<br>**3) Ability to interpret events and results.** | | | | | |

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| | **4) Ability to work as a leader and as a member of team.**<br>**5) Assess errors and eliminate them.**<br>6) Observe and measure physical phenomenon.<br>**7) Write Reports.**<br>**8) Select suitable equipment, instrument and materials.**<br>**9) Locate faults in systems.**<br>**10) Manipulative skills for setting and handling equipment.**<br>**11) The ability to follow standard test procedures.**<br>12) An awareness of the need to observe safety precautions.<br>13) To judge magnitudes without actual measurement. |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>CO. 1. Develop a program in MATLAB/ Mi-Power to assess the YBus, and ZBus of the given power system network.<br>CO. 2. Inference the power flow solution of the given power system network by using the Mi-Power software package.<br>CO. 3. Inference the fault analysis of the given power system network by using Mi-Power software package.<br>CO. 4. Demonstrate the stability analysis for the given power system network by using Mi-Power software package.<br>CO. 5. Illustrate the economic load dispatch for the given power system.<br>CO. 6. Examine the severity of the system by conducting contingency study for a given power system network. |
| **Course Content:** | |

**List of Laboratory Tasks:**

**Experiment No 1: Develop a MTALAB Code to compute Ybus.**

Level 1: Formation of Y Bus without mutual coupling by using MATLAB

Level 2: Formation of Y Bus without mutual coupling by using Mi Power

**Experiment No 2: Develop a MTALAB Code to compute Ybus.**

Level 1: Formation of Y Bus with mutual coupling.

Level 2: Formation of Y Bus with mutual coupling by using Mi Power

**Experiment No 3: Develop a MTALAB Code to compute Zbus. .**

Formation of Z Bus .

**Experiment No 4: Develop a MTALAB Code to compute system parameters**

Determination of bus currents and bus for specified power system network.

**Experiment No 5: Load flow analysis by Gauss-Siedel method.**

Perform a load flow analysis without any acceleration factor by using Mipower software package.

**Experiment No 6: Load flow analysis by newton raphson method.**

Perform a load flow analysis by using Mipower software package.

**Experiment No 7: Fault Analysis of given power system network.**

Perform a symmetrical fault analysis for the given power system network.

**Experiment No 8: Transient Stability Studies**

Analyze the transient stability of a single line diagram of a 5 bus system with three generating units, four lines and two transformer and two loads, comment on the stability of the machine.

**Experiment No 9: Optimal Generator scheduling.**

Determine the cost equations and loss co-efficients of different units in the plant are given. Determine economic generation for total load demand of 240MW.

**Experiment No 10: Contingency Analysis**

Preform the contingency analysis for the given 5 bus system network and interpret the results.

**Targeted Application & Tools that can be used:**

Power System Load flow studies, protection and stability for real time test systems.

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| Professionally Used Software: Mi Power/ ETAP/ MATLAB/PSCADA/Power World Simulator/PSSE. | |
| **Course Material**<br>1. Power System Simulation Lab Manual , Presidency University, Bengaluru.<br>**Text Book:**<br>4. A Modern Power system Analysis – by I.J.Nagrath&D.P.Kothari: Tata McGraw–Hill Publishing Company, 2nd edition.<br>5. Power System Analysis by Hadi Saadat – TMH Edition.<br>**Reference Books:**<br>1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.<br>2. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.<br>3. Power System Analysis and Design by J.Duncan Glover, M.S.Sarma, T.J.Overbye – CengageLearning publications. | |
| **Online resources:**<br>1. https://puniversity.informaticsglobal.com/<br>2. https://onlinecourses.nptel.ac.in/noc19_ee62/<br>3. http://www.eolss.net/sample-chapters/c05/e6-39a-06-02.pdf.<br>4. https://www.ebookmela.co.in/download/power-system-analysis-operation-and-control-by-abhijit-chakrabarti | |
| **Topics relevant to "SKILL DEVELOPMENT":** Performing suitable experiments to compute the load flow analysis using the modern tools like MATLAB, Mi Power for **Skill Development** through **Experiential Learning techniques.** This is attained through assessment component mentioned in Course Plan | |
| **Catalogue prepared by** | Mr. Ravi V Angadi |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/21 |

## Professional Elective Courses Catalogues;
## Track 1: General Basket

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|---|---|---|---|---|---|---|
| **Course Code: EEE3003** | **Course Title: Switchgear Protection**<br>**Type of Course: Professional Core and Theory only** | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2509 Transmission and Distribution<br>EEE2510 Electrical Power Generation and Economics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course provides the basic knowledge with regards to the need for protection of electric power systems. The course aims to understand the requirement of switchgear used in power system networks and conceptually visualize the basic aspects of protection involved in power systems. It develops an insight into the protection schemes followed in power system. | | | | | |
| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of Switchgear Protection and attain **Skill Development** through **Participative Learning** techniques. | | | | | |
| **Course Out Comes** | After the completion of the course students shall be able to:<br>1. Discuss the importance of protection in power system. | | | | | |

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| | 2. Explain the operation of fuses and switches in power system protection.<br>3. Identify various types of circuit breakers and their mechanism of operation.<br>4. Choose protective relaying schemes in conventional and modern relays | | | |
| **Course Content:** | | | | |
| **Module 1** | Introduction to protection, switches and fuses | Assignment | Data Analysis | **10 Sessions** |
| **Topics:** Introduction to Protection-Need for protective systems, Components of a protection system, Introduction to switches-switches, isolators, Fuse characteristics and types- open type, semi enclosed re-wirable type, D type cartridge fuse, HRC fuse and their applications. | | | | |
| **Module 2** | Circuit breakers | Assignment | Problem Solving | **12 Sessions** |
| **Topics:** Circuit Breakers and operational characteristics -Circuit breakers, Arc interruption theories, RRRV<br>Classification of circuit breakers-oil circuit breakers, Air circuit breakers, SF6 circuit breakers, Vacuum circuit breaker | | | | |
| **Module 3** | Protective relays | Assignment | Problem Solving | **13 Sessions** |
| **Topics:** Introduction to relays, theory of protection and classification -zones of protection, primary and backup protection, Essential qualities of protection, Classification of relays based on technology and functionality<br>Protective relaying characteristics and parameters-Over current relays- instantaneous, time current relays, Numerical Overcurrent Relays, IDMT characteristics and parameters and operation with required formulas, Time and current settings of overcurrent relays, PSM and TSM calculations<br>Directional relay, Differential relay, Effect of Line Length and Source Impedance on Performance of Distance Relays, Electromechanical distance protection relays-Operating principle of Distance protection relays, Balanced (Opposed) Voltage Differential Protection, Wire Pilot Protection, Carrier Current Protection, Electromechanical Impedance relay, Pilot Relaying Scheme, Electromechanical Reactance relay, Electromechanical MHO relay, Static relays-microprocessor based relays | | | | |
| **Module 4** | Unit protection schemes | Assignment | Problem Solving | **10 Sessions** |
| **Topics:** Protection scheme for alternator, induction motor and transformer, Buszone Protection, Frame Leakage Protection. | | | | |
| **Targeted Application & Tools that can be used:**<br>The protection finds its application in whole of the power system network as an integral part of it. Specifically finds its application in protection of electrical devices and equipment of the power systems such as generators, transformers, transmission lines, buses and motors.<br>The Commercially available simulation software tools like MiPower /MATLAB are utilized as professional tool. | | | | |
| **TextBooks**<br>1. Badri Ram and D.N. Vishwakharma, "Power System Protection and Switchgear", Second Edition, McGraw Hill Education , 2011<br>2. Sunil S.Rao, "Switchgear Protection and power systems", 13th edition, Khanna Publishers,2014. | | | | |
| **References**<br>1. BadriramandViswaKharma, "Power System Protection and Switchgear",TMH<br>2. Y. G. Paithankar and S.R. Bhide, "Fundamentals of Power Systems Protection", PHI, 2nd Edition, 2013. | | | | |

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| 3. Ravindarnath and Chandra,"Power System Protection and Switchgear", New Age Publications.<br>**Online resources**<br>1. Case study: https://puniversity.informaticsglobal.com/openFullText.html?DP=https://ieeexplore.ieee.org/document/7967241/<br>2. https://ieeexplore.ieee.org/document/712612<br>3. https://ieeexplore.ieee.org/document/5060940<br>4. Ebook:https://puniversity.informaticsglobal.com/user#/home |
| **Topics relevant to the "SKILL DEVELOPMENT"**: Arc interruption in circuit breaker, Rate of rise of restriking voltage, Protection schemes in alternator for **Skill Development** through **Participative Learningtechniques**. This is attained through assessment component mentioned in the Course Plan. |

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| **Catalogue prepared by** | Ms. Ramya N |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/21 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3006** | **Course Title: High voltage Engineering**<br>**Type of Course: Discipline Elective Theory only** | **L- T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2509 Transmission and Distribution | | | | | |
| **Anti-requisites** | | | | | | |
| **Course Description** | This course introduces the fundamental aspects of insulation breakdown in materials. The course provides adequate content about the design, measurement, and assessment of high voltage electrical equipment, test techniques, and over-voltage phenomena. The course gives an opportunity to understand the concepts by simulation through any open-source software packages available for the simulation and analysis of high voltage circuits. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of High voltage Engineering and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1) Describe the conduction and breakdown mechanism of solid, liquid, gas dielectric materials<br>2) Explain generation of high voltage and current in electrical systems | | | | | |

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| | 3) Discuss the different methods of measurement of high voltage and current<br>4) Identify the overvoltage phenomenon and the testing methodologies for<br>different high voltage equipment. | | | |
| **Course Content:** | | | | |
| **Module 1** | **Conduction and Breakdown** | Assignment | Data Collection | **6 Sessions** |
| Topics: Dielectric breakdown in Gaseous, Liquid and Solid Insulators Mechanism of breakdown of gases<br>–Townsend's criteria, Streamer theory; Paschen's Law, Penning effect, Corona discharges, | | | | |
| **Module 2** | **Generation of High Voltage and current** | Assignment | Simulation | **12 Sessions** |
| Topics: High DC voltage – Rectifier circuit, Voltage doubler circuit, Cockroft-Walton Voltage Multiplier<br>Circuit. High AC voltage – Cascaded Transformer, Series Resonant circuit. High Impulse voltage and current – Impulse generator circuit, Marx circuit, Impulse current generator. | | | | |
| **Module 3** | **Measurements of High Voltages and Currents** | Assignment | Simulation | **12 Sessions** |
| Topics: Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss<br>factor, partial discharge measurements. | | | | |
| **Module 4** | **Overvoltage Phenomenon and Testing of High Voltage** | Case Study | Data Collection | **15 Sessions** |
| Topics: Apparatus Overvoltage due to lightning, Overvoltage due to switching surge, faults or other abnormalities, Methods of Protection against HV surge, Insulation coordination in HV apparatus.<br>Standard test procedures, Laboratory test procedures, Testing of – Insulators, Bushings, Circuit breakers,<br>Isolators, Transformer, Cables, surge diverters. | | | | |
| **Targeted Application & Tools that can be used:**<br>The high voltage engineering specifically finds its application in every other critical manufacturing and processing industries as an integral part of it. Its generation circuit, its test benches and standard test procedures on are topics of higher priority.<br>The Commercially available simulation software tools like MATLAB are utilized as professional tool in the course and students are encouraged to use any open-source software available. | | | | |
| **Text Book**<br>1. M. S. Naidu & V. Kamaraju, "High Voltage Engineering", Tata McGraw Hill Education, 5 th Edition, 2013<br>2. C.L. Wadhwa, "High Voltage Engineering", New Age International Publishers, 3 rd Edition, 2012 | | | | |
| **Online learning resources**<br>1. https://nptel.ac.in/courses/108/104/108104048/<br>2. https://electrical-engineering-portal.com/download-center/books-and-guides/electricity-generation- t-d/lecture-notes-hv-engineering<br>3. Ebook: https://puniversity.informaticsglobal.com<br>4. Seminar topic: https://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=high%20voltage%20en gineering<br>5. Case study: https://www.highvoltageservices.co.uk/category/high-voltage-electrical-case-studies/ | | | | |

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| **Topics relevant to "EMPLOYIBILITY SKILLS":** Statistical evaluation of measurement data, Principle and types of analog and digital voltmeters, ammeters. for Developing **"Employability Skills"** through **Participative Learning Techniques.** This is attained through assessment components mentioned in course handout. | |
| **Catalogue prepared by** | Ms. Ragasudha C P |
| **Recommended by the Board of Studies on** | 12th. BoS held on 27/7/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting, dated 23 /10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3008** | **Course Title: Materials in Electrical Systems**<br>**Type of Course: Professional Elective & Theory only** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | PHY1002:Optoelectronics and Device Physics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course provides a fundamental knowledge of the materials used in electrical systems. The course needs basic concepts of semiconductor physics and chemistry to understand the concepts of properties of electrical materials, PV cells and in batteries. The course is conceptual in nature and develops the ability to identify exact material suitable for specific application. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Materials in Electrical System**s** and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Explain the importance of Electrical properties<br>2. Discuss Power Generation and Light generation concepts.<br>3. Identify the materials used in Energy storage devices.<br>4. Illustrate the materials used in various engineering applications. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Introduction | Quiz | Data Analysis task | | | **09 Session** |
| **Topics:** Economic relevance of the materials sector for electrical applications in the world, Physical basis of electrical conduction, Electrical conductivity in metals, Semiconductors, Intrinsic conduction properties, Extrinsic conduction by doping, Conjugated semiconductors (organic semiconductors), Superconductivity, Ionic conductivity.<br>Introduction Properties and Application of Piezoelectric materials, Eletrostrictive materials, Ferromagnetic materials, Magnetostrictive materials, Shape memory alloys, Electro archeological fluids, Magneto archeological fluids, Smart hydrogels. | | | | | | |
| **Module 2** | Power generation and light generation | Assignment | | | | **09 Session** |
| **Topics:** Power generation by photovoltaic cells, Working principle of solar cells, Materials for solar cells, Potential for power generation, Material trends in photovoltaic cells. Light Generation | | | | | | |

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| by LEDs inorganic LEDs: IR, red, green, blue, UV; Organic LEDs (small molecules and polymer). | | | | |
| **Module 3** | Electric energy storage | Assignment | Presentations | **09 Session** |
| **Topics:** Basics electrochemical reactions, Batteries, Battery structure and function, Traditional materials, Materials development for increased energy density, Fuel cells/electrolysis. | | | | |
| **Module 4** | Materials for power electronics for power control | Quiz | Data Collection and Analysis | **09 Session** |
| **Topics:** Basic Requirements, Power diodes, Types of power devices- Bipolar power devices, Unipolar power devices, Material Trends in power electronics: Si, SiC, GaN, ZnO, C (diamond, etc.) | | | | |

**Targeted Application & Tools that can be used:**
Application Area include all Electrical and Electronics material Manufacturing companies Intel Corporation, Samsung Semiconductor, Texas Instruments Inc. Micron Technology Inc.etc., Professionally Used Software: LabVIEW/MATLAB

**TextBooks**

1. Electrical Engineering Materials Adrianus J Dekker, Phi Learning Publishers
2. Electrical Properties of Materials, 8th Edition by Solymar, L, Oxford University Press New Delhi.
3. Power Semiconductor Devices by Vitezslav Benda, John Gowar and D.A. Grant

**References**

1. Introduction to Electrical Engineering Materials 4th Edn. 2004 Edition by Indulkar C, S. Chand & Company Ltd-New Delhi.
2. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi.
3. Electronic properties of engineering materials by J. D. Livingston

**Online Resources**

1. https://www.youtube.com/watch?v=3W-rOtTc3ek
2. https://www.youtube.com/watch?v=XaId7WR0mGo
3. Ebook:https://puniversity.informaticsglobal.com/search/searchresult.jsp?newsearch=true&qu eryText=Digital%20signal%20processing%20applications
4. Seminar topic: Case study: https://my.eng.utah.edu/~ma5090/topic.htm

**Topics relevant to "EMPLOYABLITY SKILLS"**: Materials for solar cells, Power diodes, Types of power devices Bipolar power devices, Unipolar power devices are for developing **Employability Skills t**hrough **Participative Learning techniques.** This is attained through assessment component mentioned in Course Plan.

**Topics relevant to "ENVIRONMENT AND SUSTAINABLITY":** Battery structure and function, Traditional materials, Materials development for increased energy density.

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| **Catalogue prepared by** | Ms. Sarin M V |
| **Recommended by the Board of Studies on** | BoS No: 12th. BoS held on 27/7/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting, held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3010** | **Course Title: Electrical Estimation and Costing**<br>**Type of Course: Discipline Elective & Theory only** | **L- T-P-C** | 3 | 0 | 0 | 3 |

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| **Version No.** | **2.0** | | | |
| **Course Pre-requisites** | EEE2509 Transmission and Distribution | | | |
| **Anti-requisites** | **NIL** | | | |
| **Course Description** | The purpose of this course is to provide an understanding of the basic concepts, design, and estimation of distribution systems and substations. This course develops and ability to design earthing systems for residential and commercial buildings and discuss practical aspects of condition monitoring and maintenance of various electrical equipment. It enhances learning the testing of various electrical equipment. This course also enhances the analytical abilities through assignments. | | | |
| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of **E**lectrical Estimation and Costing and attain **Employability Skills** through **Problem Solving** methodologies. | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Interpret electrical drawings and understand estimation fundamentals.<br>2. Estimate and costing of the wiring installation of residential and commercial buildings.<br>3. Estimate the material requirements and cost for overhead transmission and distribution lines.<br>4. Estimate the material requirements and cost for substation setup. | | | |
| **Course Content:** | | | | |
| **Module 1** | Standards for estimation | Assignment | Data collection | **10 Session** |
| Topics: Role of National Electric code and IE rules- types of wires and cables – selection of ratings of copper and aluminium wires and underground cables as per IS code– protective devices such as fuses, relays, MCB's and ELCB's - Selection of fuses for motors. Types of fuses. General rules for wiring – determination of number of sub circuits. Determination of ratings of main switch/isolator – DB – Distribution Board –single line diagram using standard electrical signs and symbols of single phase/three phase circuits. | | | | |
| **Module 2** | Wiring installation | Assignment | Data collection and estimation | **12 Session** |
| Topics: Wiring estimation for single phase/three phase residential consumers – schematic layout and diagram – single phase /three phase wiring estimation for small scale industries/offices/commercial building – Electrical Design and Estimation for High rise building. Design of lightning protection of residential buildings. | | | | |
| **Module 3** | Estimation in Transmission and Distribution (T&D) Systems | Assignment | Data collection and estimation | **13 Session** |
| Topics: Overview of T&D Systems- Components: transformers, poles, conductors, insulators., Transmission line configurations and their cost implications., Estimation Techniques- Load calculation and voltage drop considerations, Designing overhead and underground distribution networks. Costing of T&D Projects- Labor and material cost estimation for poles, cables, and transformers, Environmental and regulatory compliance costs. Case Studies- Real-world T&D project estimation (e.g., rural electrification). | | | | |
| **Module 4** | Substation Estimation | Assignment | Data collection and estimation | **10 Session** |
| Topics: Substation equipments – outdoor – indoor substations – layouts – components – selection of HV and EHV power and distribution transformers and switchgears – layout & schematic diagram for (a) 16MVA, 110/11KV outdoor substation (b) 11KV/415V, 63KVA | | | | |

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| outdoor / indoor substations. Earthing – Pipe earthing, Plate earthing, earthmat design - test procedure. |
| **Targeted Application & Tools that can be used:**<br>Application Area is Power System Data collection, Electricity Transmission and Distributed companies, Power Grid and State Electricity Boards |
| **Textbooks**<br>1. Gupta J.B Kataria& Sons -Electrical installation, Estimation & Costing<br>2. Raina&Battacharys, Electrical System Design, Estimation & Costing, Wiley Eastern |
| **References**<br>1. Estimating and Costing by S.K Bhattacharya, Tata McGraw Hill, 3 rd edition, 2006<br>2. National Electric Code, Bureau of Indian Standard Publications<br>3. S.L Uppal&Garg - Khanna publishers. Electrical wiring estimating and costing<br>4. Estimating and Costing by Surjeet Singh, Dhanpat Rai & Co., 2 ndedition, 2003.<br>5. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH, 2 nd edition, 2006.<br>6. ISI, National Electric Code, Bureau of Indian Standard Publications<br>**Online Resources**<br>1. https://nptel.ac.in/courses/108101167<br>2. https://www.scribd.com/document/360113853/ELECTRICAL-ESTIMATION-COSTING-pdf<br>3. https://www.youtube.com/watch?v=D04uxZpgp6M<br>4. https://presiuniv.knimbus.com/user#/home |
| **Topics relevant to "EMPLOYABILITY SKILLS":** Wiring estimation for single phase/three phase residential consumers – schematic layout and diagram – single phase /three phase wiring estimation for small scale industries/offices/commercial building for developing **Employability Skills** through **Problem Solving Methodologies**. This is attained through assessment component mentioned in course handout. |

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| **Catalogue prepared by** | Mr Bishakh Paul |
| **Recommended by the Board of Studies on** | BoS No: 14th, held on 22/02/2022 |
| **Date of Approval by the Academic Council** | 18th Academic Council meeting held on 03/08/22 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3011** | **Course Title: Testing and Commissioning of Electrical Equipment's.**<br>**Type of Course: 1]. Discipline Elective & 2]. Theory only** | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2508 Electrical and Electronics Measurements and Instrumentation<br>EEE2509 Transmission and Distribution<br>EEE2510 Electrical Power Generation and Economics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | Power systems and industrial plants are made up of a variety of electrical drives, transformers, circuit breakers, and other equipment that must be installed, commissioned, and maintained on a regular basis to avoid permanent breakdown. It is required to carry out or supervise the installation, commissioning, and maintenance of various electrical equipment in power stations, substations, and industry. This course will enable to understand the concepts, and principles behind the installation, commissioning, and maintenance of electrical equipment in power stations, substations, and industry. | | | | | |

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| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of Electrical Equipment Testing and Commissioning and attain **Entrepreneurial Skills**through **Participative Learning** techniques. | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to**<br>1. Prepare of maintenance schedule of different equipment and machines<br>2. Interpret various electrical equipment, machines and domestic appliances.<br>3. Select procedure of different types of earthing for different types of electrical installations.<br>4. Distinguish about electrical safety regulations and rules during maintenance | | | |
| **Course Content:** | | | | |
| **Module 1** | Safety Management | **Assignment** | **Case study** | **10 sessions** |
| **Topics:** Objectives, Safety Management during Operation and Maintenance, Clearance and Creepages, Electric Shock, need of Earthing, different methods of Earthing, factors affecting the Earth Resistance, methods of measuring the Earth Resistance, Equipment Earthing and System Grounding, Earthing Procedure - Building installation, Domestic appliances, Industrial premises, earthing of substation, generating station and overhead line. | | | | |
| **Module 2** | Installation of Electrical Equipment | **Assignment** | **Data collection** | **9 sessions** |
| **Topics:** Inspection of Electrical Equipment at site, Storage Electrical Equipment at site, Foundation of Electrical Equipment at site, Alignment of Electrical Machines, Tools/Instruments necessary for installation, technical report, Inspection, storage and handling of transformer, switchgear and motors | | | | |
| **Module 3** | Testing of Transformer, Plant and Equipment | **Assignment** | **Presentation** | **9 sessions** |
| **Topics:** General Requirements for Type, Routine and Special Tests, Measurement of winding resistance; Measurement of voltage ratio and check of voltage vector relationship; Measurement of impedance voltage/short-circuit impedance and load loss; Measurement of no-load loss and current; Measurement of insulation 13 28 resistance; Dielectric tests; Temperature-rise, insulation and HV test, dielectric absorption, switching impulse test. Testing of Current Transformer and Voltage Transformer, power transformer, distribution transformer | | | | |
| **Module 4** | Installation and Commissioning of Rotating Electrical Machines | **Assignment** | **Presentation** | **9 sessions** |
| **Topics:** Degree of protection, cooling system, installation, commissioning and protection of induction motor and rotating electric machine, insulation resistance measurement, site testing and checking, care, services and maintenance of motors, commissioning of synchronous generator, protection and automation | | | | |
| **Targeted Application & Tools that can be used:**<br>Application Area is Power System Data collection, Electricity Transmission and Distributed companies, Power Grid and State Electricity Board**s.** | | | | |
| **Textbooks**<br>1. Rao, S., "Testing, commissioning, operation and maintenance of electrical equipment", 6/E., Khanna Publishers, New Delhi | | | | |
| **References**<br>1. Paul Gill, "Electrical power equipment maintenance and testing", CRC Press, 2008.<br>2. Singh Tarlok, "Installation, commissioning and maintenance of Electrical equipment", S.K. Kataria and Sons, New Delhi,<br>3. Philip Kiameh, "Electrical Equipment Handbook: Troubleshooting and Maintenance", McGrawHill, 2003.<br>4. Relevant Indian Standards (IS Code) and IEEE Standards for-Installation, maintenance and commissioning of electrical equipments/machines.<br>**Online resources:**<br>5. https://www.iimu.ac.in/upload_data/Tender/SpecialConditionsWSequipment1.pdf | | | | |

<table>
<tr><td colspan="8">6. https://www.sciencedirect.com/topics/engineering/commissioning-process<br>7. Rao, S., "Testing, commissioning, operation and maintenance of electrical equipment", 6/E., Khanna Publishers, New Delhi<br>8. https://puniversity.informaticsglobal.com:2229/login.aspx? direct=true&db=nlebk&AN=2706929&site=ehost-live<br>5. https://puniversity.informaticsglobal.com</td></tr>
<tr><td colspan="8">Topics relevant to "ENTREPRENEURIAL SKILLS": Inspection of Electrical Equipment, Earthing Procedure - Building installation inspection of Electrical Equipment, Earthing Procedure - Building installation fordeveloping Entrepreneurial SkillsthroughParticipative Learning techniques. This is attained through the assessment component mentioned in course handout.<br>Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS":Safety Management during Operation and Maintenance, electric tests, insulation and HV test.</td></tr>
<tr><td colspan="2">Catalogue prepared by</td><td colspan="6">Mr. K Sreekanth Reddy</td></tr>
<tr><td colspan="2">Recommended by the Board of Studies on</td><td colspan="6">BoS No: 15th held on 27/7/2022</td></tr>
<tr><td colspan="2">Date of Approval by the Academic Council</td><td colspan="6">18th Academic Council Meeting held on 3/08/2022</td></tr>
</table>

<table>
<tr><td>Course Code: EEE3012</td><td colspan="3">Course Title: Reactive Power Compensation and Management.<br>Type of Course: Discipline Elective & Theory only</td><td>L- T- P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">EEE2509 Transmission and Distribution<br>EEE2510 Electrical Power Generation and Economics</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">This course provides the basic knowledge of compensation techniques, different types of compensation for transmission systems, reactive power coordination, reactive power management on the utility side and it leads to the development of analytical skills for effective power system management.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of Reactive Power Compensation and Management and attain Employability Skills through Problem Solving methodologies.</td></tr>
<tr><td>Course Out Comes</td><td colspan="7">On successful completion of the course the students shall be able to:<br>1. Distinguish the importance of load compensation for different loads<br>2. Illustrate distinct compensation techniques used in transmission lines<br>3. Demonstrate models for reactive power coordination.<br>4. Distinguish demand side reactive power management.<br>5. Distinguish user side reactive power management.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Compensation of loads</td><td>Assignment</td><td colspan="3">Data Collection</td><td colspan="2">6 Sessions</td></tr>
<tr><td colspan="8">Topics: Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples.</td></tr>
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| **Module 2** | Reactive Power Compensation for transmission lines under steady state | Assignment/Case Study | Data collection | **7 Sessions** |
| Topics: Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples Transient state reactive power compensation in transmission systems: Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation – compensation using synchronous condensers – examples | | | | |
| **Module 3** | Reactive Power Coordination | Assignment/Case Study | Data collection | **7 Sessions** |
| Topics: Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency –Harmonics, radio frequency and electromagnetic interferences. | | | | |
| **Module 4** | Demand Side Management | Assignment/Case Study | Simulation/Data Collection | **7 Sessions** |
| Topics: Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels Distribution side Reactive power Management: System losses –loss reduction methods – Reactive power planning – Economics Planning capacitor placement – retrofitting of capacitor banks | | | | |
| **Module 5** | User Side Management | Assignment/Case Study | Simulation/Data Collection | **7 Sessions** |
| Topics: KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors and types of available capacitor, characteristics and Limitations of Reactive power management in electric traction systems and arc furnaces. Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations- furnaces transformer –filter requirements – remedial measures – power factor of an arc furnace | | | | |
| **Targeted Application & Tools that can be used:**<br>Application Area is effective reactive power compensation in real time. Professionally Used Software: MATLAB and Simulink and MI Power. | | | | |
| **TextBooks**<br>1. Reactive power control in Electric power systems by T.J.E. Miller, John Wiley and sons, 1982.<br>2. Reactive power Management by D. M. Tagare, Tata McGraw Hill, 2004. | | | | |
| **References**<br>1. Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just "Reactive Power Compensation: A Practical Guide, April, 2012, Wiley publication.<br>2. Reactive power Management by D. M. Tagare, Tata McGraw Hill, 2004<br>**Online resources**<br>1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119967286<br>2. https://www.cedengineering.com/courses/fundamentals-of-reactive-power-and-voltage-regulation-in-power-systems<br>3. http://www.cbip.org/ExternalFile/REACTIVE%20POWER%20MANAGEMENT.pdf<br>4. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live | | | | |
| **Topics relevant to "EMPLOYABILITY SKILLS"**: Load patterns, basic methods of load shaping, power tariffs, KVAR based tariffs penalties for voltage flickers for developing **Employability skills** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout. | | | | |
| **Catalogue prepared by** | Dr. Snehaprabha T V | | | |
| **Recommended by the Board of Studies on** | BoS No: 14th BoS held on 22/2/22 | | | |

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| **Date of Approval by the Academic Council** | 18th Academic Council Meeting, Dated on 03/08/22 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3013** | **Course Title: VLSI Systems Type of Course: Professional Elective , Theory Only** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE2015 Digital Electronics | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | The course introduces the fabrication and layout techniques necessary to design large scale systems. It improves the knowledge on understanding electrical properties of MOS transistor and analysis of CMOS, CMOS inverters. It also develops the ability to identify the steps which are required for VLSI system design. The course is analytical in nature. The course develops programming skills through Assignments. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of VLSI Systems and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1. Summarize the methodologies for fabricating the ICs.<br>2. Illustrate logic circuits using CMOS and its equivalent layout for fabrication.<br>3. Analyze the delay and power dissipation in logic circuits by analyzing the characteristics of CMOS.<br>4. Apply arithmetic circuits for various applications. | | | | | |
| **Course Content:** | | | | | | |

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| **Module 1** | Overview of VLSI and VHDL | Assignment | Quiz | **No. of Sessions:10** |
| The VLSI design process, Architectural design, logical design, Physical design, layout styles, Full<br>custom, Semi-custom approaches, Introduction Verilog HDL, Gate level, data flow, behavioral modelling | | | | |
| **Module 2** | Introduction to MOS Devices | Assignment | Case study | **No. of Sessions: 12** |
| Introduction to MOS Transistor Theory: nMOS, pMOS Enhancement Transistor, MOSFET as a Switch, Threshold voltage, MOS Device Design Equations, Body effect, Second order effects. MOS<br>Transistor Circuit Model. Stick Diagram, Layout Design Rules. | | | | |
| **Module 3** | Combinational logic Circuits | Mini project | CMOS Design/Programming task | **No. of Sessions: 12** |
| Introduction, Static CMOS Design- Complex Logic Gates, Ratioed Logic, Pass-Transistor Logic, Transmission gate Logic, Dynamic CMOS Logic Design: Dynamic Logic Design Considerations. Speed and Power Dissipation of Dynamic logic, Signal integrity issues, Cascading Dynamic gates. | | | | |
| **Module 4** | Designing arithmetic circuits | Mini project continued | seminar | **No. of Sessions: 11** |

Adders-Ripple carry, Carry-Look ahead, Multiplier using Array based-Ripple carry adder, Carry- Save adder, Multiplier using Tree based-Wallace Tree, Dadda Tree, Booth Multiplier, Squarer.
Modelling of arithmetic circuits using HDL

**Targeted Application & Tools that can be used:**

**Application:** VLSI circuits are used everywhere, including microprocessors in a personal computer, chips in a graphic card, digital camera or camcorder, chips in a cell phone, embedded processors, and safety systems like anti-lock braking systems in an automobile, personal entertainment systems, medical electronic systems etc

**List of Open Source Software/learning website:** HDL

**Text Book**

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated circuits: A design perspective". Second Edition, Prentice Hall of India, 2013.
2. Neil H.E.Weste, David Money Harris, "CMOS VLSI DESIGN: a circuits and systems perspective", Fourth edition, Pearson 2015.

**References**

1. Samir Palnitkar, "Verilog HDL", Prentice Hall, 2010.
2. Sung-Ma Kong, Yusuf Leblebici and Chulwoo Kim, "CMOS digital integrated circuits: analysis and design", 4th edition, McGraw-Hill Education, 2015.

**Online resources:**

1. https://nptel.ac.in/courses/117102060
2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_digital_system.htm
3. Ebook: Analog and Digital VLSI Circuit Design by Panda, Saradindu First edition. New Delhi : Laxmi Publications Pvt Ltd. 2015, https://presiuniv.knimbus.com/user#/home
4. Seminar topic: https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&queryText=Digital%20signal%20processing%20applications
5. Case study: http://users.ece.utexas.edu/~adnan/ecd-summer-05.pdf
6. https://presiuniv.knimbus.com/user#/home

**Topics relevant to "EMPLOYABILITY SKILLS":** Verilog HDL, Signal integrity issues, Modelling of arithmetic circuits using HDL fordeveloping**Employability Skills**through**Participative Learning techniques**. This is attained through assessment component mentioned in Course Plan.

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| **Catalogue prepared by** | Mr. K Sreekanth Reddy |
| **Recommended by the Board of Studies on** | BoS No: 15th BoS held on 27/7/2022 |
| **Date of Approval by the Academic Council** | 18th Academic Council Meeting held on 03/08/2022 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3014** | **Course Title: Digital Signal Processing System**<br>**Type of Course: Discipline Elective, Theory only** | **L- T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2501 Signals and Systems | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | The course emphasis is on theory and methods for digital signal processing including basic principles governing the analysis and design of discrete-time systems as signal processing devices. It also develops knowledge in selection of suitable sensor based on requirement and application. The | | | | | |

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| | course is analytical in nature and needs basic knowledge of mathematical and computing. The course develops programming skills through assignments. | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Digital Signal Processing and attain **Employability Skills** through **Problem Solving** methodologies. | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1. **Describe** the basic concepts of discrete-time signals<br>2. **Apply** DFT for digital signal analysis.<br>3. **Discover** IIR filter for a given specification<br>4. **Compute** FIR filter coefficients for a given specification | | | |
| **Course Content:** | | | | |
| **Module 1** | **Basics of DSP, Fourier Transforms, and Convolution** | Assignment | Quiz | **No. of Sessions:10** |
| Linear convolution of sequences using DFT, Introduction to Circular convolution, Circular convolution-Concentric circle method and Matrix multiplication method, Calculation of linear convolution from circular convolution. | | | | |
| **Module 2** | **FFT Algorithms** | Assignment | Case study | **No. of Sessions: 13** |
| Introduction to FFT, Comparison of FFT with Direct evaluation of the DFT, DIT-algorithm: Radix-2 DIT-FFT algorithm and its problems. DIF-algorithm: Radix-2 DIF-FFT algorithm and its problems, Comparison. IDFT using FFT algorithm. | | | | |
| **Module 3** | **IIR Filter Design and Realizations** | Mini project | Design of a filter/Programming task | **No. of Sessions:** 13 |
| IIR filters –Introduction- characteristics of analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations. | | | | |
| **Module 4** | **FIR Filter Design and Realizations** | Mini project continued | seminar | **No. of Sessions: 10** |
| Sampling method, direct form realizations - Bartlett and Blackmann window functions, Parallel and Lattice structures, General-purpose digital signal processors | | | | |
| **Targeted Application & Tools that can be used:**<br>**Application:** DSP is used primarily in areas of the audio signal, speech processing, RADAR, seismology, audio, SONAR, voice recognition, secure communications, electro-optics, intelligence an array of military applications can benefit from the digital signal processing (DSP) capabilities of programmable logic.<br>**List of Open Source Software/learning website:** NPTEL, MATLAB | | | | |
| **Text Book**<br>1. John G. Proakis, D.G. Manolakis and D.Sharma, "Digital Signal Processing Principles, Algorithms and Applications", 4th edition, Pearson Education.<br>2. Sanjit K. Mitra, Digital Signal Processing, 4th edition.<br>3. (L1) : Lecture notes /PPT | | | | |
| **References**<br>1. Sophocles J. Orfanidis, "Introduction to Signal Processing" 2nd edition, Prentice Hall, Inc, 2010<br>2. Oppenhiem V.A.V and Schaffer R.W, "Discrete – time Signal Processing", 3rd edition, Pearson new international edition, 2014.<br>3. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat, V. K. Aatre, Micro and Smart Systems: Technology and modeling, Willey Publications,2012.<br>4. Lawrence R Rabiner and Bernard Gold, "Theory andData Acquisition and Signal Processing Pearson India Education Services, 2016. | | | | |

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| **Online resources:**<br>1. https://nptel.ac.in/courses/117102060<br>2. https://www.tutorialspoint.com/digital_signal_processing/index.htm<br>3. Ebook: Digital Signal Processing, Regis, Carlos Danilo Miranda, New York : Momentum Press. https://presiuniv.knimbus.com/user#/home<br>4. Seminar topic: https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&queryText= Digital%20signal%20processing%20applications<br>5. Case study: https://www.slideshare.net/VaibhavTayal8/dsp-case-study<br>6. https://presiuniv.knimbus.com/user#/home. |
| **Topics relevant to "EMPLOYABILITY SKILLS":** Design of IIR filters from analog filters, DIF-algorithm for developing **Employability Skills** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout. |

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| **Catalogue prepared by** | Mr. K Sreekanth Reddy |
| **Recommended by the Board of Studies on** | 15th held on 27/7/2022 |
| **Date of Approval by the Academic Council** | 8th Academic Council Meeting held on 3/8/2022 |

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|---|---|---|---|---|---|---|
| **Course Code:** **EEE3015** | **Course Title: Industrial Automation with PLC and SCADA**<br>**Type of Course: Discipline Elective & Theory** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisite** | **NIL** | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course deals with PLC hardware/software and their importance in automation. SCADA deals with communication protocols and real time control of power systems using EMS. The course is both conceptual and analytical in nature. It develops programming and simulation skills. The associated laboratory provides an opportunity to validate the concepts Taught and enhances the ability to visualize the real system performance | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Industrial Automation with PLC and SCADA and attain **Employability Skills** through **Experiential Learning** techniques | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1) Evaluate network protocols that provide interoperability and communication technologies<br>2) Write PLC codes for automation applications requiring special functions.<br>3) Use PLC for an automatic control system confining to standards.<br>4) Apply SCADA for various utilities.<br>5) Verify the theoretical concepts and applications of PLCs by conducting experiments. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Introduction to Programmable | Assignment | List all the PLC applications in industries | | **6 Sessions** | |

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| | Logic Controllers: | | like Siemens, ABB, Schneider Electric | |
| Topics: Advantages & disadvantages of PLC with respect to relay logic, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC. | | | | |
| **Module 2** | PLC Programming Methodologies: | Quiz | Programming | **6 Sessions** |
| Topics: Ladder diagram, STL, functional block diagram, SFC, Instruction List. Creating ladder diagram from process control descriptions, Introduction to IEC61131 international standard for PLC. | | | | |
| **Module 3** | Introduction to SCADA | Assignment | Simulation | **6 Sessions** |
| Topics: Data acquisition system, Evolution of SCADA, Communication Technologies, Monitoring and Supervisory Functions. | | | | |
| **Module 4** | Distributed Control Systems: | Case study | Simulation | **5 Sessions** |
| DCS detail engineering, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface, control, display etc. | | | | |
| **Targeted Application is** **Siemens, ABB, Power-grid, Yokogawa Electric**<br>**Tools that can be used: NI Lab-VIEW , Siemens Step 7-Micro/Win 32, S7-200 PLC** | | | | |
| **Text Books**<br>1. W.Boldon, 'Programmable logic controllers', 5th Edition, Elsevier India Pvt. Ltd., New Delhi, 2011.<br>2. Stuart A.Boyer, "SCADA: 'Supervisory control and Data Acquisition', 4th Edition, ISA, 2010. | | | | |
| **References**<br>1. Robert Radvanovsky, Jacob Brodsky, "Handbook of SCADA/Control Systems Security", 2nd edition, CRC press, 2016.<br>2. G. K. McMillan, Douglas Considine, "Process/Industrial Instruments Hand book", 5th edition, McGraw Hill, New York, 2009.<br>**Online learning resources**<br>1. Case study https://presiuniv.knimbus.com/user#/home<br>2. Seminar https://presiuniv.knimbus.com/user#/home<br>3. https://electrical-engineering-portal.com/resources/plc-programming-training<br>4. https://www.plcacademy.com/<br>5. Ebook:https://electrical-engineering-portal.com/download-center/books-and-guides/electrical-engineering/plc-book | | | | |
| **Topics relevant to development of "EMPLOYABILITY SKILL":** PLC programming, SCADA for developing **Employability Skills** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout. | | | | |
| **Catalogue prepared by** | Ms. Ragasudha C P | | | |
| **Recommended by the Board of Studies on** | BoS No: 15th BoS held on 27/7/22 | | | |
| **Date of Approval by the Academic Council** | 18th Academic Council Meeting No.18, Dated 03/08/22 | | | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3030** | **Course Title: Energy Storage Systems**<br>**Type of Course: Discipline Elective & Theory only** | | **L-T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | | |
| **Course Pre-requisites** | **Nil** | | | | | | |
| **Anti-requisites** | **Nil** | | | | | | |
| **Course Description** | The subject deals with various energy storage technologies, their configurations and working. The course also covers mobile and hybrid storage system used in Electric vehicles. The subject is conceptual and is directly related to Industrial applications. This course gives fair knowledge in various forms of energy and the need for the storage of energy. The course develops critical thinking and programming abilities of students. | | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Energy Storage Systems and attain **Employability Skills** through **Participative Learning** techniques. | | | | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1] Summarize various energy storage technologies.<br>2] Explain different electrical energy storage systems.<br>3] Discuss about mobile and hybrid energy storage devices.<br>4] Describe the energy management with storage systems. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1** | Introduction to energy storage systems | Assignment | Data Collection | **6 Sessions** | | | |
| Introduction to energy storage systems- Role of energy storage systems, applications. Overview of energy storage technologies: Thermal, Mechanical, Chemical, Electrochemical, Electrical. Efficiency of energy storage systems. | | | | | | | |
| **Module 2** | Electrical energy storage | Assignment | Data Collection | **8 Sessions** | | | |
| Electrical energy storage- Batteries, Super capacitors, Superconducting Magnetic Energy Storage (SMES), charging methodologies, SoC, SoH estimation techniques. Hydrogen production and storage, fuel cells. Numerical | | | | | | | |
| **Module 3** | Mobile storage system & Hybrid Energy storage systems | Case Study | Data Collection | **6 Sessions** | | | |
| Mobile storage system: electric vehicle, G2V, V2G.<br>Hybrid Energy storage systems: configurations and applications. | | | | | | | |
| **Module 4** | Storage for renewable energy systems | Case Study | Data Collection | **6Sessions** | | | |
| Storage for renewable energy systems: Solar energy, Wind energy, pumped hydro energy, fuel cells.<br>Energy storage in Microgrid and Smart grid. | | | | | | | |
| **Module 5** | Energy Management with storage systems | Assignment | Programming/Simulation/Data Collection/any other such associated activity | **7Sessions** | | | |

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| Energy Management with storage systems - Increase of energy conversion efficiencies by introducing energy storage<br>Concept of Distributed Energy Storage System (DESS) |
| **Targeted Application & Tools that can be used:** Application areas are in Power sector, Portable electronic devises, Electric and Hybrid Electric Vehicles etc<br><br>**Professionally Used Software: MATLAB/Mi Power.** |
| **Textbooks**<br>1. A. R. Pendse, "Energy Storage Science and Technology", SBS Publishers & Distributors Pvt. Ltd., New Delhi, (ISBN - 13:9789380090122), 2011.<br>2. Energy Storage: Fundamentals, Materials and Applications by Robert Huggins, Springer.<br>**References Books**<br>1. James M. Eyer, Joseph J. Iannucci and Garth P. Corey ", "Energy Storage Benefits and Market Analysis", Sandia National Laboratories, 2004.<br>2. The Electrical Energy Storage by IEC Market Strategy Board.<br>**Online Resources**<br>1. https://www.youtube.com/watchv=j7RaL_XKywk&ab_channel=EnergyConservationandWasteheatRecovery<br>2. https://ieeexplore.ieee.org/document/4635523<br>3. https://www.worldenergy.org/publications/entry/innovation-insights-brief-five-steps-to-energy-storage<br>4. https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=3&sid=15d54a1f-070b-4419-b1d2.<br>5. https://energystorage.org/resources/industry-resources/case-studies/. |
| **Topics relevant to "EMPLYOBILITY SKILLS":** Role of energy storage systems, applications, Energy Management with storage systems for developing **Employability skills** through **Participative Learning techniques.** This is attained through assessment component mentioned in course handout.<br>**Topics relevant to "ENVIRONMENT and SUSTAINABILITY":** Storage for renewable energy systems, Distributed Energy Storage System (DESS) |

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| **Catalogue prepared by** | Ms. Jisha L K |
| **Recommended by the Board of Studies on** | 12th BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

Professional Elective Courses Catalogues;
Track 2: Power and Energy Basket

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|---|---|---|---|---|---|---|
| **Course Code: EEE3400** | **Course Title: Solar Photovoltaic and wind energy systems**<br>**Type of Course: Discipline elective & Theory only** | **L- T-P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |

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| **Course Pre-requisites** | **NIL** | | | |
| **Anti-requisites** | **NIL** | | | |
| **Course Description** | This course provides an understanding of the conversion principles and technology behind Various Solar and Wind Energy Systems. It also examines the issues involved in the integration of various Solar Photovoltaic and wind energy sources with the help of Simulation and their economics for heat, power, and transportation needs. It also develops analytical thinking abilities. | | | |
| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of Solar Photovoltaic and wind energy systems and attain **Employability Skills** through **Participative Learning** techniques. | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1) Summarize the various Global Energy scenarios and issues.<br>2) Explain the working principle of solar energy system components<br>3) Explain the working principle of Wind energy system components<br>4) Summarize about the modelling of Integrated energy systems. | | | |
| **Course Content:** | | | | |
| **Module 1** | Global and National Energy Scenario | Assignment | data analysis task | **12 Sessions** |
| Topics: Overview of conventional & renewable energy sources, need, potential &development of renewable energy sources, Future of Energy Use, Global and Indian Energy scenario, Energy for sustainable development, renewable electricity and key elements, CO2 reduction potential of renewable energy- concept of Hybrid systems. | | | | |
| **Module 2** | Solar Energy: | Paper Presentation | Programming/Simulation | **12 Sessions** |
| Topics: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Solar-Electrical Power Generation, general Solar Photo Voltaic (SVP) system, Different configurations, SPV system components and their characteristics, Stand-Alone and Grid Connected SPV systems | | | | |
| **Module 3** | Wind Energy | Paper Presentation | Programming/Simulation | **11 Sessions** |
| Topics: Wind Energy Conversion, Potential, Nature of the wind, Wind Data and Energy Estimation, Site selection, Types of wind turbines, Wind farms, Wind Generation and Control using DFIG, classification of wind, characteristics, offshore wind energy – Hybrid systems, wind energy potential and installation in India. | | | | |
| **Module 4** | Integrated Energy Systems: | Paper Presentation | Simulation/Data Analysis | **10 Sessions** |
| Topics: Introduction, Integrated Smart infrastructure, Integrated Energy system Modeling, Various Integrated energy schemes, their cost benefit analysis. | | | | |
| **Targeted Application & Tools that can be used:**<br>**Application Area is TATA Solar, Luminous, GE, Siemens, State and Regional load dispatch centres**<br>**Professionally Used Software:** MI Power, MATLAB Simulink | | | | |
| **Text Book(s)**<br>**1:** Renewable Energy- Edited by Godfrey Boyle-oxford university, press, 3rd edition, 2013.<br>**2:** Solar Photovoltaic Power Systems: Principles,Design and Applications, by **Dr. Sundaravadivelu S** (Author), **Mr. Suresh R. Norman** (Author), **Dr. Johnsi Stella I,** Notion Press, 2018.<br>**Reference Book(s)**<br>1. Integrated energy systems modeling--Karlsson, Kenneth Bernard; Skytte, Klaus Morthorst; Published in: DTU International Energy Report 2015 | | | | |

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| 2. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition.<br>**Online Resources**<br>1. https://www.coursera.org/courses?query=solar%20energy<br>2. https://alison.com/courses/engineering/renewable-energy<br>3. https://www.youtube.com/watchv=mh51mAUexK4&list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk&ab_channel=NPTELIITGuwahati<br>4. https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=3&sid=15d54a1f-070b-_4419-b1d2<br>5. https://www.tandfonline.com/doi/full/10.1080/23311916.2016.1189305 |
| **Topics relevant to "EMPLOYABILITY SKILLS":** Solar-Electrical Power Generation, Wind Generation, Wind Data and Energy Estimation for developing **Employability skills** through **Participative Learning techniques.** This is attained through assessment component mentioned in course handout.<br>**Topics relevant to "ENVIRONMENT AND SUSTAINIBILITY":** Over view of conventional & renewable energy sources, need, potential &development of renewable energy sources, Future of Energy Use, Global and Indian Energy scenario, Energy for sustainable development, renewable electricity and key elements, CO2 reduction potential of renewable energy |

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| **Catalogue prepared by** | Mr. Bishakh Paul |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3401** | **Course Title: Electrical Power Utilization**<br>**Type of Course: Professional Elective & Theory Only** | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE1007 Basics of Electrical and Electronics Engineering | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | The purpose of this course is to enable the electrical power utilization, the course develops the ability to identify the importance of Electrical power in various utilities with illumination, heating and welding. The performance characteristics of electrical drives and their deployment with different loading environment. Also, the impact of acceleration, braking, retardation and adhesive weight in electric traction system is attained. The course aids the analytical skills in utility sector. The course also enhances the programming abilities through assignments. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Utilization of Electrical Energy and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Explain the principles and advantages of electric heating and welding methods, and evaluate their applications and efficiencies.<br>2. Explain key illumination concepts, analyze light distribution using polar curves and photometry, and design effective lighting systems. | | | | | |

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| | 3. Apply the principles of electric traction systems and braking methods to analyze train movement and speed-time curves<br>4. Calculate tractive effort, power, and specific energy consumption, and assess the effects of acceleration, braking, and adhesive weight on performance. |

**Course Content:**

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| **Module 1** | Electric Heating and Welding | Assignment | Data Collection | **6 Sessions** |
| Topics: Electric heating: Advantages and methods of electric heating, resistance heating induction heating and dielectric heating: Electric welding: resistance and arc welding, electric welding equipment, comparison between AC and Welding. | | | | |
| **Module 2** | Illumination | Assignment/Case Study | Data collection | **7 Sessions** |
| Topics: Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere. Sources of light: Discharge lamps, MV and SV lamps, basic principles of light control, types and design of lighting and flood lighting. | | | | |
| **Module 3** | Train Mechanics | Assignment/Case Study | Data collection | **7 Sessions** |
| Topics: System of electric traction and track electrification, special features of traction motor, methods of electric braking-plugging, rheostat braking and regenerative braking, mechanics of train movement, speed-time curves for different service. | | | | |
| **Module 4** | Electric Traction | Assignment/Case Study | Simulation/Data Collection/ | **7 Sessions** |
| Topics: 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. | | | | |

**Targeted Application & Tools that can be used:**

Application Area is Power System utilization in real time. Professionally Used Software: MATLAB.

**Text Book:**

1. S Sivarnagaraju, D Srilatha, M Balasubbareddy, "Generation and Utilization of Electrical Energy", Pearson Education India, 1st Edition, 2010.
2. Utilization of Electric Power & Electric Traction. J. B. Gupta. S. K. Kataria & Sons, New Delhi, Latest edition.

**References**

1. N V Suryanarayana, "Utilization of Electrical Power including Electric drives and Electric traction New Age International (P) Limited, Publishers, 1st Edition, 1996.
2. C L Wadhwa, "Generation, Distribution and Utilization of electrical Energy", New Age International (P) Limited, 1st Edition, 1997.
3. Partab, "Art & Science of Utilization of electrical Energy", Dhanpat Rai &Sons 2nd Edition, 2000.
4. E Openshaw Taylor, Orient Longman, "Utilizations of Electric Energy", 1st Edition, 2003.

**Online Resources:**

1. EBook: https://presiuniv.knimbus.com/user#/home
2. https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ee99/
3. 2G59q7SbOts062q7JKtJzxgeKzs3nhqeNOtqqrUd%2bprkWyq99%2bq9eze7Kj30zhqrFP4qyzebbZvorj2.ueLpOLfhuWz44ak2uBV59%2fmPvLX5VW%2fxKR57LOvUbWntk6xraR%2b7ejrefKz7nzkvPOE6srjkPIA&vid=29&sid=5ac3e684-9a30-45af-a5c4-a4c437d65a8c@redis.

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| **Topics relevant to "EMPLOYABILITY SKILLS":** Design of lighting and flood lighting, methods of electric braking-plugging, rheostat braking and regenerative braking for developing **Employability Skills** through **Participative Learning Techniques**. This is attained through assessment component mentioned in Course Plan.<br>**Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS":** Standard Test methods, safety procedure. | |
| **Catalogue prepared by** | **Dr. Nageswara Rao Atyam** |
| **Recommended by the Board of Studies on** | 12th BoS held on 27/7/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3402** | **Course Title: Power System Operation and Control**<br>**Type of Course: Discipline Elective & Theory only** | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | **2.0** | | | | | |
| **Course Pre-requisites** | EEE2509 Transmission and Distribution | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The purpose of this course is to introduce the operation and control of power systems. The course develops analytical ability to study the unit commitment for load dispatch, load frequency control, effective generation in interconnected power systems. The course aids the analytical skills in effective operation of power system. This course develops programming abilities with the help of MATLAB software tools. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Power System Operation and Control and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Demonstrate the unit commitment problem for economic load dispatch.<br>2. Describe the knowledge of LFC of a single Area System.<br>3. Describe the knowledge of LFC of a Two Area System.<br>4. Inspect the usage of energy with limited resources.<br>5. Interpret the interchange in inter connected power systems. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Unit commitment problem and solution for optimal power flow | Assignment | Data Collection | | **10 Sessions** | |
| Topics: Constraints in UCP, UCP solution methods. Priority list method, introduction to Dynamic programming Approach. OPF without inequality constraints, inequality constraints on control variables and dependent variables. | | | | | | |
| **Module 2** | LFC for Single Area System | Assignment/Case Study | Data collection | | **12 Sessions** | |

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| Topics: Definition of control area, single area control, Block diagram representation of an isolated Power System, Steady State analysis, Dynamic Response-Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation, steady state response. | | | | |
| **Module 3** | LFC for Two Area System | Assignment/Case Study | Data collection | **12 Sessions** |
| Topics: Load frequency control of two-area system, uncontrolled case and controlled case, tie-line bias control, steady state representation. Optimal two-area LF control- performance Index and optimal parameter adjustment. Load frequency control and Economic dispatch control, regulation of two generators in parallel. | | | | |
| **Module 4** | Generation based on limited Supply of Energy | Assignment/Case Study | Simulation/Data Collection/ | **10 Sessions** |
| Topics: Take-or-pay fuel supply contract, composite generation production cost function. Solution by gradient search techniques, Hard limits and slack variables, Fuel scheduling by linear programming. PMU – system monitoring, data acquisition and controls – System hardware configurations – SCADA and EMS functions – state estimation problem – measurements and ero | | | | |
| **Targeted Application & Tools that can be used:**<br>Application Area is Power System operation in real time. Professionally Used Software: MATLAB and Simulink and MI Power. | | | | |
| **Text Books**<br>1. Power Generation, Operation and Control - by A.J.WoodandF.Wollenberg, Johnwiley& sons Inc. 1984.<br>2. Modern Power System Analysis - by I.J.Nagrath & D.P.Kothari, Tata McGraw-Hill Publishing Company ltd, 2nd edition. | | | | |
| **Topics relevant to "EMPLOYIBILITY SKILLS":** Load frequency control of two-area system, uncontrolled case and controlled case, tie-line bias control, steady state representation for Developing **"Employability Skills"** through **Participative Learning Techniques.** This is attained through assessment components mentioned in course handout. | | | | |
| **Catalogue prepared by** | Mr Bishakh Paul | | | |
| **Recommended by the Board of Studies on** | 12th BoS held on 27/07/2021 | | | |
| **Date of Approval by the Academic Council** | 16th Academic Council meeting held on 23/10/2021 | | | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3403** | **Course Title: Energy Audit and Demand side Management**<br><br>**Type of Course: Discipline Elective & Theory only** | **L- T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2509 Transmission and Distribution<br>EEE2030 Electrical Power Generation and Economics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | Energy Audit helps to map the flow of energy (in its various forms) across the value chain, highlighting areas for interventions. It also introduces to the methods of evaluating lifetime of machine based on time value money and demand,economic analysis with repect to demand side management. This course is designed to develop analytical ability on the mechanism of energy | | | | | |

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| | audit and the technologies/simulation tools typically employed to undertake an audit exercise, supported by case studies & site visits. | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Energy Audit and Demand side Management and attain **Entrepreneurial Skills** through **Problem Solving** methodologies. | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Discuss the need of energy audit and energy audit methodology.<br>2. Explain audit parameters and working principles of measuring instruments used to measure the parameters.<br>3. Illustrate energy audit of boilers, furnaces, power plant, steam distribution system and compressed air systems.<br>4. Illustrate energy audit HVAC systems, motors, pumps, blowers and cooling towers.<br>5. Explain load management techniques, effects of harmonics, electricity tariff, improvement of power factor and losses in transmission. | | | |
| **Course Content:** | | | | |
| **Module 1** | **Energy Audit :Methodology and Types** | Assignment | Data Collection | **11 Sessions** |
| Topics:<br>Energy Scenarios: Energy Conservation, Energy Audit, Energy Scenarios, Energy Consumption, Energy Security, Energy Strategy, Codes, standards and Legislation.<br>Definition of Energy Audit, Place of Audit, Energy – Audit Methodology, Financial Analysis, Sensitivity Analysis, Project Financing Options, Energy Monitoring and Training. | | | | |
| **Module 2** | **Energy Audit: Boilers & Buildings** | Case Study/ Assignment | Data Collection/ Design | **9 Sessions** |
| Topics:<br>Classification of Boilers, Parts of Boiler, Efficiency of a Boiler, Role of excess Air in Boiler Efficiency, Energy Saving Methods.<br>Energy Audit Applied to Buildings: Energy – Saving Measures in New Buildings, Water Audit, Method of Audit, General Energy – Savings Tips Applicable to New as well as Existing Buildings. | | | | |
| **Module 3** | **Energy Audit of HVAC Systems** | Case study | Data Collection | **11 Sessions** |
| Topics:<br>Introduction to HVAC, Components of Air – Conditioning System, Types of Air – Conditioning Systems, Human Comfort Zone and Psychrometry, Vapour – Compression Refrigeration Cycle, Energy Use Indices, Energy – Saving Measures in HVAC, Star Rating and Labelling by BEE.<br>Electrical-Load Management: Electrical Basics, Electrical Load Management, Variable- Frequency Drives, Harmonics and its Effects, Electricity Tariff, Power Factor. | | | | |
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| **Module 4** | **Energy Audit: Motors, Lighting system and DSM** | Assignment/ Presentation | Data Collection / Estimation | **14 Sessions** |
| **Topics: Energy Audit of Lighting Systems:** Fundamentals of Lighting, Different Lighting Systems, Ballasts, Fixtures (Luminaries), Reflectors, Lenses and Louvres, Lighting Control Systems, Lighting System Audit, Energy Saving Opportunities. Demand side Management: Scope of DSM, Evolution of DSM concept, DSM planning and Implementation, Load management as a DSM strategy, Applications of Load Control, End use energy conservation, Tariff options for DSM. | | | | |
| **Targeted Application & Tools that can be used:**<br><br>Application Area is Power System Data collection, Electricity Transmission and Distributed companies, Power Grid and State Electricity Boards<br>**Professionally Used Software:** Mi Power/ PS CAD | | | | |

**Textbooks:**

1. "Industrial Energy management systems" Array .C, White,Philip S, David R Brown, Hemisphere publishing corporation, New York.
2. "Handbook on Energy Audit "Sonal Desai McGraw Hill 1st Edition, 2015

**References**

**1.** "Energy management "by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.

**Online resources:**

1. https://www.youtube.com/watch?v=iY2YaIlfEGk
2. https://vemu.org/uploads/lecture_notes/03_01_2020_1480276911.pdf
3. https://idoc.pub/documents/anilkumar-km-notes-for-energy-auditing-demand-side-management-unit1-1pdf-klzzqgxxpglg
4. Case study: A Research article onDemand Side Management: Demand Response, Intelligent Energy Systems, and Smart Loads
5. Ebook: https://puniversity.informaticsglobal.com:2069/document/7503335

**Topics relevant to "ENTREPRENEURIAL SKILLS":** The load Management techniques, effects of harmonics, electricity tariff, improvement of power factor and losses in transmission for developing **Entrepreneurial Skills** through **Problem Solving methodologies.** This is attained through assessment component mentioned in course handout.

**Topics relevant to HUMAN VALUES and PROFESSIONAL ETHICS:** Energy- Saving measures in New buildings, Audit, Saving Tips .

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| **Catalogue prepared by**<br>**Catalogue Updated by** | Ms. Ramya N<br><br>Mr. K Sreekanth Reddy |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/21 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3404** | **Course Title: Microgrid Operation and Control**<br>**Type of Course: Discipline Elective & Theory only** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | **EEE2511 Power Electronics** | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The course describes the concept of Microgrid with emphasis on its configuration, characteristics, distributed renewable and non-renewable generation technologies. The course deals with the IEEE standard used for DER Integration I, integration of solar sources and PV control. The course is conceptual in nature and improves analytical skills. | | | | | |
| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of Microgrid Operation and Control and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Outline the significance of microgrid in big utility grid.<br>2. State IEEE standard 1547-2018 while designing the controllers.<br>3. Explain PWM based controllers to extract maximum power from SPV system | | | | | |

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| | 4. Summarize the hierarchical microgrid control | | | |
| **Course Content:** | | | | |
| **Module 1** | Concept of Microgrid | Assignment | Data Analysis | **8 Sessions** |
| Topics: Concept of Microgrid, Distributed generation and Microgrid concept: Introduction, Power System Structure, Traditional Grid, Microgrid definition and characteristics, typical micro grid configuration, distributed renewable energy technologies, non-renewable distributed generation technologies, interconnection of microgrids, technical and economical advantages of micro grid, key challenges, | | | | |
| **Module 2** | DER integration I | Quiz | Data Analysis | **7 Sessions** |
| Topics: IEEE Standard for Interconnection (IEEE Std 1547™-2018 ) : concept of area electric power system, point of common coupling, point of coupling, General interconnection technical specifications and performance Requirements, Reactive power capability and voltage/power control requirement, Voltage and Frequency disturbance ride-through requirements | | | | |
| **Module 3** | DER integration II | Assignment | Simulation | **7 Sessions** |
| Topics: Integration of solar sources: Modeling of the Entire PV Energy Conversion System, PV Controller, EES Controller, Grid Connection Control. Steps of control of entire PV energy system. Integration of wind power: Speed and power relations, Power extracted from the wind, Aerodynamic torque control, Control of a PMSG based wind energy generation system. | | | | |
| **Module 4** | DER integration III | Case study | Programming | **11 Sessions** |
| Topics: Hierarchical Microgrid Control, Local or primary Control : Droop Control, Droop Control in Inverter-based Distributed Generators, performance of primary controller, Secondary Control and Tertiary Control. Centralized and decentralized Energy Management System (EMS) in microgrids | | | | |
| **Targeted Application is** **Power-grid, KPTCL,BHEL.**<br>**Tools that can be used: MATLAB** | | | | |
| **Text Books**<br>1. " H. Lee Willis, Walter G. Scott, 'Distributed Power Generation – Planning and Evaluation', Marcel Decker Press, 2000.<br>2. Robert Lasseter, Paolo Piagi, 'Micro-grid: A Conceptual Solution', PESC 2004, June 2004. | | | | |
| **References**<br>1.M. Godoy Simoes, Felix A. Farret, 'Renewable Energy Systems – Design and Analysis with Induction Generators', CRC press.<br>2.F. Katiraei, M.R. Iravani, 'Transients of a Micro-Grid System with Multiple Distributed Energy Resources', International Conference on Power Systems Transients (IPST'05) in Montreal, Canada on June 19-23, 2005.<br>**Online resources**<br>**Case Study**<br>1. https://www.electricalindia.in/power-distribution-systems-in-india/Assignment<br>2. https://onlinelibrary.wiley.com/doi/full/10.1002/2050-7038.12885<br>3. https://puniversity.informaticsglobal.com | | | | |
| **Topics relevant to "EMPLOYABILITY SKILLS"**: Reactive power capability and voltage/power control requirement for developing **Employability Skills** through **Participative Learning techniques**. This is attained through the assessment component mentioned in course handout..<br>**Topics relevant to "ENVIRONMENT & SUSTTAINABILITY":** Integration of solar sources, PV Energy Conversion System, wind energy generation system. | | | | |
| **Catalogue prepared by** | Ms Jisha L k/Mr Sumit Kumar Jha | | | |
| **Recommended by the Board of Studies on** | 15th BoS held on 27/7/2022 | | | |

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| **Date of Approval by the Academic Council** | 18th Academic Council Meeting held on Dated 03/08/2022 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3405** | **Course Title: Smart Grid Technologies**<br>**Type of Course: Discipline Elective & Theory only** | **L-T-P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2509 Transmission and Distribution<br>EEE2030 Electrical Power Generation and Economics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The purpose of this course is to enable to realize the need for smart grid architecture and role of information and communication technology (ICT) in smart grid. The course needs basic knowledge of power generation, transmission and distribution scheme. The course is both conceptual and analytical in nature and help students to develop critical thinking abilities in building simulation models through projects and case studies/ Assignments. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Smart Grid Technologies and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1: Compare the concepts of traditional grid to Smart Grid.<br>2: Discuss the aspects of communication and information technologies in Smart grid<br>3: Explain the key components of Smart metering and related communication protocols.<br>4: Discuss the components of modern substation and Distribution management system<br>5: Distinguish different types of Energy storage Technologies in Smart Grid | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Basic Concepts of Smart Grid | Assignment | Data collection Task | **4 Sessions** | | |
| Topics:<br>**Definitions of SG – SG Domains – Functionalities of SG –ICT in SG – Issues and Challenges in SG – Characteristics of SG – Overview of technologies required for smart grid** | | | | | | |
| **Module 2** | Communication and information technology in Smart Grid and smart metering. | Assignment | Data collection task | **14 Sessions** | | |
| Topics: Data communication -Dedicated and shared communication channels -Switching techniques- Communication channels - Layered architecture and protocols.<br>Smart metering – Smart Meters-Overview -Communications infrastructure and protocols for smart metering – Demand side Management | | | | | | |
| **Module 3** | Distribution Automation and DMS | Simulation Project/ programming/Case study | Data Analysis | **10 Sessions** | | |
| Topics: Distribution automation equipment - Introduction -Substation automation equipment, Faults in distribution systems, Voltage regulation<br>Distribution Management Systems –Introduction, SCADA, Modelling and analysis tools, Applications of DMS | | | | | | |
| **Module 4** | Energy Storage Technologies in SG. | Case study / Presentation | Data collection | **4 Sessions** | | |

Topics: Energy Storage system – Introduction –Application areas of Energy storage systems- Different Energy storage technologies.

**Targeted Application & Tools that can be used:**
Application Area is Power System Data collection, Electricity Transmission and Distributed companies, Power Grid and State Electricity Boards
Professionally Used Software: Mi Power/ PS CAD, NexGrid

**Textbook Book(s)**

1. "Smart Grid Technologies and Applications" JanakaEkanayake et al, Wiley 2012
2. Smart Grid: Fundamentals Of Design And Analysis by James Momoh, John Wiley, 2015.

**Reference Book(s)**

1. Kundur P., „Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
2. Pai M A, „Computer Techniques in Power System Analysis", Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007 "Gonen"

**Web Resources:**

1. https://onlinecourses.nptel.ac.in/noc19_ee64/preview
2. https://npti.gov.in/smart-grid-technologies
3. https://nmcdn.io/e186d21f8c7946a19faed23c3da2f0da/8273a55233334806bb7a7189b8794fba/files/e-learning-center/Smart-Grid-Curriculum-Unit1.pdf
4. **https://www.youtube.com/watch?v=KgVFJnmJvKk&list=PLLy_2iUCG87D59Bc8Jqfqt43LvPC0KgC&ab_channel=IITRoorkeeJuly2018**
5. https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=3&sid=15d54a1f-070b-4419-b1d2
6. https://www.cs.cmu.edu/~jmartins/smart.html
7. Ebook: https://presiuniv.knimbus.com/user#/home

**Topics relevant to "EMPLOYABILITY SKILLS":** Substation automation equipment, Faults in distribution systems, Voltage regulation for developing **Employability Skills** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

**Topics relevant to development of "ENIVIRONMENT AND SUSTAINABILITY":** Different Energy storage technologies.

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| **Catalogue prepared by** | Ms. Ramya N |
| **Recommended by the Board of Studies on** | 12th. BoS held on 27/7/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3406** | **Course Title: Big Data Analytics in Power System**<br><br>**Type of Course: Discipline Elective &Theory only** | **L-T-P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2509 Transmission and Distribution<br>EEE2030 Electrical Power Generation and Economics | | | | | |
| **Anti-requisites** | **Nil** | | | | | |

<table>
<tr><td>Course Description</td><td colspan="4">This course introduces power system developments that lead to high data collection. The internet of things relies on a vast number of smart machines connected without human intervention in a smart grid scenario. The course identifies and analyses the various sources of big data used in general and in power systems; the importance of data in analytics in smart grid communication; an emphasis on optimization techniques; data mining techniques used in distribution systems; and power system severity prediction using big data and machine learning. Critical thinking and analysis are taught. Assignments boost programming and simulation skills.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Big Data Analytics in Power System and attain Employability Skills through Participative Learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:<br>1. Identify the various sources of data in power system.<br>2. Explain the role of big data in smart grid communications.<br>3. Explain the concept of optimization of big data in electric power systems.<br>4. Describe the various data mining techniques to optimize the big data in power system.<br>5. Describe the severity prediction of power system by using Big data and machine learning.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Role of Big Data Analytics in Power System Application</td><td>Assignment</td><td>QUIZ/True or FALSE Type</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Introduction Big Data, Big Data: Why and Where, General Applications of Big Data, Characteristics of Big Data and Dimensions of Scalability. Big Data Role in Power System, Sources of Big Data in Power System, Big Data Characteristics in Power System, Important applications of Big Data in Power System Sector.</td></tr>
<tr><td>Module 2</td><td>Big Data in Smart Grid communications</td><td>Case Study</td><td>Data collection of Local distribution systems and data analysis.</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Introduction, The Grid Modernization, The Grid Interconnection with the Internet of Things, Data Traffic Pattern in a Smart Grid Environment, The Massive Flow of Information in a Smart Scenario, The Volume of Generated Data in a Smart Distribution System, Intelligent Data Collection Devices in Smart Grid: PMU: An Intelligent Data Collection Device in Smart Grid, Role of PMU in Smart Grid , Emerging Trends and BIg Data Analytics at Distribution level Grid , D PMUs: Design and Prototyping, Data Science Pertaining to field of Smart Grid , Smart Grid Use Cases, Analytics in Smart Grids. Tools and Technologies for Smart Grid.</td></tr>
<tr><td>Module 3</td><td>Optimization Techniques of Big Data in Electric Power Systems</td><td>Assignment</td><td>Digital Report</td><td>10 Sessions</td></tr>
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| Topics: Big Data Optimization in Electric Power Systems: Introduction, Background, Scientometric Analysis of Big Data, Big Data and Power Systems, Optimization Techniques Used in the Big Data Analysis. | | | | |
| **Module 4** | Data - Mining Methods in Distribution system. | Assignment | Technical Seminar | **10 Sessions** |
| Topics: Introduction, Transmission and Distribution System Losses, Electricity Theft Methods, Data Mining and Electricity Theft, Issues and Directions in Electricity Theft-Related Data-Mining Research. | | | | |
| **Module 5** | Role of Big Data in Contingency Analysis | Case Study | Programming/ Simulation, Data Collection, Data analysis and prediction | **5 Sessions** |
| Topics: Introduction, Concept of Load Flow Studies, Contingency analysis, Data Processing and Preprocessing, Prediction of Severity of the System. | | | | |
| **Targeted Application & Tools that can be used:** Professionally Used Software: MATLAB/Simulink/MI-Power/Python/R/Excel/HADOOP/Weka/Tensor Flow/AML/BigML. | | | | |
| **Text Book**<br>1. Big Data Application in Power Systems, by Reza Arghandeh (Editor), Yuxun Zhou (Editor), Elsevier Science (27 November 2017) | | | | |
| **References**<br>1. Big Data Analytics in Future Power Systems, by Ahmed F. Zobaa, Trevor J. Bihl, 2020 by CRC Press.<br>2. Smart Electrical and Mechanical Systems, by Rakesh Sehgal, Neeraj Gupta, Anuradha Tomar, Academic Press, 2022, ISBN 978-0-323-90789-7 | | | | |
| **Online Resources:**<br>1. EBook:https://energyinformatics.springeropen.com/articles/10.1186/s42162-018-0007-5<br>2. Case study: EBook: https://presiuniv.knimbus.com/user#/home<br>3. Case study: https://www.sciencedirect.com/science/article/pii/B9780323907897010010 | | | | |
| **Topics relevant to development of "EMPLOYABILITY SKILLS":** Smart Distribution System and interpret the collected data for the different time zones for developing **Employability skills** through **Participative Learning techniques.** This is attained through assessment component mentioned in course handout. | | | | |
| **Catalogue prepared by** | Mr. Ravi V Angadi | | | |
| **Recommended by the Board of Studies on** | BoS No: 14th BoS held on 22/2/22 | | | |
| **Date of Approval by the Academic Council** | 18th Academic Council Meeting held on 03/08/2022 | | | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3407** | **Course Title: Energy Storage Systems**<br>**Type of Course: Discipline Elective & Theory only** | | **L-T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | | |
| **Course Pre-requisites** | **Nil** | | | | | | |
| **Anti-requisites** | **Nil** | | | | | | |
| **Course Description** | The subject deals with various energy storage technologies, their configurations and working. The course also covers mobile and hybrid storage system used in Electric vehicles. The subject is conceptual and is directly related to Industrial applications. This course gives fair knowledge in various forms of energy and the need for the storage of energy. The course develops critical thinking and programming abilities of students. | | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Energy Storage Systems and attain **Employability Skills** through **Participative Learning** techniques. | | | | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1] Summarize various energy storage technologies.<br>2] Explain different electrical energy storage systems.<br>3] Discuss about mobile and hybrid energy storage devices.<br>4] Describe the energy management with storage systems. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1** | Introduction to energy storage systems | Assignment | Data Collection | | **6 Sessions** | | |
| Introduction to energy storage systems- Role of energy storage systems, applications. Overview of energy storage technologies: Thermal, Mechanical, Chemical, Electrochemical, Electrical. Efficiency of energy storage systems. | | | | | | | |
| **Module 2** | Electrical energy storage | Assignment | Data Collection | | **8 Sessions** | | |
| Electrical energy storage- Batteries, Super capacitors, Superconducting Magnetic Energy Storage (SMES), charging methodologies, SoC, SoH estimation techniques. Hydrogen production and storage, fuel cells. Numerical | | | | | | | |
| **Module 3** | Mobile storage system & Hybrid Energy storage systems | Case Study | Data Collection | | **6 Sessions** | | |
| Mobile storage system: electric vehicle, G2V, V2G.<br>Hybrid Energy storage systems: configurations and applications. | | | | | | | |
| **Module 4** | Storage for renewable energy systems | Case Study | Data Collection | | **6Sessions** | | |
| Storage for renewable energy systems: Solar energy, Wind energy, pumped hydro energy, fuel cells.<br>Energy storage in Microgrid and Smart grid. | | | | | | | |
| **Module 5** | Energy Management with storage systems | Assignment | Programming/Simulation/Data Collection/any other such associated activity | | **7Sessions** | | |

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| Energy Management with storage systems - Increase of energy conversion efficiencies by introducing energy storage<br>Concept of Distributed Energy Storage System (DESS) |
| **Targeted Application & Tools that can be used:** Application areas are in Power sector, Portable electronic devises, Electric and Hybrid Electric Vehicles etc<br>**Professionally Used Software: MATLAB/Mi Power.** |
| **Textbooks**<br>2. A. R. Pendse, "Energy Storage Science and Technology", SBS Publishers & Distributors Pvt. Ltd., New Delhi, (ISBN - 13:9789380090122), 2011.<br>3. Energy Storage: Fundamentals, Materials and Applications by Robert Huggins, Springer.<br>**References Books**<br>2. James M. Eyer, Joseph J. Iannucci and Garth P. Corey ", "Energy Storage Benefits and Market Analysis", Sandia National Laboratories, 2004.<br>3. The Electrical Energy Storage by IEC Market Strategy Board.<br>**Online Resources**<br>2. https://www.youtube.com/watchv=j7RaL_XKywk&ab_channel=EnergyConservationandWasteheatRecovery<br>3. https://ieeexplore.ieee.org/document/4635523<br>4. https://www.worldenergy.org/publications/entry/innovation-insights-brief-five-steps-to-energy-storage<br>5. https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=3&sid=15d54a1f-070b-4419-b1d2.<br>6. https://energystorage.org/resources/industry-resources/case-studies/. |
| **Topics relevant to "EMPLYOBILITY SKILLS":** Role of energy storage systems, applications, Energy Management with storage systems for developing **Employability skills** through **Participative Learning techniques.** This is attained through assessment component mentioned in course handout.<br>**Topics relevant to "ENVIRONMENT and SUSTAINABILITY":** Storage for renewable energy systems, Distributed Energy Storage System (DESS) |

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| **Catalogue prepared by** | Ms. Jisha L K |
| **Recommended by the Board of Studies on** | 12th BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3408** | **Course Title: Electrical Distribution System**<br>**Type of Course: Program Core and Theory only** | **L- T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE1007 Basics of Electrical and Electronics Engineering | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | The course teaches electrical power distribution. The course covers supply system and distribution practises, load characteristics and load modelling, distribution feeders, voltage drop and power loss calculations, substation equipment, location and grounding, protection, system planning, and automation. Critical thinking and analysis are also taught. Improve design and simulation skills in the course with AutoCAD, MATLAB, MiPower, and other current tools. | | | | | |

<table>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Electrical Distribution System and attain Skill Development through Participative Learning methodologies.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:<br>1. Determine the various factors associated with the distribution systems.<br>2. Sketch the Single line diagram of various types of Substations.<br>3. Calculate the voltage drop for the given feeder system.<br>4. Identify the basic requirements of protection scheme and automation system.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Distribution Systems</td><td>Assignment</td><td>Programming</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Introduction, supply systems, the distribution systems, load characteristics and load modelling:Loads and Load Characteristics, Various factors, Relation Between Load and Loss Factor: A Simplified Approach, Load Growth and Diversified Demands, Load Modeling, Load Growth and Forecasting.</td></tr>
<tr><td>Module 2</td><td>Substations Equipment, Location and Grounding</td><td>Assignment</td><td>Design a SLD of SS using CAD Software.</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Introduction, Substation Components, Symbols for Equipment in Sub-Stations, Classification of Sub-Stations, Comparison between Outdoor and Indoor Sub-Stations, Bus-Bar Arrangements in Sub-Stations, Key Diagram of 66/11 kV Sub-Station, Key Diagram of 11kV/400 V Indoor Sub-Station, Gas Insulated Substation (GIS), Grounding and Earth Connections and Earthing System.</td></tr>
<tr><td>Module 3</td><td>Distribution Feeders</td><td>Assignment</td><td>Case Study</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Introduction, Primary and Secondary Distribution, Distribution Substation Location and Planning, Feeder Loading and Voltage-Drop Considerations, Voltage-Drop in Feeder Lines with Different Loadings, primary and secondary distribution networks and Design Considerations. Numerical examples on voltage droop in feeder.</td></tr>
<tr><td>Module 4</td><td>Protection & Distribution system Automation</td><td>Assignment</td><td>Programming/Simulation</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Introduction, Basic Requirements, and Overcurrent Protection: Fuses, Circuit Breakers, Protective Relays and Relaying, Coordination Between Different Protective Devices. Distribution Automation: Basic Definitions, Project Planning, Communication, Sensors, Supervisory Control and Data Acquisition (SCADA), Consumer Information Service (CIS), Geographical Information System (GIS), Automatic Meter Reading (AMR) & Automation Systems.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:<br>Various industries/ organization like KPTCL, HESCOM, BESCOM, CHESCOM, GESCOM, MESCOM and other states government and private sector working in the field of Power distribution analysis and protection system. Professionally Used Software: Mi Power/ ETAP/ MATLAB/PSCADA/Power World Simulator/PSSE.</td></tr>
<tr><td colspan="5">Text Books<br>1. Electric Power Distribution – by A.S. Pabla, Tata McGraw–hill Publishing Company, 6th edition, 1997<br>2. Electric Power Distribution systems- by VKamaraju, Tata McGraw–hill Publishing company, 2009.</td></tr>
<tr><td colspan="5">References</td></tr>
</table>

1. Electric Power Distribution system, Engineering – by TuranGonen, McGraw–hill Book Company.
2. Principles of Power System- by S. Chand Publishers (Revised Edition)
3. William H. Kersting, Distribution System Modeling and Analysis, CRC Press
4. Anthony J. Pansini, 'Guide to Electrical Power Distribution Systems, The Fairmont Press

**online learning resources**

9. EBook: https://presiuniv.knimbus.com/user#/home
10. Seminar: https://onlinecourses.nptel.ac.in/noc19_ee62/
11. Case Study:https://www.emerald.com/insight/content/doi/10.1108/eb010130/pdfplus/html
12. https://www.emerald.com/insight/content/doi/10.1108/COMPEL-12-2016-0586/pdfplus/html

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| **Topics relevant to "SKILL DEVELOPMENT":** | Various types of Distribution Modelling and applications for **Skill Development** through **Participative Learning**. This is attained through assessment component mentioned in course handout. |
| **Catalogue prepared by** | **Mr. Ravi V Angadi** |
| **Recommended by the Board of Studies on** | BoS No: 15th BoS held on 27/7/22 |
| **Date of Approval by the Academic Council** | 18th Academic Council Meeting held on 03/8/22 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3409** | **Course Title: Power Market and Policy**<br>**Type of Course: Discipline Elective and Theory only** | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | **1.0** | | | | | |
| **Course Pre-requisites** | EEE2030 Electrical Power Generation and Economics<br>EEE2509 Transmission and Distribution | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course explores the economics of electricity markets, pricing structures, regulatory frameworks, and environmental policies. It aims to provide students with a comprehensive understanding of how electricity markets operate and the economic principles that underpin them. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Power Market and Energy policies and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Understand the structure and functioning of electricity markets.<br>2. Describe the economic principles, regulatory frameworks and various agreements of electricity market.<br>3. Explain the market design and financial instruments in energy market.<br>4. Understand environmental policies impact on energy markets. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Introduction : Electricity Markets, Structure and Pricing | Assignment | Data Collection | **10 Sessions** | | |

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| Topics: Fundamental concepts of electricity markets, structure and operation, historical context of electricity markets, transition of regulated monopolies to competitive markets, key terminology in market, different market structures - monopoly, oligopoly, competitive markets, implications for pricing, pricing mechanisms – cost based pricing, market-based pricing, and demand response in price setting. | | | | |
| **Module 2** | Economic Principles and Regulatory Frameworks | Assignment/Case Study | Data collection | **12 Sessions** |
| Topics: Overview of economic theories of electricity markets, supply and demand dynamics, price elasticity, and market equilibrium, real-world electricity market scenarios, regulatory environment governing electricity markets, roles of government agencies, regulatory bodies, and international agreements in market operations and competition. | | | | |
| **Module 3** | Electricity Market Design and Financial Instruments | Assignment/Case Study | Data collection | **12 Sessions** |
| Topics: Analysis of market design, role of market clearing mechanisms, capacity markets, and ancillary services, different market designs, financial instruments for electricity trading, contracts, options, and swaps, concept of market risk. | | | | |
| **Module 4** | Renewable Energy Integration and Environmental Policies | Assignment/Case Study | Data Collection | **11 Sessions** |
| Topics: Challenges and opportunities associated with integrating renewable energy sources in electricity markets, policies promoting renewable energy sources, analysis of environmental policies affecting electricity generation and consumption, carbon pricing, emissions trading systems, and renewable portfolio standards, market behavior and investment decisions. | | | | |
| **Targeted Application & Tools that can be used:**<br>Application Area is energy market in real time. Professionally Used Software: POMATO and NemSight. | | | | |
| **Text Books**<br>1. Power System Economics: Designing Markets for Electricity by Steven Stoft.<br>2. Electricity Markets: Pricing, Structures and Economics by Chris Harris.<br>3. Energy Policy and the Environment: A Global Perspective by J.R. Moroney.<br>4. The Economics of Electricity Markets by Marija Ilic and Ljupco Kocarev. | | | | |
| **Topics relevant to "EMPLOYIBILITY SKILLS":** Pricing mechanisms, regulatory environment governing electricity markets, Analysis of market design, financial instruments for electricity trading for Developing **"Employability Skills"** through **Participative Learning Techniques.** This is attained through assessment components mentioned in course handout. | | | | |
| **Catalogue prepared by** | Dr. D P Somashekar | | | |
| **Recommended by the Board of Studies on** | | | | |
| **Date of Approval by the Academic Council** | | | | |

Professional Elective Courses (PEC)

Track 3: Automotive Electronics Basket

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|---|---|---|---|---|---|---|
| **Course Code: EEE3500** | **Course Title: Electric Vehicle Technology** | **L-T- P-C** | 3 | 0 | 0 | 3 |

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|---|---|---|---|---|---|---|
| | **Type of Course: 1]. Discipline Elective, 2]. Theory only** | | | | | |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE1007 Basics of Electrical and Electronics Engineering | | | | | |
| **Anti-requisites** | NIL | | | | | |
| **Course Description** | This course introduces the fundamental concepts, principles, analysis and design of hybrid and electric vehicles. This course helps students to understand vehicle mechanics and working of Electric Vehicles and recent trends. The course enables them to analyze different power converter topology used for electric vehicle applications. Also, it provides the ability to develop the electric propulsion unit and its control for application of electric vehicles through assignments. The course is both conceptual and analytical in nature and needs fair knowledge of mathematical and computing. The course develops the critical thinking and analytical skills. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Electric Vehicles and attain **Entrepreneurial Skills** through **Participative Learning** techniques. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Describe the fundamental laws and vehicle mechanics.<br>2. Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.<br>3. Analyze DC and AC drive topologies used for electric vehicle application.<br>4. Discuss different energy storage technologies used for hybrid electric vehicles and their control. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Introduction and Vehicle Fundamentals | Assignment | Computation and Data Analysis | **of Sessions: 6** | | |
| Introduction : Environmental Impact and History of Modern Transportation ,Vehicle fundamentals: General Description of Vehicle Movement, Vehicle Resistance, dynamic equation, tractive force Determination; vehicle parameters and performance metrics. | | | | | | |
| **Module 2** | Electric and Hybrid Electric Vehicles | Quiz | Data collection and Analysis | **of Sessions: 10** | | |
| Electric Vehicles: Architecture of an electric vehicle, essentials and performance of electric vehicles – Traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations<br>Hybrid electric drivetrains: Concepts, architecture, design, control strategies, merits and demerits, Sizing of major components. | | | | | | |
| **Module 3** | Electric Propulsion Systems | Case study | Simulation and data analysis | **No. of Sessions:8** | | |
| Electric Propulsion Systems: DC motor drives, induction motor drives and permanent magnet motor drives, switched and synchronous reluctance | | | | | | |
| **Module 4** | Energy storage Devices | Assignment | Data collection | **No. of Sessions:8** | | |
| Energy storage Devices: Electrochemical batteries – Reactions, thermodynamic voltage, lead-acid batteries, nickel based batteries, lithium based batteries, flywheel and ultra-capacitors, Battery management systems. | | | | | | |
| **Targeted Application & Tools that can be used:**<br>Application: Automotive industry.<br>Software tools: Matlab-Simulink | | | | | | |
| **Text Book**<br>1.Mehrdad Ehsani, YiminGao, sebastien E. Gay and Ali Emadi, —Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design‖, CRC Press, 2009. | | | | | | |

2. Iqbal Husain, —Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2011, Second Edition.

**References**


1. James Larminie and John Loury, —Electric Vehicle Technology-Explained‖, John Wiley & Sons Ltd., 2003, Second Edition.
2. C.C. Chan and K.T. Chanu Modern Electric Vehicle Technology, OXFORD University, 2011
3. Sheldon S. Williamson,- Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer,2013
4. Chris Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011, Second Edition


**Online resources:**

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://nptel.ac.in/courses/108/106/108106170/
3. IEEE Explore - School of Engineering
4. https://www.coursera.org/learn/electric-vehicles-mobility
5. Seminar:https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&queryText=ELECTRIC%20VEHICLES
6. Video: https://www.youtube.com/watch?v=GHGXy_sjbgQ
7. Text book of Electric and Hybrid Vehicles : Power Sources, Models, Sustainability, Infrastructure and the Market, Gianfranco Pistoia, 1st ed. Amsterdam : Elsevier. 2010 https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=0&sid=52da4e6e-8813-45d5-87f9-73b9f493f358%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=342445&db=nlebk

**Case Study:**

I. https://www.simpli.com/answers
II. https://www.upgrad.com/ev_technology/iit-delhi
III. https://www.coursera.org/

**Topics relevant to "ENTREPRENEURIAL SKILLS":** Vehicle fundamentals, total tractive effort calculation and design of drive train for different vehicle architectures for developing **Entrepreneurial Skills** through **Participative Learning techniques.** This is attained through assessment component mentioned in course handout.

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| **Catalogue prepared by** | Ms. Ragasudha C P |
| **Recommended by the Board of Studies on** | BoS No: 14th BoS held on 22/2/2022 |
| **Date of Approval by the Academic Council** | 18th Academic Council meeting held on 3/8/2022 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3501** | **Course Title: Battery Management Systems**<br>**Type of Course: Discipline Elective & Theory only** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | **NIL** | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course will provide a firm foundation on the architecture and functioning of battery-management-system, how Lithium-ion batteries work and how to model their behavior mathematically. It also gives an exposure to the role of battery management system in Electric Vehicles. The course is of analytic type which involves building the equivalent circuit models of batteries and learning various algorithms. The course develops analytical and problem-solving abilities. | | | | | |

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| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of Battery Management Systems and attain **Entrepreneurial Skills** through **Problem Solving** methodologies. | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1. Summarize the basic components and functionality of the Battery Management System<br>2. Discuss various requirements and topologies of Battery Management System.<br>3. Explain various algorithms used in Battery Management System<br>4. Describe the Battery Management System of Electric Vehicles.<br>5. Describe the function of battery in electric vehicle application. | | | |
| **Course Content:** | | | | |
| **Module 1** | Introduction to Battery Management Systems | Assignment | Data Analysis | **6 Sessions** |
| **Topics:** Introduction to Battery Management Systems (BMS), important terminology used to describe battery cells, Architecture of BMS, Classification of BMS, principles of operation of standard electrochemical battery cells. | | | | |
| **Module 2** | Lithium-ion cells | | | **8 Sessions** |
| **Topics:** Lithium-ion cells - Advantages of Lithium-ion cells over standard electrochemical battery cells, primary components of Lithium-ion cells, and their working. Equivalent circuit model Lithium – ion cells and the simulation | | | | |
| **Module 3** | BMS requirements & BMS Topologies | Assignment | Problem Solving | **6 Sessions** |
| **Topics:** BMS requirements - Requirements for sensing and high-voltage control, requirements for protection, interface, performance management, and diagnostics, BMS Topologies - Distributed topology, modular topology and centralised topology | | | | |
| **Module 4** | Algorithms used in BMS | Assignment | Problem Solving | **8 Sessions** |
| **Topics:** Algorithms used in BMS - Cell Balancing Algorithm, Communication Algorithms, Battery Pack Balancing and Power Estimation, numerical | | | | |
| **Module 5** | BMS in Electric Vehicles | Assignment | Problem Solving | **6 Sessions** |
| **Topics:** BMS in Electric Vehicles- Functions of BMS in EVs and HEVs, IoT-Based Battery Management System for EVs | | | | |

**Targeted Application & Tools that can be used:**

BMS is an integral part of smart phones, EVs and HEVs, Laptops etc.

Software tools: Matlab/Simulink can be used to model and test BMS model.

**TextBooks**

1. Davide Andrea, "Battery management Systems for Large Lithium-Ion Battery Packs", Artech House, 2010.
2. Battery Management Systems, Volume I: Battery Modeling **by Gregory L. Plett**

**References**

1. Iqbal Hussain, "Electric and Hybrid Vehicles-Design Fundamentals", CRC Press, Second Edition, 2011.
2. Chris Mi, MA Masrur, and D W Gao, "Hybrid Electric Vehicles- Principles and Applications with Practical Perspectives", Wiley, 2011
3. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles; Fundamentals Theory and Design", Second Edition, CRC Press.

**Online resources:**

1. https://puniversity.informaticsglobal.com/openFullText.html?DP:2232/cgi-bin/koha/opac-

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| detail.plbiblionumber=8072&query_desc=kw%2Cwrdl%3A%20Electronic%20Devices%20and%20Circuits<br>2. https://www.coursera.org/learn/battery-management-systems<br>3. https://www.youtube.com/watch?v=MZyY1dpka7c<br>4. https://www.youtube.com/watch?v=jFMvphaEiJs |
| **Topics relevant to " ENTREPRENEURIAL SKILLS"**: BMS in Electric Vehicles, Functions of BMS in EVs and HEVs, IoT-Based Battery Management Systems for EVs for developing **Entrepreneurial Skills** through **Problem Solving** methodologies**.** This is attained through assessment components mentioned in the course handout.<br>**Topics relevant to "ENVIRONMENT AND SUSTAINABILITY"**: Battery cells, Lithium-ion cells, Battery Pack Balancing and Power Estimation. |

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| **Catalogue prepared by** | Ms. Ramya N |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code:**<br>**EEE3502** | **Course Title: Automotive Embedded Systems**<br>**Type of Course:**<br>**Discipline Elective Theory** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE2506 Microprocessor and Microcontrollers<br>EEE2015 Digital Electronics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course gives an introduction to embedded systems design and implementation and provides the fundamental skill to assemble the hardware components, program using software and interface with other devices. This course offers a range of topics of immediate relevance to industry. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Automotive Embedded Systems and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes** | On successful completion of this course the students shall be able to:<br>1. Identify the Embedded system components.<br>2. Discuss the various technological aspects of embedded systems.<br>3. Illustrate software aspects and programming concepts to the design of Embedded System.<br>4. Demonstrate the interfacing subsystems with external systems. | | | | | |
| **Course Content:** | | | | | | |
| Module 1 | Concept of Embedded System Design | Assignment | Data Analysis | 6 Sessions | | |
| **Topics:** Components, classification, skills required. Embedded Micro controller cores: Architecture of 6808 and 6811. Embedded Memories ROM variants, RAM | | | | | | |
| Module 2 | Technological Aspects of Embedded System | Assignment | Problem Solving | 10 Sessions | | |
| **Topics:** Applications of embedded system: Examples of Embedded systems SOC for bar code scanner. Interfacing between analog and digital blocks, Signal conditioning, digital signal | | | | | | |

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| processing, DAC & ADC interfacing, Sample & hold, multiplexer interface Internal ADC interfacing (excluding 6805 & 6812) | | | | |
| Module 3 | Design Trade Offs | Assignment | Problem Solving | 8 Sessions |
| **Topics:** Data Acquisition System and Signal conditioning using DSP, Issues in embedded system design. Design challenge, design technology, trade-offs. Thermal considerations | | | | |
| Module 4 | Embedded Systems and Subsystem interfacing | Assignment | Quiz | 12 Sessions |
| **Topics:** Real time programming Languages, operating systems. Programming concepts and embedded programming in C. Round Robin, Round Robin with interrupts, function queue-scheduling architecture.<br>Subsystem interfacing: With external systems user interfacing, Serial I/O devices, Parallel port interfaces: Input switches, Key boards and Memory interfacing. | | | | |
| **Targeted Application & Tools that can be used:**<br>Application Area is Aerospace and defense electronics, Robotics, Automotive, broadcast and entertainment, consumer and internet appliances, Data Imaging, Data Communications, Telecommunications and Mobile data infrastructure Industries.<br>Professionally Used Software: MP LAB, Visual Studio, PROTEUS SOFTWARE,AVR STUDIO SOFTWARE,ATMEGA16 | | | | |
| **TextBooks:**<br>1. "Embedded Microcomputer systems: Real time interfacing" Valvano J.W, Cengage Learning, 2nd Edition.<br>2. "Embedded System, Architecture, Programming and Design" Raj Kamal TMH, 2nd Edition 2008. | | | | |
| **References**<br>1. "The Art of Designing Embedded systems" Jack Ganssle Newnes 2 nd Edition, 2008.<br>2. A Unified Hardware/Software Introduction, Frank Vahid, Tony Givargis Wiley student edition 2002.<br>**Online resources:**<br>1. https://skill-lync.com/electrical-engineering-courses/introduction-automotive-embedded- systems-autosar/about<br>2. https://dl.acm.org/doi/10.5555/1523336<br>3. https://cse.buffalo.edu/~bina/cse321/fall2015/Automotive-embedded-systems.pdf<br>4. Seminar:https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&qu eryText=op%20amps<br>5. Video: https://www.youtube.com/watch?v=yfl7lSZU5pg.<br>6. Ebook: https://d1.amobbs.com/bbs_upload782111/files_38/ourdev_629261ASTZIF.pdf.<br>7. https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=0&sid=52da4e6e-8813- 45d5-87f9-<br>8. 73b9f493f358%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=342445&db=nlebk<br>9. Case Study: https://www.skill-lync.com/embedded<br>10. https://community.ruggedboard.com/embedded/training<br>11. https://in.seekweb.com/search/quick_results | | | | |
| **Topics relevant to "EMPLOYABILITY SKILLS"**: Applications of embedded system, Embedded systems SOC for bar code scanner, Interfacing between analog and digital blocks for developing **Employability skills** through **Participative Learning techniques.** This is attained through assessment component mentioned in course handout. | | | | |

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| **Catalogue prepared by** | Dr. Snehaprabha T V |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/21 |
| **Date of Approval by the** | 16th Academic Council Meeting held on 23/10/21 |

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| **Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3503** | **Course Title: Power Electronics Applications for Electrical Vehicles**<br><br>**Type of Course: Discipline Elective & Theory only** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE3001 ELECTRIC DRIVES | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | The course includes an overview of system architectures of EV's and system dynamic modeling and control at levels appropriate to determine requirements, also this course introduces a concept of design and control of power converters for electric drive vehicles, also enables to know the various drives used for EV's and energy management in EV's. The course develops an analytical skills and enhances the programming/Simulink modeling abilities through assignments. | | | | | |
| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of Power Electronics Applications for Electrical Vehicles and attain **Entrepreneurial Skills** through **Problem Solving** methodologies. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1] Explain the various technologies are associated with EV's.<br>2] Describe the architectures of HEV, PHEV and EV's.<br>3] Analyze the modelling of DC-DC converter systems for EV's.<br>4] Describe the AC Motor drive operation for EV's<br>5] Analyze the electrical circuit modelling of Battery system. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | An Overview of Power Electronics in EV's | Assignment | QUIZ/True or FALSE Type | **No. of Sessions: 7** | | |
| Topics: Introduction, Multidisciplinary Technologies (Body Design, Batteries, Electric Propulsion, Intelligent Energy Management), EV Propulsion ( Motors, Power Converters, Electronic Controllers), Battery Charging, Power Accessories ( Temperature Control Unit, Power Steering, Auxiliary Power Converter Unit. Hybrid Electric Vehicles. | | | | | | |
| **Module 2** | System overview | Assignment | Data Collection rating of various Electric Vehicles | **No. of Sessions:7** | | |
| Topics: Vehicle dynamics, Architectures of hybrid (HEV), plug-in hybrid (PHEV) and electric vehicles (EV), Rating and sizing of drivetrain components. | | | | | | |
| **Module 3** | Bidirectional DC-DC converters | Assignment | Modeling and simulations of DC-DC Converter. | **No. of Sessions: 8** | | |
| Topics: Introduction, Introduction to switched-mode power converters, isolated and non-isolated converters, Steady-state operation, analysis and simulations, Modeling of losses and efficiency. | | | | | | |
| **Module 4** | Inverter Based AC Motor Drives | Assignment | Modeling and simulations | **No. of Sessions: 8** | | |
| Topics: An introduction to AC machine operation and models, Permanent magnet synchronous machine, Induction machine, DC-to-AC inverter operation and controls, advanced control techniques, AC drive modeling. | | | | | | |

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| **Module 5** | Energy Management Strategies | Assignment | Modeling and simulations of battery systems | **No. of Sessions:8** |

Topics: An introduction to battery electro- chemistry, Types and characteristics of battery cells, energy, power, cycle life, calendar life, cost, Cell charge/discharge characteristics, electrical circuit modeling, Battery management system, cell balancing, Modeling battery systems.

**Targeted Application & Tools that can be used:**

The major targeted applications of the course is extended to various fields such as mainly Automotive electrical and electronic systems, commercial, industrial, residential, telecommunication, transportation, utility systems and Aerospace etc. In case of automotive electronics, the electrically-generated systems are used in automobiles such as road vehicles like telematics, in-car entertainment systems, and so on. The need to control engines of automobiles originated in automotive electronics for proper controlling and conversion. Professionally Used Software: MATLAB/Simulink

**Text Book**

1. Ehsani, Mehrdad, Yimin Gao, Stefano Longo, and Kambiz Ebrahimi, "Modern electric, hybrid electric, and fuel cell vehicles", CRC press, 2018, 3rd Edition.
2. Haitham Abu-Rub, Mariusz Malinowski, Kamal Al-Haddad, "Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications",Wiley Publishers, June 2014.

**References**

1. Yangsheng Xu, Jingyu Yan, Huiihuan Qian and Tin Lun Lam, "Hybrid Electric Vehicle Design and Control: Intelligent Omni directional Hybrids", Mc-Graw Hill Education, 2014.
2. R. Erickson, D. Maksimovic, Fundamentals of Power Electronics, Springer 2001 (Chapters 1-5); on-line access available from CU network.
3. Evaluation of the 2010 Toyota Prius Hybrid Electric Drive System, Oak Ridge National Lab report.
4. Davide Andrea, Battery Management Systems for Large Lithium-Ion Battery Packs, Artech House, 2010.
5. C.Mi, M.A.Masrur, D.W.Gao, Hybrid Electric Vehicles, Wiley 2011.

**Online Resources:**

1.Ebook: https://puniversity.informaticsglobal.com:2282/ehost/ebookviewer/ebook/bmxlYmtfXzE2NjQ0OF9fQU41?sid=5ac3e684-9a30-45af-a5c4-a4c437d65a8c@redis&vid=3&format=EB

2.Casestudy: https://puniversity.informaticsglobal.com:2282/ehost/ebookviewer/ebook/bmxlYmtfXzE2NjYwNV9fQU41?sid=5ac3e684-9a30-45af-a5c4-a4c437d65a8c@redis&vid=4&format=EB

3. Seminar: https://puniversity.informaticsglobal.com/menu
4. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ee18/
5. https://www.elprocus.com/power-electronics-in-automotive-applications/
6. https://www.energy.gov/eere/vehicles/power-electronics-research-and-development

**Topics relevant to "ENTREPRENEURIAL SKILLS":** The Vehicle dynamics, Architectures of hybrid (HEV), plug-in hybrid (PHEV) and electric vehicles (EV), Rating and sizing of drivetrain components **Entrepreneurial Skills** through **Problem Solving methodologies.** This is attained through the assessment component mentioned in the course handout.

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| **Catalogue prepared by** | Mr. Ravi V Angadi & Mr. K Sreekanth Reddy |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3504** | **Course Title: AI Techniques for EVs and HEVs**<br>**Type of Course: Discipline Elective &Theory only** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | Data structures and Algorithms | | | | | |
| **Course Description** | The purpose of this course is to introduce about the battery management techniques using IoT. This course helps students to understand different AI techniques and algorithms used for the control of Electric Vehicles. Each topic will be developed in logical progression with up-to-date information. The course is both conceptual and analytical in nature and needs basic knowledge of mathematics. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through projects**.** | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of AI Techniques for EVs and HEVs and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1] Summarize IoT Based Battery Management System and type of batteries for EV and HEV.<br>2] Identify the features of different AI Techniques used for the control operation of EVs.<br>3] Explain AI Based BLDC drive for optimum operation of EV<br>4] Explain the Modelling of three phase converters for EV applications. | | | | | |
| **Module 1** | IoT-Based Battery Management System for Electric Vehicle | Assignment | Programming Task | **08 Sessions** | | |
| **Topics:**<br>Introduction, Battery configuration, Types of batteries for HEV and Electric Vehicles (EV), Functional Blocks of Battery Management Systems, IoT based BMS. | | | | | | |
| **Module 2** | AI Techniques | Quiz | Simulation / control algorithm implementation | **08 Sessions** | | |
| **Topics:**<br>Basics of Artificial Intelligence, Advantages of Artificial Intelligence in EV, Fuzzy Control, Genetic Algorithm, Artificial Neural Network-Based Controller. | | | | | | |
| **Module 3** | AI Techniques for optimum operation of EV. | Project work | Simulation | **09 Sessions** | | |
| **Topics:**<br>Brushless DC Motor, Closed-Loop Model of BLDC Motor Drive, BLDC Motor Speed Controller with ANN Based PID Controller, Analysis of Different Speed Controllers, Basic Components of an Active Magnetic Bearing (AMB). | | | | | | |
| **Module 4** | Modeling and Analysis of Three-Phase Power Converters for EV Applications | Project work | Simulation | **09 Sessions** | | |
| **Topics:**<br>Introduction, Overall System Modeling, Mathematical Modeling and Analysis of Small Signal Modeling, Modeling of HESS and its Analysis. | | | | | | |
| **Targeted Application & Tools that can be used:**<br>Artificial intelligence is first reflected in the electrical design for electrical equipment, automation control, automotive Fault Diagnosis, EV manufacturing companies, state estimation of permanent | | | | | | |

magnet synchronous motors, harmonic reduction, research and development, image processing and signal processing.
**Professionally Used Software:** MATLAB / Simulink

**Text Books:**
T1. Artificial Intelligent Techniques for Electric and Hybrid Electric Vehicles, Chitra A, P.Sanjeevikumar, and S. Himavathi, Wiley-2020.
T2.S. Rajasekaran and G. A. V. Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms"- PHI, New Delhi,2003.

**References**
R1. Hybrid vehicles and hybrid electric vehicles new developments, energy management and emerging technologies, Hilda bridges, Nova Publishers, New York.
R2. D. E. Goldberg," Genetic Algorithms"- Addison Wesley 1999.

**Web Resources:**
1. https://www.researchgate.net/publication/342918764_Artificial_Intelligent_Techniques_for_Electric_and_Hybrid_Electric_Vehicles
2. https://www.mdpi.com/2076-3417/8/2/187/pdf
3. https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&queryText=op%20amps
4. Video: https://www.youtube.com/watch?v=DRvgoSFj0PE.
5. **https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=0&sid=52da4e6e881345d587f973b9f493f358%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=342445&db=nlebk**
6. **https://www.wiley.com/enus/Artificial+Intelligent+Techniques+for+Electric+and+Hybrid+Electric+Vehicles-p-9781119681908.**
7. **Case Study:**
**https://www.ijcrt.org**

**Topics relevant to "EMPLOYABILITY SKILLS"** : Fuzzy Control, Genetic Algorithm, Artificial Neural Network-Based Controller for developing **Employability skills** through **Participative Learning techniques.** This is attained through assessment component mentioned in course handout.
**Topics relevant to "ENIVIRONMENT AND SUSTAINABILITY":** Types of batteries for HEV and Electric Vehicles (EV)

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| **Catalogue prepared by** | Mr. K Sreekanth Reddy<br>Mr. Sarin M V |
| **Recommended by the Board of Studies on** | 12th BoS held on 27/7/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3505** | **Course Title: Introduction to Micro Electro Mechanical Systems**<br>**Type of Course: Discipline Elective & Theory only** | **L- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | **NIL** | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course intends to provide basic knowledge of fabrication of different microelectronics system. The course deals with various sensors and actuators. It enhances mathematical modelling ability and programming skills to interface the hardware models of MEMS. The course develops the analytical thinking ability. | | | | | |

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| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Introduction to Micro Electro Mechanical Systems and attain **Employability Skills** through **Participative Learning** techniques. | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Explain the semiconductors and solid mechanics to fabricate MEMS devices.<br>2. Classify various sensors and actuators,<br>3. Describe different MEMS devices.<br>4. Associate MEMS sensors and actuators using Intelli-Site software. | | | |
| **Course Content:** | | | | |
| **Module 1** | INTRODUCTION | Quiz | Data Analysis task | **08 Sessions** |
| Topics : Energy Domains and Transducers- Sensors and Actuators- Definition of MEMS.-MEMS devices. Silicon as a MEMS material - mechanical properties of silicon. Mechanical components in MEMS. Design concepts of mechanical components, Working Principles of Microsystems- Engineering Science for Microsystems design and Fabrication Technologies | | | | |
| **Module 2** | **SENSORS AND ACTUATORS-I** | Case Study | Data Collection and Analysis | **08 Sessions** |
| Topics : Electrostatic sensors – Applications – Interdigitated Finger capacitor – Comb drive devices– Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators | | | | |
| **Module 3** | **SENSORS AND ACTUATORS-II** | Assignment | Data Collection and Analysis | **08 Sessions** |
| Topics :Piezoresistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators Applications to Inertia , Acoustic, Tactile and Flow sensors. | | | | |
| **Module 4** | Electrostatic Actuation | Assignment | Modelling and Simulation | **09 Sessions** |
| **Topics:** Electrostatic Forces, Normal Force, Tangential Force, Fringe Effects, Electrostatic Driving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Step and Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency. | | | | |
| **Targeted Application & Tools that can be used:** The applications areas include various design and manufacture jobs on various Electrical , mechanical and Electronics companies.<br>**Software Tool- :** IntelliSuite Software | | | | |
| **Textbooks:**<br>1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012, 2nd edition<br>2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000. 3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002. | | | | |
| **References**<br>1. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.<br>2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.<br>3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002, 2nd edition<br>4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005, 1st edition.<br>5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010. | | | | |
| **Online Resources**<br>1. https://nptel.ac.in/courses/117/105/117105082/<br>2. **Seminar:** https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&queryText=op%20amps<br>3. **Case Study:** https://ieeexplore.ieee.org/abstract/document/4745240.<br>4. **Ebook:** https://puniversity.informaticsglobal.com | | | | |

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| **Topics relevant to "EMPLOYABILITY SKILLS":** Engineering Science for Microsystems design and Fabrication Technologies for developing **Employability Skills** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout. | |
| **Catalogue prepared by** | Ms. Ramya K |
| **Recommended by the Board of Studies on** | BoS No: 12th. BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | Academic counselling meeting No.16, Dated 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3506** | **Course Title: Sensors and Transducers**<br>**Type of Course: Discipline Elective, Theory Only** | **L- T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | Nil | | | | | |
| **Anti-requisites** | Nil | | | | | |
| **Course Description** | This course imparts the knowledge of fundamentals, classification and characterization of various sensors and transducers. It also develops knowledge in selection of suitable sensor based on requirement and application. The course is both conceptual and analytical in nature and needs basic knowledge of mathematical and computing. The course develops the critical thinking and analytical skills. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Sensors, Transducers and their applications and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Explain the usage of gauges and transducers to measure pressure, direction and distance.<br>2. Discuss the use of light transducers and other devices used for the measurement of electromagnetic radiations.<br>3. Explain the working of different temperature sensing devices.<br>4. Discuss the principles and applications of various electronic sensors | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Gauges & Transducers | Assignment | Quiz | **12 Sessions** | | |
| Resistance strain gauge, piezoelectric pressure gauge, characteristics. Electronic circuits for strain gauge, load cells. Interferometer, Fibre-optic methods. Pressure gauges Aneroid capacitance pressure<br>gauge, ionization gauge, Using the transducers for applications, Capacitor plate sensor, Inductive sensors, LVDT Accelerometer systems, rotation sensors drag cup, devices, piezoelectric devices. Rotary encoders. | | | | | | |
| **Module 2** | Light radiation | Assignment | Data collection | **12 Sessions** | | |
| Colour temperature, light flux, photo sensors, photomultiplier, photo resistor and photoconductors, photodiodes, phototransistors, photovoltaic devices, fiber-optic applications, light transducer, solid-<br>state, transducers liquid crystal devices. | | | | | | |
| **Module 3** | Heat and Temperature | Assignment | Developing a measurement system | **11 Sessions** | | |

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| Bimetallic strip, Bourdon temperature gauge, thermocouples, Resistance thermometers, thermistors,<br>PTC thermistors, bolometer, Pyroelectric detector. | | | | |
| **Module 4** | Electronic Sensors | Case study | Application | **10 sessions** |
| Proximity detectors – Inductive and capacitive, ultrasonic, photo beam detectors Reed switch, magnet<br>and Hall-effect units, Doppler detectors, liquid level detectors, flow sensors, smoke sensors. | | | | |
| **Targeted Application & Tools that can be used:**<br>**Application:** Various types of Industries, Robotics, Automation of machines<br>**List of Software/learning website:** NPTEL, Multisim, PSpice, LabVIEW (NI) | | | | |
| **Text Books**<br>1. Doebelin E O, —Measurement Systems, Application and Design , McGraw Hill, Fifth Edition, 2004<br>2. Ian R Sinclair, —Sensors and Transducers‖, Third Edition, Newness publishers, 2001. | | | | |
| **References**<br>1. R 1. Jack P Holman, —Experimental Methods for Engineers‖, Seventh Edition, McGraw Hill, USA, 2001.<br>2. Robert G Seippel, —Transducers, Sensors and Detectors‖, Reston Publishing Company, USA, 1983.<br>**Online resources**<br>1. https://nptel.ac.in/courses/108/108/108108147/<br>2. https://www.coursera.org/learn/sensors-circuit-interface<br>https://www.udemy.com/course/sensors-sensor-fundamentals<br>3. **Seminar:** https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&qeryText=op%20amps<br>4. **Video:** https://www.youtube.com/watch?v=nSeW3R2hr1A.<br>5. **E-book:** https://puniversity.informaticsglobal.com | | | | |
| **Topics relevant to "EMPLOYABILITY SKILLS":** knowledge of various types of sensors for developing **Employability Skills** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.. | | | | |
| **Catalogue prepared by** | Ms. Ragasudha C P | | | |
| **Recommended by the Board of Studies on** | BoS No: 14th. BoS held on 22/2/2022 | | | |
| **Date of Approval by the Academic Council** | 18th Academic Council meeting held on 3/8/22 | | | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3507** | **Course Title: Advanced Drive Assistant Systems**<br>**Type of Course: Discipline Elective & Theory only** | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | **1.0** | | | | | |
| **Course Pre-requisites** | EEE2009 Analog Electronics Circuits<br>EEE2503 DC Machines and Special Machines<br>EEE2504 AC Machines | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course provides an in-depth exploration of Advanced Driver Assistance Systems (ADAS) and Autonomous Vehicles (AVs), focusing on their technologies, functionalities, regulatory frameworks, and future trends. The course draws on multiple authoritative sources to provide a comprehensive understanding of the course. | | | | | |

<table>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Power Market and Energy policies and attain Employability Skills through Participative Learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:<br>1. Understand the fundamental technologies behind Advanced Driver Assistance Systems (ADAS) and Autonomous Vehicles (AVs).<br>2. Discuss the functionalities and components that contribute to vehicle automation.<br>3. Explain the machine learning and control systems for autonomous driving systems.<br>4. Describe safety assurance methodologies for autonomous driving technologies.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Autonomous Vehicles</td><td>Assignment</td><td>Data Collection</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Concept of autonomous vehicles, historical evolution of AV technology, various levels of automation, SAE standards and consider the societal implications of AV adoption, including potential benefits and challenges, Basic components of ADAS and AVs, sensors, actuators, and control units.</td></tr>
<tr><td>Module 2</td><td>Sensor Technologies</td><td>Assignment/Case Study</td><td>Data collection</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Topics: Types of sensors, Cameras-Types (monocular vs. stereo), role in object detection, lane keeping, and traffic sign recognition. Radar-Functionality, advantages in distance measurement and velocity detection, applications in adaptive cruise control and collision avoidance, LiDAR-Principles of operation, 3D maps of surroundings, and obstacle detection.</td></tr>
<tr><td>Module 3</td><td>Control Systems for Autonomous Driving and Machine Learning in Autonomous Vehicles</td><td>Assignment/Case Study</td><td>Data collection</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Topics: Control theory to vehicle dynamics, PID control, trajectory planning, motion control strategies, various driving conditions, machine learning techniques used in autonomous vehicles, neural networks for perception tasks, reinforcement learning for decision-making processes.</td></tr>
<tr><td>Module 4</td><td>Vehicle Automation Levels and Future Trends of ADAS</td><td>Assignment/Case Study</td><td>Simulation/Data Collection/</td><td>11 Sessions</td></tr>
<tr><td colspan="5">Topics: SAE levels of driving automation from Level 0 (no automation) to Level 5 (full automation). Examination of the implications, challenges, driver monitoring systems, user interfaces designs, safety assurance methodologies for AVs, testing protocols, simulation environments, real-world validation techniques for safe operation, fail-safe mechanisms and redundancy strategies.<br>Future Trends in ADAS and AV Technology: vehicle-to-everything (V2X) communication technologies, advancements in AI technologies for navigation and perception, and integration with smart infrastructure.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:<br>Application Areas are Autonomous Valet Parking systems and Navigation System in real Professionally Used Software: MATLAB software.</td></tr>
<tr><td colspan="5">Text Books<br>1. Autonomous Vehicles: The Road to Driverless Cars by Chris Urmson and Laura S. Desch.</td></tr>
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| 2. Advanced Driver Assistance Systems: A Comprehensive Guide by Ravendra Singh and R. K. Gupta.<br>3. Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms by Nikolaus Correll et al.<br>4. Vehicle Automation edited by Gereon Meyer and Sven Beiker.<br>5. Fundamentals of Autonomous Vehicles by Francisco M. M. Ramos et al. | |
| **Topics relevant to "EMPLOYIBILITY SKILLS":** Trajectory planning, Machine Learning Techniques, Communication technologies, for Developing **"Employability Skills"** through **Participative Learning Techniques.** This is attained through assessment components mentioned in course handout. | |
| **Catalogue prepared by** | Dr. D P Somashekar |
| **Recommended by the Board of Studies on** | |
| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|---|
| **Course Code: EEE3508** | **Course Title: Electric Mobility and Charging Infrastructure**<br>**Type of Course: Program Core and Theory** | | **L-T- P- C** | **3** | **0** | 0 | **3** |
| **Version No.** | **1.0** | | | | | | |
| **Course Pre-requisites** | NA | | | | | | |
| **Anti-requisites** | **Nil** | | | | | | |
| **Course Description** | The Course is designed with an objective of giving an overview of Electric Mobility and Charging Infrastructure The Course discusses the introduction to energy storage and charging methods. The Course is conceptual and analytical in nature and needs fair knowledge of mathematical computation. The course develops the critical thinking and analytical skills . | | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Electric mobility and Charging infrastructure and attain **Entrepreneurial Skill** through **Problem solving** methodologies. | | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Outline the Energy Storage requirements of Electric Vehicles and recent trends<br>2. Explain the Concepts of Charging methods and its technology for Electric vehicle.<br>3. Describe about the types of charges and its types.<br>4.Explain the concepts of EVSE communication and its usage.<br>4. Summarize the types charging communication | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1** | **Introduction** | Assignment | Any Energy Storage Device | **10 Sessions** | | | |
| **Topics:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles - Battery based energy storage - Fuel Cell based energy storage - Super Capacitor based energy storage - Fly wheel based energy storage. | | | | | | | |
| **Module 2** | **Charging methods** | Assignment | Data collection and Analysis | **8 Sessions** | | | |
| **Topics:** Electric Vehicle Technology and Charging Equipment's - Basic charging Block Diagram of Charger - Difference between Slow charger and fast charger - Slow charger design rating - Fast charger design rating. | | | | | | | |

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| **Module 3** | **Types of chargers** | Assignment | Case study | **10 Sessions** |
| **Topics:** AC charging and DC charging - On board and off board charger specification - Type of Mode of charger Mode 2, Mode 3 and Mode 4 - EVSE associated charging time calculation - Selection and sizing of fast and slow charger (AC & DC) - AC Pile Charger, DC Pile Charger. | | | | |
| **Module 4** | **Evse communication** | Assignment | Computation and Data Analysis | **8 Sessions** |
| Topics: EVSE Power Module selection and technical specification - Selection of EVSE Communication Protocol (PLC / Ethernet / Modbus/ CAN Module ) - Communication gateway - Specification of open charge point protocol (OCCP 1.6/2.0) - Bharat DC001 & AC001 Charger specification - Communication Interface between charger and CMS ( Central Management System) - Payment apps. | | | | |
| **Module 5** | **Charging communication** | Assignment | Computation and Data Analysis | **9 Sessions** |
| Topics: Selection of AC charger type-1 , type -2 and type -3 - Communication between AC charger and EV - Selection of DC charger connector GB/T, CHAdeMO, CCS-1 and CSS-2 - Communication methodology of DC fast chargers. | | | | |

**Targeted Application & Tools that can be used:**

The Course is designed with an objective of giving an overview of Electric Vehicles and battery technology. The Course discusses the history, configurations of Electric vehicles and the electrical characteristics of batteries. The Course is conceptual and analytical in nature and needs fair knowledge of mathematical computation. The course develops the critical thinking and analytical skills.

**Text Book**

1. "Vehicle Inspection Handbook", American Association of Motor Vehicle Administrators.
2. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles_ Fundamentals, Theory, and Design, Second Edition", CRC Press, 2010.
3. Amir Khajepour, Saber Fallah and Avesta Goodarzi, "Electric and Hybrid Vehicles Technologies, Modeling and Control: A Mechatronic Approach", John Wiley & Sons Ltd, 2014.
1.

**References**

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017
3. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, MehrdadEhsaniYiminGao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018.

**Online learning resources:**

1. EBook:https://presiuniv.knimbus.com/user#/home
2. https://elearn.nptel.ac.in/shop/executive-workshops/execedu-closed/https-elearn-nptel-ac-in-shop-iit-workshops-ongoing-cpoem-cohort-4/?v=c86ee0d9d7ed
3. https://archive.nptel.ac.in/courses/108/106/108106170/
4. https://elearn.nptel.ac.in/shop/iit-workshops/completed/emobility-and-electric-vehicle-engineering-cohort-3/?v=c86ee0d9d7ed

**Topics relevant to 'SKILL DEVELOPMENT':** Analysis of battery storage systems and their Application, the role of storage devices and controller for the application of Electric vehicles. Topics relevant to 'ENVIRONMENT AND SUSTAINABILITY': AC charger type-1 , type -2 and type -3 - Communication between AC charger and EV - Selection of DC charger connector GB/T, CHAdeMO, CCS-1 and CSS-2 - Communication methodology of DC fast chargers

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| **Catalogue prepared by** | Mr. Sunil Kumar A V |
| **Recommended by the Board of Studies on** | |

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| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code:** **EEE3509** | **Course Title: Vehicle Electrification and Renewable Integration** **Type of Course: Program Core and Theory** | **L-T- P- C** | **3** | **0** | 0 | **3** |
| **Version No.** | **1.0** | | | | | |
| **Course Pre-requisites** | Nil | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | The key aspect of vehicle Electrification and Renewable integration systems is the efficiency and effectiveness of energy transfer. This course equips students to understand and analyse the various modes and equipment used in electric vehicle charging. It covers the classification, sizing, and standards of chargers, including communication protocols and their role in ensuring interoperability. Additionally, the course addresses the planning and implementation of public charging infrastructure, along with emerging technologies and future trends, such as wireless charging and the integration of renewable energy sources. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Vehicles Electrification and Renewable Integration and attain **Entrepreneurial Skills** through **Problem Solving** methodologies. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Understand the various components of Electric vehicle charging system<br>2. Comprehend the different types of Electric vehicle chargers and their standards.<br>3. Interpret the various communication protocols used in Electric vehicle charging.<br>4. Familiarize with the recent trends in Electric vehicle charging. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | **Introduction to EV charging** | Assignment | Computation and Data Analysis | **10 Sessions** | | |
| **Topics:** Introduction to EV charging Electric Vehicle Charging; Charging Modes; Electric Vehicle Supply Equipment (EVSE): Types, Components of EV Battery Chargers; Challenges in Electric Vehicle Charging. | | | | | | |
| **Module 2** | **Charger sizing and standards** | Assignment | Data collection and Analysis | **11 Sessions** | | |
| **Topics:** Charger sizing and standards Charger Classification; Slow Charging and Fast Charging; DC Charging and AC Charging; Selection and Sizing of Chargers: Charger Connectors and Cables; Charging Standards: Connectors, Supply Equipment; EMI/EMC; Testing Methods for Chargers and EVSE | | | | | | |
| **Module 3** | **Public charging infrastructure** | Assignment | Infrastructure and policy | **12 Sessions** | | |

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| **Topics:** Public charging infrastructure Location, Planning and Implementation of Public Charging Stations; Components; Selection and Sizing - HT/LT Equipment & Cables; Protection; Safety Standards: Policy and Regulatory Aspects; EV Charging Station and their Business Models; Economic Aspects; Major Challenges. | | | | |
| **Module 4** | **Renewable Sources Integration** | Assignment | Case study | **12 Sessions** |
| Topics: Types of Renewable Energy Sources, Connection Between RE and EV Infrastructure , Challenges of Integrating Renewable Energy into EV Charging Networks, Regulatory and Policy Challenges, Opportunities for Sustainable Integration of Renewables with EV Charging, Environmental Impact. | | | | |

**Targeted Application & Tools that can be used:**

The course subject finds it application in many major areas of technologies like Charger sizing and standards Charger, Public charging infrastructure Location and Integration of Renewables with EV Charging.Software tools: Matlab-Simulink, Application: Automotive industry.

**Text Book**

1. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", 3rd Edition, CRC Press, 2021 2.
2. Code of Practice for Electric Vehicle Charging Equipment Installation, 4th Edition, IET, 2020.

**References**

3. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", 1st Edition, Springer, 2013. 2.
4. Tom Denton, "Automotive Electrical and Electronic Systems", 5th Edition, Routledge, 2018 3. WolfhardLawrenz, "CAN System Engineering: From Theory to Practical Applications", Springer, 2nd Edition, 2013.
5. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, MehrdadEhsaniYiminGao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018.

**Online learning resources:**

1. EBook:https://presiuniv.knimbus.com/user#/home
2. https://onlinecourses.nptel.ac.in/noc21_ee112/preview
3. https://elearn.nptel.ac.in/shop/iit-workshops/completed/emobility-and-electric-vehicle-engineering-cohort-3/?v=c86ee0d9d7ed.
4. https://elearn.nptel.ac.in/shop/executive-workshops/execedu-closed/certificate-programme-on-emobility-cpoem-cohort-5/?v=c86ee0d9d7ed.

**Topics relevant to 'SKILL DEVELOPMENT':** The Sustainable Integration of Renewables with EV Charging. Topics relevant to 'ENVIRONMENT AND SUSTAINABILITY': Types of Renewable Energy Sources, Connection Between RE and EV Infrastructure , Challenges of Integrating Renewable Energy into EV Charging Networks.

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| **Catalogue prepared by** | Mr. Sunil Kumar A V |
| **Recommended by the Board of Studies on** | |
| **Date of Approval by** | |

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| **the Academic Council** | |

Professional Elective Courses (PEC)
Track 4: Power Electronics and Industrial Drives Courses Catalogs

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|---|---|---|---|---|---|---|
| **Course Code:** **EEE3600** | **Course Title:** **Special Electrical Machines**<br>**Type of Course:** **Discipline Elective & Theory only** | **L- T-P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2503 DC Machines and Special Machines<br>EEE2504 AC Machines | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The basic objective of this course is to introduce the theory, construction, design, control electronics and in-depth analysis of several special electrical machines as an extension to the study of AC & DC electrical machines. This course also extend the fundamental principles into a way of critical thinking for problem solving in real time applications thereby learning analytical skills and programming skills through Lab VIEW/MATLAB. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Special Electrical Machines and their Applications and attain **Employability Skills** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Explain the construction, principle of operation and power converter for switched reluctance motor and stepper motor<br>2. Explain construction, principle of operation, theory of torque production in brushless DC motor and Permanent magnet synchronous motor.<br>3. Implement the control aspect of special electrical machines using Lab VIEW/MATLAB.<br>4. Interpret the features of electric motors for Traction applications. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | **Switched Reluctance Motor and Stepper Motor** | **Assignment** | **Simulation task** | **10 Sessions** | | |
| **Switched Reluctance Motor**<br>Construction, Principle of operation, design of stator and rotor pole arc, power converter for switched reluctance motor.<br>**Stepper Motors**<br>Construction, principle of operation-theory of torque production, Types of stepping motor. | | | | | | |
| **Module 2** | **Permanent Magnet Brushless D.C. Motors and Permanent Magnet Synchronous Motors** | **Assignment** | **Simulation task/Data collection Task** | **10 Sessions** | | |
| **Permanent Magnet Brushless D.C. Motors**<br>Construction, principle of operation ,EMF and Torque equations , Torque speed characteristics , Sensor less motors , Motion control<br>**Permanent Magnet Synchronous Motors**<br>Construction, Principle of operation , EMF and torque equations, Starting, Rotor configurations, Dynamic model | | | | | | |

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| **Module 3** | **Control of Special Machines and Applications** | **Quiz** | **Data Analysis** | **10 Sessions** |
| Open loop control and closed loop control of stepper motor using Microprocessor, Characteristics of stepper motor in open loop drive, DSP Control of switched reluctance motor for fraction type load, DSP/Microprocessor Control of brushless dc motor, Applications. | | | | |
| **Module 4** | **Electric Motors for traction drives** | **Group Discussion** | **Data Analysis** | **9 Sessions** |
| AC motors, DC motors, single sided linear induction motor for traction drives, comparison of AC and DC traction. | | | | |

**Targeted Application & Tools that can be used:**
Application Areas are Motor Design, Automation companies like Schneider Electric, Mitsubishi electric etc, Automobiles and Electrical Vehicle Manufacture companies like Tesla etc.
**Professionally Used Tools:** LabVIEW/MATLAB

**TextBooks:**
**1. Venkata Ratnam K, Special Electrical Machines, CRC Press, 2009.**
**2. Krishnan, R., "Permanent Magnet and BLDC Motor Drives", CRC Press, 2009.**

**References**
**1. Chang-liang, X., "Permanent Magnet Brushless DC Motor Drives and Controls", Jun 2012.**
**2. Kenjo, T., and Sugawara, A., Stepping Motors and their Microprocessor Controls, Oxford Science Publications, 1984.**
**3. Miller, T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Oxford Science Publications, 1989.**

**Online Resources**
1. https://nptel.ac.in/courses/108/102/108102156/
2. https://www.youtube.com/watch?v=DMDTkXeFkb8
3. Ebook : https://puniversity.informaticsglobal.com/login
4. Seminar topic: https://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=special%20electric%20machines%20review%20papers
5. Case study: https://www.researchgate.net/publication/342360681_Economic_Benefits_of_Energy-Efficient_Electrical_Machines_A_Case_Study

**Topics relevant to "EMPLOYABILITY SKILLS":** PMBL DC Motor, Control of switched reluctance motor for developing **Employability Skills** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.

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| **Catalogue prepared by** | Ms. Ramya K |
| **Catalogue updated by** | Mr. K Sreekanth Reddy |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3601** | **Course Title: Power Quality and Harmonics**<br>**Type of Course: Discipline Elective & Theory only** | **L- T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | **2.0** | | | | | |
| **Course Pre-requisites** | **Nil** | | | | | |
| **Anti-requisites** | **Nil** | | | | | |

<table>
<tr><td>Course Description</td><td colspan="4">The Power Quality and Harmonics course focuses on the study and analysis of power quality issues in electrical systems, with a particular emphasis on harmonic distortion, its sources, effects, and mitigation techniques. Students will learn how harmonics are generated, their impact on power systems and equipment, and how to measure, analyze, and correct power quality problems.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Power Quality and Harmonics and attain Skill Development through Experiential Learning techniques</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:<br>1.Analyze harmonic distortion using advanced tools and techniques, including Fourier analysis and spectral analysis.<br>2.Apply techniques for harmonic mitigation and power factor correction such as passive and active filters, and active power compensation systems.<br>3.Evaluate the economic impact of power quality issues and provide solutions to optimize energy use and system reliability<br>4.Identify and quantify harmonics in power systems, understanding their sources and the effects on electrical equipment and systems</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Harmonic Analysis and Advanced Measurement Techniques</td><td>Quiz</td><td>Data Analysis task</td><td>08 Sessions</td></tr>
<tr><td colspan="5">Fourier Series and Fourier Transform for Harmonic Analysis, Spectral Analysis, Advanced Harmonic Measurement Techniques, Practical applications: Analyzing harmonic distortion in real-world systems (e.g., industrial motor drives, power supplies).</td></tr>
<tr><td>Module 2</td><td>Harmonic Mitigation Techniques and Power Factor Correction</td><td>Group Discussion</td><td>Data Collection</td><td>08 Sessions</td></tr>
<tr><td colspan="5">Passive Filters for Harmonic Mitigation, Active Filters, Power Factor Correction (PFC), Advanced Power Compensation Systems, Case studies on designing harmonic filters for industrial loads and power systems.</td></tr>
<tr><td>Module 3</td><td>Economic Impact of Power Quality Issues and Optimization Solutions</td><td>Assignment</td><td>Programming Task</td><td>08 Sessions</td></tr>
<tr><td colspan="5">Economic Impact of Harmonics and Power Quality Disturbances, Energy Optimization Solutions, Cost-Benefit Analysis of Harmonic Mitigation Strategies, Designing for Power Quality and Energy Efficiency.</td></tr>
<tr><td>Module 4</td><td>Harmonics in Power Systems and Their Impact</td><td>Assignment</td><td>Data Collection and Analysis</td><td>08 Sessions</td></tr>
<tr><td colspan="5">Introduction to Power Quality and Harmonics, Sources of Harmonics, Effects of Harmonics, Measurement of Harmonics.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:<br>Power System harmonic studies, protection and stability for real time test systems. Professionally Used Software: MATLAB & Simulink, PSCAD</td></tr>
<tr><td colspan="5">Text Book<br>1. Ewald F. Fuchs and Mohammad A. S. Masoum, “Power Quality in Power Systems and Electrical Machines”, 2nd Edition.</td></tr>
<tr><td colspan="5">References<br>1. Arun G. Phadke, James S. Thorp, “Power Quality: Problems and Mitigation Techniques”, 1st Edition (2008) .</td></tr>
</table>

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| 2. Surya Santoso, H. Wayne Beaty, Robert C. Dugan, "Power Quality: Monitoring, Analysis, and Enhancement", 2nd Edition (2009)<br>**online learning resources**<br>1.https://nptel.ac.in/courses/108/105/108105153/<br>2.https://www.youtube.com/watch?v=xLjk5DrScEU&list=PLt5syl71JKf0IacRzLI-02Q_udP4nJiJg<br>3. https://www.researchgate.net/publication/50366322_POWER_QUALITY_AN_IMPORTANT_ASPECT<br>4.https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d2706929%26site%3dehost-live |
| **Topics relevant to development of "SKILL DEVELOPMENT"**Economic Impact of Harmonics and Power Quality Disturbances, Energy Optimization Solutions, Cost-Benefit Analysis of Harmonic Mitigation Strategies **Skill Development** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course hand-out. |

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| **Catalogue prepared by** | **Mr. Bishakh Paul** |
| **Recommended by the Board of Studies on** | BoS No: 12th BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/21 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3602** | **Course Title: Modern power electronics and AC drives**<br>**Type of Course: Discipline Elective & Theory only** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2511 Power Electronics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The purpose of this course is to understand the basic concepts and design of advanced power electronics and AC drives. This course includes the detailed analysis of several AC drives used and their analysis. The course is both conceptual and analytical in nature. The course develops the simulation abilities through assignments and project work. The course also enhances the ability to identify suitable drives for specific industrial applications. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Modern power electronics and AC drives and attain **Employability Skills** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Explain the torque speed characteristics for different control parameters by their equivalent circuit analysis<br>2. Select different slip recovery drive schemes for speed control of I.M. at rotor side.<br>3. Explain Vector control of Induction Motor Drive<br>4. Illustrate the characteristics of synchronous motor using UPF and constant flux linkage control<br>5. Interpret the speed Control of variable Reluctance motor drive and brushless DC motor drive. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | AC Drives | Assignment | Data collection | **10 Session** | | |

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| Topics: Introduction to AC Drives: Introduction to motor drives – Torque production – Equivalent circuit analysis – Speed – Torque Characteristics with variable voltage operation Variable frequency operation constant v/f operation – Variable stator current operation. | | | | |
| **Module 2** | Control of Induction motor drives | Assignment | Problem solving | **13 Session** |
| Topics: Control of Induction motor drives at Stator side Scalar control – Voltage fed inverter control – Open loop volts/Hz control – Control of Induction Motor Drive at Rotor Side and Vector Control Slip power recovery drives – Static Kramer Drive – Phasor diagram – Torque expression – speed control of a Kramer Drive – Static Scherbius Drive – modes of operation. Vector control of Induction Motor Drives: Principles of Vector control – Vector control methods – Direct methods of vector control – Indirect methods of vector control – Adaptive control principles | | | | |
| **Module 3** | Control of Synchronous motor drives | Assignment | Problem Solving | **12 Session** |
| Topics: Synchronous motor and its characteristics – Control strategies – Constant torque angle control – Unity power factor control – Constant mutual flux linkage control. Controllers: Flux weakening operation – Maximum speed – Direct flux weakening algorithm – Constant Torque mode controller – Flux Weakening controller – indirect flux weakening – Maximum permissible torque – speed control scheme | | | | |
| **Module 4** | Variable Reluctance and Brushless DC Motor drives | Assignment | Problem Solving | **10 Session** |
| Topics: Variable Reluctance motor drive – Torque production in the variable reluctance motor Drive characteristics and control principles – Current control variable reluctance motor service drive. Brushless DC Motor drives: Three phase full wave Brushless dc motor – Sinusoidal type of Brushless dc motor- current controlled Brushless dc motor Servo drive. | | | | |

**Targeted Application & Tools that can be used:**

Application Area is Power Electronics and Electric Drives, Automobile industries, Electric Vehicles

Software Tools: MATLAB/Simulink

**Textbooks**

1. Electric Motor Drives Pearson Modeling, Analysis and control – R. Krishnan – Publications – 1 st edition – 2002
2. Modern Power Electronics and AC Drives B K Bose – Pearson Publications 1st edition

**References**

1. Power Electronics and Control of AC Motors – MD Murthy and FG Turn Bull pergman Press (For Chapters II, III, V ) 1st edition
2. Power Electronics and AC Drives – BK Bose – Prentice Hall Eagle wood diffs New Jersey (for chapters I, II, IV ) - 1 st edition
3. Power Electronic circuits Devices and Applications – M H Rashid – PHI – 1995.
4. Fundamentals of Electrical Drives – G.K. Dubey – Narora publications – 1995 (for chapter II) Power Electronics and Variable
5. frequency drives – BK Bose – IEEE Press – Standard publications - 1 st edition – 2002.

**Online Resources**

1. https://nptel.ac.in/courses/108/104/108104011/
2. https://lecturenotes.in/subject/1374/advanced-electric-drives
3. Ebook: https://puniversity.informaticsglobal.com
4. Seminar topic: https://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=modern%20power%20 electronics%20and%20ac%20drives%20review%20paper
5. Case study: https://www.researchgate.net/publication/251830696_Power_Electronics_and_AC_Machine_Drives_-Advances_and_Trends

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| **Topics relevant to "EMPLOYABILITY SKILLS":** Control of Induction Motor Drive at Rotor Side, Brushless DC Motor drives are for developing **Employability Skills** through **Problem Solving Methodologies**. This is attained through assessment component mentioned in course handout. | |
| **Catalogue prepared by** | Mr Sarin MV |
| **Recommended by the Board of Studies on** | BoS No: 14th BoS held on 22/2/22 |
| **Date of Approval by the Academic Council** | 18th Academic Council Meeting held on 3/8/2022 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3603** | **Course Title: Flexible A. C Transmission Systems (FACTS)** **Type of Course: Discipline Elective & Theory only** | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE3002 Power System Analysis<br>EEE2511 Power Electronics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This course deals with various FACTS devices which are used for proper operation of existing AC system and make it more flexible in normal and abnormal conditions. The course develops the analytical skills. It also develops Simulation abilities of different types of FACTS Controllers in MI power Software. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Flexible A. C Transmission Systems (FACTS) and attain **Employability Skills** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1) Classify various compensators suited for various power system purposes.<br>2) Describe the converter configuration for different power systems applications such as HVDC, FACTS etc.<br>3) Explain the behaviour of the power system with different shunt and series compensators.<br>4) Summarize the benefits of incorporating FACTS devices in Power System | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Power Transmission control | Assignment | data analysis task | | **9 Sessions** | |
| **Topics:** FACTS concept and General system considerations - Transmission Interconnections, Flow of power in an AC system, basic types of FACTS controllers, IEEE definitions, FACTS devices in India and abroad. Shunt compensation and shunt FACTS devices - Concept of shunt compensation, objectives of shunt compensation, variable impedance type shunt compensators (TCR, TSC, FC-TCR, TSC-TCR) - circuit diagram, principle of operation, working, waveforms / characteristics. Simulation assignment in MI Power | | | | | | |
| **Module 2** | Static power convertor: | Paper Presentation | Simulation and Programming Task | | **12 Sessions** | |
| **Topics:** Switched converter type shunt compensator (STATCOM) - circuit diagram, principle of operation, working, waveforms / characteristics, control schemes for shunt compensators. Series compensation and Series FACTS devices - Concept of series compensation, objectives of series compensation, variable impedance type series compensators (GCSC, TSSC, TCSC), Switching converter type series compensators - circuit diagram, principle of operation, working, waveforms/characteristics, control schemes for series compensators. Simulation assignment in MI Power | | | | | | |
| **Module 3** | Unified Power Flow Controllers | Case Study | Simulation and data analysis task | | **12 Sessions** | |

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| **Topics:** Static voltage and phase angle regulators - Objectives of voltage and phase angle regulators, power flow control, improvement of transient stability, power oscillation damping, thyristor-controlled voltage and phase angle regulators.<br>Combined FACTS compensators and other special purpose FACTS devices - Unified Power flow Controller (UPFC) - objectives and need, principle of operation, Interline power flow controller (IPFC) - objectives and need, principle of operation. NGHSSR damper, thyristor-controlled braking resistor (TCBR). Simulation assignment in MI Power |
| **Targeted Application & Tools that can be used:**<br>Application Area is Power System Stability and reactive power compensation using FACTS Devices in organizations like Power-grid, BESCOM, NTPC and Tata Power Corporation.<br>Professionally Used Software: MI Power, MATLAB |
| **Text Books**<br>1. Padiyar K. R, "FACTS controllers in power transmission and distribution", New Age Publishers, India, 2007.<br>2. Narayan G Hingorani, Laszlo Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", Wiley-IEEE Press; 1st edition (10 December 1999) |
| **References**<br>**1.** T. J. E. Miller, "Reactive power control in Electric systems", Wiley-Interscience Publication, John Wiley and sons, 1982.<br>2. Narain G. Hingorani and Laszlo Gyugyi, "Understanding FACTS – Concepts and technology of Flexible AC transmission system", IEEE power Engineering Society, 1999.<br>**Online resources**<br>1.Seminar:https://nptel.ac.in/courses/108/107/108107114/<br>2.Case study:<br>https://www.academia.edu/41556656/Flexible_AC_Transmission_Systems__FACTS__Controllers_FACTS_D<br>3. Ebook:https://puniversity.informaticsglobal.com |
| **Topics relevant to "EMPLOYABILITY SKILLS":** Static Power converters, SVC and STATCOM for developing **Employability Skills** through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout. |

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| **Catalogue prepared by** | Mr. Bishakh Paul |
| **Recommended by the Board of Studies on** | 12th BoS held on 27/07/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/2021 |

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|---|---|---|---|---|---|
| **Course Code: EEE3604** | **Course Title: HVDC Transmission**<br><br>**Type of Course: Discipline Elective & Theory only** | **L- P- C** | 3 | 0 | 3 |
| **Version No.** | 2.0 | | | | |
| **Course Pre-requisites** | EEE2509 Transmission and Distribution<br>EEE2511 Power Electronics | | | | |
| **Anti-requisites** | **Nil** | | | | |
| **Course Description** | The purpose of this course is to explain the HVDC power transmission. The course also briefs the various converters used, their control aspects and modern trends in HVDC transmission. The course is both conceptual and analytical in nature and needs fair knowledge of Power electronics circuits and their working. The course develops the critical thinking and analytical skills. | | | | |

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| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of HVDC Transmission and attain **Employability Skills** through **Problem Solving** methodologies. | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1. Explain the advantages of dc transmission over ac transmission.<br>2. Discuss the operation of Line Commutated Converters and Voltage Source Converters.<br>3. Summarize the control strategies used in HVDC transmission system.<br>4. Discuss the modern trends in HVDC transmission.<br>5. Analyze the requirement of protection circuit for different types of HVDC system. | | | |
| **Course Content:** | | | | |
| **Module 1** | DC Transmission Technology | Assignment | Data Collection | **9 Sessions** |
| Topics:<br>DC Transmission Technology- Comparison of AC and DC Transmission. Application of DC Transmission. Types of HVDC Systems. Components of a HVDC system**,** Modern trends in DC transmission | | | | |
| **Module 2** | Line Commutated Converter based systems | Assignment | Programming | **10 Sessions** |
| Topics:<br>Line Commutated Converter based systems Line Commutated Converters (LCCs): Six pulse converter, Analysis neglecting commutation overlap, harmonics, Twelve Pulse Converters. Inverter Operation. Effect of Commutation Overlap. Expressions for average dc voltage, AC current and reactive power absorbed by the converters. Effect of Commutation Failure, Misfire and Current Extinction in LCC links. | | | | |
| **Module 3** | Voltage Source Converter based systems | Assignment | Simulation | **8 Sessions** |
| Topics:<br>Voltage Source Converter based systems- Two and Three-level VSCs. PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation. Analysis of a six-pulse converter. Real and Reactive power control using a VSC. | | | | |
| **Module 4** | Control of HVDC Converters | Assignment | Programming | **9 Sessions** |
| Topics:<br>Control of HVDC Converters- Principles of Link Control in a LCC HVDC system. Control Hierarchy, Firing Angle Controls – Phase-Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link. Higher level Controllers - Power control, Frequency Control, Stability Controllers. Reactive Power Control. | | | | |
| **Module 5** | Converter faults, protection and smoothing reactors | Assignment | Data Collection | **9 Sessions** |
| Topics: | | | | |

Converter faults, Protection against over-currents, Overvoltage's in a converter station, Surge arresters, Protection against over-voltages, Smoothing reactors, DC line, Transient over voltages in DC line, Protection of DC line, DC breakers, Monopolar operation, Effects of proximity of AC and DC transmission lines.

**Targeted Application & Tools that can be used:**
Application Area is Power System, Electricity Transmission and Distributed companies, Power Grid Corporation and State Electricity Boards
**Professionally Used Software: MATLAB/Mi Power.**

**Text Book(s)**

**1:** K. R. Padiyar, "HVDC Power Transmission Systems", New Age International Publishers, 2011

**2:** HVDC Transmission, Second Edition by **S Kamakshaiah**, **V Kamaraju**

**References Book(s)**

1. Edwart, K., Direct Current Transmission (Vol. 1), John Wiley and Sons (2008)
2. HVDC Transmission: Power Conversion-Applications in Power Systems, Chan-Ki Kim. *et al*, Wiley(2009)
3. Arrillaga, J. and Smith, B.C., AC to DC Power System Analysis, IEE Press (2008).

**Online Resources:**

1. https://nptel.ac.in/courses/108/104/108104013/
2. https://www.youtube.com/watch?v=pRZ2ygbbyTg
3. https://studymaterialz.in/hvdc-power-transmission-systems-by-padiyar/
4. https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=3&sid=15d54a1f-070b- 4419-b1d2
5. https://ieeexplore.ieee.org/abstract/document/4745240
6. EBook: https://puniversity.informaticsglobal.com

**Topics relevant to "EMPLOYABILITY SKILLS ":** Application of DC Transmission, Voltage Source Converter based systems, Voltage Source Converter based systems for developing **Employability skills** through **Problem Solving Methodologies**. This is attained through assessment component mentioned in course handout.

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| **Catalogue prepared by** | Ms Jisha L K |
| **Recommended by the Board of Studies on** | BoS No: 14th BoS held on 22/2/2022 |
| **Date of Approval by the Academic Council** | 18th Academic Council Meeting held on 3/8/2022 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3605** | **Course Title: Wireless Power Transfer and Emerging Technologies**<br>**Type of Course: Discipline Elective & Theory only** | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | **1.0** | | | | | |
| **Course Pre-requisites** | EEE2502 Electromagnetic Fields<br>EEE2507 Control Systems Engineering<br>EEE2501 Signals and Systems | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The purpose of this course delves into the principles, design considerations, and applications of wireless power transfer (WPT) technology, exploring various emerging methods for transmitting electrical energy without physical wires, including inductive coupling, resonant coupling, and radiative techniques, while also examining potential applications in diverse fields like electric vehicles, consumer electronics, alongside discussions on the latest advancements and challenges in this rapidly evolving field. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Wireless Power Transfer and emerging technologies attain **Employability Skills** through **Participative Learning** techniques. | | | | | |

<table>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:<br>1. Understand the fundamental principles behind various wireless power transfer technologies.<br>2. Describe the efficiency factors affecting WPT systems.<br>3. Explain the various wireless power transfer systems technologies.<br>4. Describe the Dynamic wireless charging techniques for electric vehicles.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Basic Principles</td><td>Assignment</td><td>Data Collection</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Wireless Power Transfer Methods, Near-field Technology, Far-field Technology, Wireless Power Transfer Standards, Wireless Power Consortium, Air Fuel Alliance, NFC standard, SAE J2954, Proprietary System Solutions, Functionality of a Wireless Power Transfer System, Basic Principles of Inductive Components, Basic Transformer Model, Capacitive Compensation, Coupling and Efficiency, Leakage, Shielding Material.</td></tr>
<tr><td>Module 2</td><td>Wireless Power Receiver and Transfer Efficiency</td><td>Assignment/Case Study</td><td>Data collection</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Topics: Wireless power receiver architecture, Building blocks of wireless power receiver, coupling efficiency, power losses, and compensation techniques for resonant coupling, design methodologies for WPT systems, component selection (transmitters and receivers), and layout considerations.</td></tr>
<tr><td>Module 3</td><td>Emerging Technologies of WPT</td><td>Assignment/Case Study</td><td>Data collection</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Topics: Microwave Power Transmission, Efficiency improvement, Safety assurance, Real-time reconfigurability, Retro-reflective beam forming scheme, capacitive coupling, resonant inductive coupling advancements.</td></tr>
<tr><td>Module 4</td><td>Dynamic Wireless Power charging Technologies for EVs</td><td>Assignment/Case Study</td><td>Data collection</td><td>11 Sessions</td></tr>
<tr><td colspan="5">Topics: Challenges and solutions related to alignment, control strategies, and real-time power management, Dynamic Wireless Power Transfer for In-Motion Electric Vehicles, Power rails and pickups, Segment and power supply scheme, Circuit topologies and impedance matching, Control strategies, Electromagnetic interference, standards - SAE J2954, infrastructure requirements, and market trends in EV wireless charging technology.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:<br>Application Areas are power transfer industries, and Electric vehicle charging stations in real time.<br>Professionally Used Software: MATLAB.</td></tr>
<tr><td colspan="5">Text Books<br>1. Wireless Power Transfer - Fundamentals and Technologies, Eugen Coca, 2016.<br>2. Wireless Power Transfer: Principles and Applications, Zhen Zhang, Hongliang Pang, 1st Edition, John Wiley & Sons, Inc., 2022.<br>3. Wireless Power Transfer: Fundamentals, Technologies, and Applications by Chun T. Liu and Yusuke Watanabe.<br>4. Wireless Power Transfer: Theories and Applications by S.P. Singh et al.<br>5. Wireless Power Transfer and Wireless Charging by Zhongfeng Wang.<br>6. Wireless Charging Technology for Electric Vehicles by Hongyu Wu et al.<br>7. Emerging Technologies in Wireless Power Transfer: Principles and Applications by Sourabh Bhardwaj and Sandeep Kumar.</td></tr>
<tr><td colspan="5">Topics relevant to "EMPLOYIBILITY SKILLS": Wireless power receiver architecture, Microwave Power Transmission, Dynamic Wireless Power Transfer for In-Motion Electric Vehicles, Power rails and pickups, Segment and power supply schemes, EV wireless charging technology for Developing "Employability Skills" through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td colspan="4">Dr. D P Somashekar</td></tr>
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| **Recommended by the Board of Studies on** | |
| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3606** | **Course Title: Electromagnetic Interference (EMI) and Protection** **Type of Course: Discipline Elective & Theory** | **L- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | EEE2502 Electromagnetic Fields<br>EEE2507 Control Systems Engineering<br>EEE2501 Signals and Systems | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | All systems that generate or consume electrical energy can produce electromagnetic noise that may interfere with the operation of the system itself and/or other systems. Electromagnetic interference (EMI) is a potential threat to present-day electronic devices. The course shows the students how the principles of electricity and magnetism can be applied to design electrical and electronic systems that can co-exist harmoniously, that is, to design systems that are electromagnetically compatible with each other. The students will learn how electromagnetic disturbances are generated in systems, how they couple to other systems, and how systems can be protected. | | | | | |
| **Course Objective** | The objective of the course is to enumerate sources of electromagnetic interferences, to design EMI Filter for insertion loss and for switch mode power supplies, to understand concept of Faraday screens for EMI Prevention and attain **Skill Development** through **Problem Solving methodologies**. | | | | | |
| **Course Out Comes** | On successful completion of the course, the students shall be able to:<br>1. Recognize the sources of conducted and radiated EMI in power electronic converters and consumer appliances and suggest remedial measures to mitigate the problems.<br>2. Assess the insertion loss and design EMI filters to reduce the loss and design EMI filters, common-mode chokes, and RC-snubber circuits measures to keep the interference within tolerable limits.<br>3. Analyze EMI propagation, design filters/inductors, apply safety regulations, and conduct EMI measurements using LISN.<br>4. Design and implement Faraday screens and shielding techniques to minimize EMI in switching devices, transformers, and power electronics while ensuring EMC compliance. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Introduction | Assignment | Analyze the effect of power supply components on Conducted emissions. | **10 Sessions** | | |
| Topics:<br>Sources of conducted and radiated EMI, EMC standardization and description, measuring instruments, conducted EMI references, EMI in power electronic equipment: EMI from power semiconductors circuits. | | | | | | |
| **Module 2** | Noise suppression in relay systems and EMI filter elements | Assignment | Describing various EMI filters | **13 Sessions** | | |

Topics:
**Noise suppression in relay systems:** AC switching relays, shielded transformers, capacitor filters, EMI generation and reduction at source, influence of layout and control of parasites.
**EMI filter elements:** Capacitors, choke coils, resistors, EMI filter circuits. Ferrite breeds, feed through filters, bifilar wound choke filter, EMI filters at source, EMI filter at output.

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| **Module 3** | EMI in switch mode power supplies | Assignment | Understand the effect of conducted EMI noise on power supply lines | **13 Sessions** |

Topics: EMI propagation modes, power line conducted-mode inference, safety regulations (ground return currents), Power line filters, suppressing EMI at sources, Line impedance stabilization network (LISN), line filter design, common mode line filter inductors- design& example, series –mode inductors and problems, EMI measurements.

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| **Module 4** | Faraday screens for EMI prevention | Assignment | Prevention of EMI | **09 Sessions** |

Topics: Faraday Screens for EMI prevention in switching devices, transformers, safety screens, faraday screens on output components, reducing radiated EMI on gapped transformer cores, metal screens, and electrostatic screens in transformers.

**Targeted Application & Tools that can be used:**
The course subject finds its application in many major areas of technologies like power electronics & smart grids, industrial automation & robotics, automotive & transportation, and many more. Tools that can be used are Altair Feko, Ansys HFSS, MATLAB, LTspice, PSpice, etc.

**Text Book**

1. Electromagnetic Compatibility in Power Electronics, Laszlo Tihanyi, IEEE Press.
2. EMI Filter Design, Pullen Timotty. M. Ozenbaugh, N. Richard Lee, CRC Press, Taylor & Francis.
3. Practical Design for Electromagnetic Compatibility, R. F. Ficchi Hayden Book Co.

**References**


1. Stuart Borlase, "Smart Grid: Infrastructure Technology Solutions", CRC Press.
2. Handbook on Switch-Mode Power Supplies, Keith H. Billings, McGraw-Hill Publisher, 1989.
3. Dr. V.P. Kodali, Engineering Electromagnetic Compatibility, IEEE Publication Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
4. Henry W. Ott, Electromagnetic Compatibility Engineering, John Wiley & Sons Inc, New York, 2009
5. Clayton R.Paul, Introduction to electromagnetic compatibility, John Wiley and Sons, Inc. 1991.
6. Daryl Gerke and William Kimmel, EDN's Designer's Guide to Electromagnetic Compatibility, Elsevier Science & Technology Books, 2002.
7. Dr Kenneth L Kaiser, 2005. The Electromagnetic Compatibility Handbook, CRC Press.
8. Bernhard Keiser, Principles of Electromagnetic Compatibility, 3rd Edition, Artech house, 1986.


**Online learning resources**

1. https://presiuniv.knimbus.com/user#/home
2. https://nptel.ac.in/courses/108106138
3. https://www.ee.iitb.ac.in/web/course_lists/ee-785-electromagnetic-interference-and-compatibility/
4. https://www.youtube.com/playlist?list=PLFxhqwM1F4ywicEggR3pzF0FcFcGQvZ82

**Topics relevant to development of "SKILL DEVELOPMENT":** Performing the EMI filters designing for **Skill Development** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course hand-out.
**Topics relevant to "ENVIRONMENT & SUSTAINABILITY":** EMI prevention.

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| **Catalogue prepared by** | **Dr. Markala Karthik** |
| **Recommended by the Board of Studies on** | |

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| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3607** | **Course Title: Machine Modeling & Analysis**<br>**Type of Course: Discipline Elective & Theory** | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE1007 Basics of Electrical and Electronics Engineering<br>EEE2503 DC Machines and Special Machines<br>EEE2504 AC Machines | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | In this course, mathematical models of electrical machines are developed. The most common alternating current machines, synchronous and asynchronous machines, are treated thoroughly. The mathematical models are used in stationary and dynamic analysis of their behavior in power grids, industrial applications and motor drives. The models that are developed are based on classic 2-axis theory. Different variants of the models are developed and demonstrated for different areas of use. The subject further deals with the physical origin of the parameters included in the models. How these can be manipulated by design is dealt with to some extent. The course also describes factors that determine the load capacity of the machines. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Machine modeling and attain **Skill Development** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. **Knowledge:** After the course, the candidate should know the various static and dynamic models of the synchronous and asynchronous machine.<br>2. **Apply:** The student must also be able to choose a model with sufficient accuracy, depending on the application.<br>3. **Discuss:** The candidate must also know the machine's static and dynamic properties and behavior in various application.<br>4. **Analyze:** After completing the course, the candidate must know which physical parameters limit the capability of the machines. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | **Introduction to Electrical Circuits** | Assignment/ Quiz | Numerical solving Task | **10 Sessions** | | |
| **DC Circuits:** Concept of Circuit and Network, Types of elements, Network Reduction Techniques- Series and parallel connections of resistive networks, Star–to-Delta Transformations, Mesh Analysis, Nodal Analysis, Numerical examples.<br>**AC Circuits:** Fundamentals of single phase circuits - Series RL, RC and R-L-C Circuits, Concept of active power, reactive power and Power factor, Numerical examples.<br>Introduction to three phase system and relation between line and phase values in Star & Delta connection, Numerical examples. | | | | | | |
| **Module 2** | **Semiconductor and Diode applications** | Assignment/ Quiz | Memory Recall based Quizzes | **10 Sessions** | | |
| Mass Action Law, Charge densities in a semiconductor, Types of SC, Junction diodes -Ideal and practical behaviour, Modelling the Diode Forward Characteristic, and Diode applications like | | | | | | |

rectifiers, Clipping and clamping circuits. Zener diode, characteristics and its applications like voltage regulator.

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| **Module 3** | **Transistors and its Applications** | Assignment/ Quiz | Memory Recall-based Quizzes | **10 Sessions** |

Transistor characteristics, Current components, BJT Configurations (CB, CC, CE configurations) and their current gains. Operating point, Biasing & stabilization techniques: Fixed Bias, Voltage divider bias and its stability factor and load line analysis. Single and multistage amplifier, Darlington pair.
JFET (Construction, principal of Operation and Volt –Ampere characteristics). Pinch- off voltage, Comparison of BJT and FET. MOSFET (Construction, principal of Operation and symbol), MOSFET characteristics in Enhancement and Depletion modes.

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| **Module 4** | **Fundamentals of Electrical Machines** | Assignment/ Quiz | Numerical solving Task | **10 Sessions** |

**Electrical Machines:** Single phase transformers: principle of operation and EMF equation, Numerical examples. DC Motor: principle of operation, Back EMF, torque equation, Numerical examples. AC Motor: Principle operation of Induction Motors and its Applications.
**Special Machines:** Introduction to special electrical machines and its applications.

**Targeted Application & Tools that can be used:**

**Targeted Applications:** Application Area includes all electrical and electronic circuits (power supply unit, regulator unit, embedded devices, hardware electronics etc.). The students will be able to join a profession which involves basics to high level of electronic circuit design.
Professionally Used Software: Multisim/ P Spice
Besides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis..

**Project Work/ Assignment:**

**1. Article review:** At the end, of course an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format.
**2. Presentation:** There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.
**3. Case Study**: - At the end of the course students will be given a 'real-world' application based circuits like Power Amplifier, Signal/Function Generator etc. as a case study. Students will be submitting a report which will include Circuit Diagrams, Design, Working Mechanism and Results etc. in appropriate format

**Text Book(s):**

1. Bhattacharyya Mrittunjay, "Electrical Machines: Modelling And Analysis", PHI learning Pvt Ltd. Delhi.2016.
2. Paul C. Krause, Oleg Wasynczuk, Scott D.Sudhoff, "Analysis of Electric Machinery and Drive Systems" John Wiley and Sons, 2nd Edition, 2006.
3. CheeMunOng, "Dynamic Simulation of Electric Machinery: Using MATLAB/SIMULINK", Prentice Hall, 1st Edition, 1997.

**Reference Book (s):**

1. R Krishnan, "Permanent Magnet Synchronous and Brushless DC Motor Drives, CRC Press; 2009.
2. Bimbhra P.S., "Generalized Circuit Theory of Electrical Machines", Khanna Publishers Limited, 5th Edition, New Delhi, 2000.
3. R Krishnan, "Electric Motor Drives – Modelling, Analysis and Control", Pearson Education, 2015.

**Online Resources (e-books, notes, ppts, video lectures etc.):**

1. https://presidencyuniversity.linways.com
2.

**E-content:**

1. "Modeling and Analysis of Electric Machines. Instructor: Dr. Krishna Vasudevan, Department of Electrical Engineering, IIT Madras: https://archive.nptel.ac.in/courses/108/106/108106023/"

2. NPTEL Videos: Advanced Electric Drives by Prof. S P Das(https://nptel.ac.in/courses/108/104/108104011/#)
3. S. Ji and J. Ye, "Generalized Linear Discriminant Analysis: A Unified Framework and Efficient Model Selection," in IEEE Transactions on Neural Networks, vol. 19, no. 10, pp. 1768-1782, Oct. 2008, doi: 10.1109/TNN.2008.2002078
https://ieeexplore.ieee.org/document/4633689
4. S. Ruoho, E. Dlala and A. Arkkio, "Comparison of Demagnetization Models for Finite-Element Analysis of Permanent-Magnet Synchronous Machines," in IEEE Transactions on Magnetics, vol. 43, no. 11, pp. 3964-3968, Nov. 2007, doi: 10.1109/TMAG.2007.906749. https://ieeexplore.ieee.org/document/4352044

**Topics relevant to "SKILL DEVELOPMENT":** Performing suitable experiments to compute the electric circuit parameters, performance operation of machines, and operation of semiconductor devices for **Skill Development** through **Participative Learning techniques.** This is attained through assessment component mentioned in course plan.

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| **Catalogue prepared by** | Dr. Ajay Kumar Maurya |
| **Recommended by the Board of Studies on** | |
| **Date of Approval by the Academic Council** | |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3608** | **Course Title: Switched Mode Power Supplies**<br>**Type of Course: Discipline Elective & Theory only** | **L- T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE1007 Basics of Electrical and Electronics Engineering<br>EEE2009 Analog Electronics Circuits<br>EEE2511 Power Electronics | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This course provides a comprehensive understanding of Switched-Mode Power Supplies (SMPS), including their working principles, circuit topologies, control strategies, and design considerations. Students will gain theoretical knowledge and exposure in designing and troubleshooting SMPS circuits. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of **Switched Mode Power Supplies** and attain the **EMPLOYABILITY SKILLS** through **PARTICIPATIVE LEARNING** methodologies. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Explain various topologies of DC/DC converter<br>2. Select the key Peripheral Components of SMPS<br>3. Summarize the Power Factor Correction of SMPS.<br>4. Apply the various SMPS Testing Technologies. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Overview of SMPS & Topologies of DC/DC converter | Assignment | Data Collection | | **12 Sessions** | |
| **Topics: Switching-Mode Power Supply (SMPS):** Overview, Classification of Integrated Regulated Power Supply, Characteristics of SMPS, New Development Trend of SMPS, Basic | | | | | | |

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| Principles of SMPS, Control Mode Type of SMPS, Working Mode of SMPS, Feedback Type of SMPS, Load Characteristics of SMPS.<br>**Topologies of the DC/DC Converter:** Basic Principle of Buck Converter, Basic Principle of - Boost Converter, Buck-Boost Converter, Charge Pump Converter, (Single-ended primary inductor converter) SEPIC, Flyback Converter, Forward Converter, Push-Pull Converter, Half/Full Bridge Converter, Soft Switching Converter, | | | | |
| **Module 2** | Key Peripheral Components of SMPS | Assignment/ Case Study | Data Collection | **12 Sessions** |
| **Topics: Method for Selecting Key Peripheral Components of SMPS:** Selection Method for - Fixed Resistor, Capacitors, Inductor Characteristics and Selection Method for Magnetic Beads, Selection Method for EMI Filter - Input Bridge Rectifier, Output Rectifier, Transient Voltage Suppressor (TVS), Power Switching Tube, Optical Coupler, Adjustable Precision Shunt Regulator, SMPS Protection Elements. | | | | |
| **Module 3** | Power Factor Correction of SMPS | Assignment | Programming/Simulation | **10 Sessions** |
| **Topics: Power Factor Correction of SMPS**: Brief Introduction to Power Factor Correction (PFC), Basic Principle of Passive PFC Circuit, Examples of Passive PFC Circuit, Basic Principle of Active PFC Circuit, Examples of Active PFC Circuit, Principle and Application of High-Power PFC, Measures to Suppress PFC Electromagnetic Interference, PFC Configuration Scheme. | | | | |
| **Module 4** | SMPS Testing Technology | Assignment/Case Study | Programming/Simulation/Data Collection/ | **11 Sessions** |
| **Topics: SMPS Testing Technology**: Parameter Testing of SMPS, Performance Testing of SMPS, SMPS Measurement Skills, Accurate Measurement Method of Duty Ratio, Method to Detect the Magnetic Saturation of High-Frequency Transformer with Oscilloscope, Digital Online Current/Resistance Meter, Electromagnetic Compatibility Measurement of SMPS, Waveform Test and Analysis of SMPS. | | | | |
| Targeted Application & Tools that can be used:<br>Switched-Mode Power Supplies (SMPS) are widely used across various industries due to their high efficiency and compact size. Some key applications include Consumer Electronics, Industrial Applications, Automotive & Transportation, Renewable Energy. The tools that can be used are MATLAB/Simulink, SIMetrix/SIMPLIS, LTspice | | | | |
| Text Book<br>1. "Switching Power Supply Design" – Abraham I. Pressman, Keith Billings, Taylor Morey | | | | |
| **References**<br>1. "Switchmode Power Supply Handbook" – Keith Billings, Taylor Morey<br>2. "Power Electronics: Converters, Applications, and Design" – Ned Mohan, Tore M. Undeland, William P. Robbins<br>3. "Fundamentals of Power Electronics" – Robert W. Erickson, Dragan Maksimovic<br>4. "Switchmode Power Supplies: Theoretical and Practical Design" – Christophe Basso | | | | |
| **Online Resources:**<br>1. Book: https://presiuniv.knimbus.com/user#/home<br>2. http://sdnbvc.digimat.in/nptel/courses/video/108108036/L11.html<br>3. Case Study: http://www.digimat.in/nptel/courses/video/108102047/L01.html<br>4. http://www.eols.net/sample-chapters/c05/6-39a-06-02.pdf<br>5. https://www.youtube.com/watch?v=Od0k9nqtoCM | | | | |
| Topics relevant to "Employability skill": Selecting Key Peripheral Components of SMPS, SMPS Testing Technology for employability skill development through Participative Learning techniques. This is attained through assessment component mentioned in course plan. | | | | |
| **Catalogue prepared by** | Dr. Jisha L K | | | |
| **Recommended by the Board of Studies on** | BoS No: 19$^{th}$BoS held on 03/07/2024 | | | |

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| **Date of Approval by the Academic Council** | 24th Academic Council Meeting held on 03/08/2024 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE3609** | **Course Title: FPGA for Power Electronic Converters**<br>**Type of Course: Discipline Elective & Theory only** | **L- T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | EEE1007 Basics of Electrical and Electronics Engineering<br>EEE2009 Analog Electronics Circuits<br>EEE2511 Power Electronics | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This course focuses on the application of Field-Programmable Gate Arrays (FPGAs) in Power Electronic Converters. Students will learn how to design, simulate, and implement FPGA-based controllers for DC-DC converters, inverters, rectifiers, and AC-AC converters. The course covers PWM control, real-time feedback systems, advanced modulation techniques, and FPGA programming for high-performance power conversion. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of **FPGA for Power Electronic Converters** and attain the **EMPLOYABILITY SKILLS** through **PARTICIPATIVE LEARNING** methodologies. | | | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Explain various design and verification tools in FPGA<br>2. Explain the simulation using Xilinx Webpack<br>3. Develop verilog HDL program for Combinational and Sequential Logic Circuits.<br>4. Apply FPGA to generate triggering pulses for different power electronic circuits | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Introduction to Field Programmable Gate Arrays | Assignment | Data Collection | | | **12 Sessions** |
| **Topics:** Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA, Development and evolution of digital devices - design and verification tools, Abstraction levels of digital system design - Configurable logic Blocks (CLB), Input/Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series - overview of Spartan and Virtex FPGA boards. Significance of FPGA in Power Electronics | | | | | | |
| **Module 2** | Verilog HDL | Assignment/ Case Study | Data Collection | | | **10 Sessions** |
| **Topics: Verilog HDL :** Introduction to Verilog HDL and simulation using Xilinx Webpack - Modeling styles: Behavioral, Dataflow, and Structural Modeling, gate delays, switch-level Modeling, Hierarchal structural modeling | | | | | | |
| **Module 3** | Verilog Programming | Assignment | Programming/Simulation | | | **12 Sessions** |
| **Topics: Verilog Programming for Combinational and Sequential Logic Circuits:** Verilog HDL program for combinational logic circuits – Adder/subtractor – Multiplexers – Demultiplexers – Encoders – Priority Encoder - Decoders – Comparators, generating triggering pulses for power converters<br>Verilog HDL program for sequential logic circuits - Flip-Flops, Shift Registers, Counters, Clock divider circuit – Generation of multi-phase clock - Finite State Machine Modelling | | | | | | |

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| **Module 4** | FPGA Applications | Assignment/Case Study | Programming/Simulation/Data Collection/ | **11 Sessions** |
| **Topics: FPGA Applications to Power Electronic System** : Gate Pulse generation for AC-AC converter, AC-DC converter, PWM generation for Buck Converter, SPWM generation. DC motor control, Induction Motor Control | | | | |
| Targeted Application & Tools that can be used:<br>Renewable Energy & Smart Grid, Electric Vehicles (EVs) & Transportation, Industrial Motor Drives & Automation,. Aerospace, Defense & High-Performance Power Electronics The tools that can be used are Xilinx Vivado, SIMetrix/SIMPLIS, LTspice | | | | |
| Text Book<br>1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis" Pearson, Second Edition, 2009.<br>2. Wayne Wolf, "FPGA-Based System Design", Prentice Hall India Pvt. Ltd., 2005. | | | | |
| **References**<br>1. Ming-Bo Lin., Digital System Designs and Practices Using Verilog HDL and FPGAs. Wiley, 2008<br>2. Woods, R., McAllister, J., Yi, Y. and Lightbody, G. FPGA-based implementation of signal processing systems. John Wiley & Sons, 2017. | | | | |
| **Online Resources:**<br>1. Book: https://presiuniv.knimbus.com/user#/home<br>2. http://sdnbvc.digimat.in/nptel/courses/video/108108036/L11.html<br>3. Case Study: http://www.digimat.in/nptel/courses/video/108102047/L01.html<br>4. http://www.eols.net/sample-chapters/c05/6-39a-06-02.pdf | | | | |
| Topics relevant to "Employability skill": Verilog Programming for Combinational and Sequential Logic Circuits for employability skill development through Participative Learning techniques. This is attained through assessment component mentioned in course plan. | | | | |
| **Catalogue prepared by** | Dr. Jisha L K | | | |
| **Recommended by the Board of Studies on** | BoS No: 19$^{th}$BoS held on 03/07/2024 | | | |
| **Date of Approval by the Academic Council** | 24$^{th}$Academic Council Meeting held on 03/08/2024 | | | |

**Open Elective Courses**

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|---|---|---|---|---|---|---|
| **Course Code: EEE1002** | **Course Title: IoT Based Smart Building Technology**<br>**Type of Course: Open Elective & Theory only** | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | **NIL** | | | | | |
| **Anti-requisites** | **Nil** | | | | | |
| **Course Description** | This Course intends to provide a basic understanding of IoT based building technology as all modern buildings will have a heavy focus on automation and efficient usage of energy through IOT. The course uses the fundamentals of mathematics and software tools and enhances the process of learning. The course is both conceptual and analytical in nature and imparts the basic skills of developing the IoT based systems through assignments and mini projects. Gaining knowledge in this field gives an experience to build innovative projects that enhances and improves the chances of a great career in IOT. | | | | | |

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| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of IOT Based Smart Building Technology and attain **Skill Development** through **Participative Learning** techniques. | | | |
| **Course Out Comes** | **On successful completion of the course the students shall be able to:**<br>1. Summarize about IOT Concepts and Applications.<br>2. Explain about communication over internet.<br>3. Experiment with Arduino architecture and its Programming.<br>4. develop distinct models using PIR Sensors.<br>5. Interpret the knowledge about integration of cloud platform. | | | |
| **Course Content:** | | | | |
| **Module 1** | Introduction to IoT | Assignment | Quiz | **6 Sessions** |
| **Topics:** IOT an Introduction – Scope of IOT - Basics of Networking - Communication in Smart Buildings - Impact Of IOT On Smart Buildings - Energy and Cost Efficiency | | | | |
| **Module 2** | Communication Over Internet | Assignment | Data Collection | **6 Sessions** |
| **Topics:** How Internet works – understanding the Design of a Communication Network – Wireless Communication Devices – Concept of ESP 8266 and its powering up. | | | | |
| **Module 3** | Arduino and its Interfacing | Assignment | Case study | **7 Sessions** |
| **Topics:** An Introduction to Arduino and its architecture – Arduino UNO connection and Detection – Programming in Arduino - ESP 8266 AT Commands – Interfacing with Arduino – Debugging Techniques. | | | | |
| **Module 4** | Sensing in IOT | Assignment | Simulation/Data Collection | **7 Sessions** |
| **Topics:**Sensors and Data Acquisition – PIR Sensors – Interfacing Arduino with Sensors – Sensor Calibration – Reading data from PIR Sensor. | | | | |
| **Module 5** | Control and design of smart buildings using PIR for electrical loads | Simple model based on Case Study | Simulation/Data Collection | **7 Sessions** |
| **Topics:** Relay and Electrical loads – interfacing relay drivers to Arduino – Programming logic – Thinkspeak API - Smart Building using PIR - Design the Arduino Sketch – Testing the model. | | | | |

**Targeted Application & Tools that can be used:**

Application: To assess and analyze various parameters involved in a smart building using IOT.
Professionally Used Software: Arduino, Python Programming.

**Text Book**


1. Internet of Things: Principles and Paradigms by Raj kumarBuyya and Amir vahid
2. Foundational elements of an IOT by Joe Biron &Jonathan Follett.
3. Exploring Arduino: Tools and Techniques for Engineering Wizardry 1st Edition by Jeremy Blum


**References**


1. Gao, Xinghua, et al. "Internet of Things Enabled Data Acquisition Framework for Smart Building Applications." *Journal of Construction Engineering and Management* 147.2 (2021): 04020169.
2. Sivagami, P., et al. "Smart Home Automation System Methodologies-A Review." *2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV)*. IEEE, 2021.
3. Zahra, Syed Rameem, and Mohammad Ahsan Chishti. "Smart Cities Pilot Projects: An IoT Perspective." *Smart Cities: A Data Analytics Perspective*. Springer, Cham, 2021. 231-255.
4. Hu, Ming. "Smart Building and Current Technologies." *Smart Technologies and Design For Healthy Built Environments*. Springer, Cham, 2021. 75-91.
5. Deng, Der-Jiunn, and Abderrahim Benslimane. "Innovation and Application of Internet of Things

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| for Smart Cities." *Mobile Networks and Applications*: 1-2.<br>**Online Learning Resources**<br>1. https://www.i-scoop.eu/internet-of-things-iot/facility-management-iot-smart-buildings/<br>2. Case study: https://www.hindawi.com/journals/js/2018/1757409/<br>3. Seminar:https://puniversity.informaticsglobal.com<br>4. Ebook:https://puniversity.informaticsglobal.com |
| **Topics relevant to "SKILL DEVELOPMENT":**Understanding the Design of a Communication Network – Wireless Communication Devices for developing **Skill Development**through**Participative Learning Techniques.** This is attained through assessment components mentioned in the Course Plan. |

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| **Catalogue prepared by** | **Dr. Nageswara Rao Atyam** |
| **Recommended by the Board of Studies on** | BoS No: 12th. BoS held on 27/7/21 |
| **Date of Approval by the Academic Council** | 16th Academic Council Meeting held on 23/10/21 |

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|---|---|---|---|---|---|---|
| **Course Code: EEE1003** | **Course Title: Basic Circuit Analysis**<br>**Type of Course: Open Elective Theory only** | **L-T-P- C** | 3 | 0 | 0 | 3 |
| **Version No.** | **1.0** | | | | | |
| **Course Pre-requisites** | **NIL** | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | This Course intends to provide a basic understanding of electrical circuits which are used in several applications like computer hardware, Automotive electronics, mobile communications and so on and its analysis using NI lab view. The course is both conceptual and analytical in nature and imparts the basic skills of developing the Simulink models, Programming and hardware interfacing through assignments and mini projects. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of **Basic Circuit Analysis** and attain **Skill Development** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>1. Explain Kirchhoff's Voltage Law and Kirchhoff's Current Law<br>2. Describe Superposition theorem and Thevenin's theorem for DC excitation.<br>3. Discuss the behaviour of RL and RC circuits for DC and AC excitation.<br>4. Describe the concept of virtual Instrumentation using NI lab view<br>5. Demonstrate the Superposition theorem and Thevenin's theorem for DC excitation | | | | | |
| **Course Content:** | | | | | | |
| **Module 1** | Basic concepts of circuits and | Assignment | Data sheet collection of resistors and | | | **08 Sessions** |

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| | AC fundamentals | | inductors and validation of parameters values using NI lab view | |
| Topics:<br>Concept of Potential difference. Current and network elements, Ohm's law, Kirchhoff's laws, ideal and practical voltage and current sources, series and Parallel circuits , AC fundamentals | | | | |
| **Module 2** | Mesh and Nodal analysis using NI lab View | Hands on Task & programming | Lab-VIEW program with data acquisition and to measure resistance of a thermistor with change in the temperature | **08 Sessions** |
| Topics:<br>Basic Mesh and Nodal analysis for DC excitation only | | | | |
| **Module 3** | Introduction to basic circuit theorems | Assignment | Development of Simulink model and Analysis using MATLAB & NI lab View | **10 Sessions** |
| Topics:<br>Super position theorem, Maximum power Transfer theorem and Thevenin's theorem for DC excitation, Validation of Theorems with dependent sources, numerical on theorems. | | | | |
| **Module 4** | Analysis of series RL and RC circuits with AC excitation using NI lab View | Assignment | Simulation using NI lab view and Analysis | **10 Sessions** |
| Topics: Analysis of series RL and RC circuits with AC excitation, voltage and current waveforms, Concept of leading, lagging and power factor. | | | | |
| **Targeted Application & Tools that can be used:**<br>The knowledge of basic circuit analysis is required in the fields of circuit design, computer hardware, Automotive electronics, mobile communications, power systems and power converter circuit analysis. Furthermore, the concepts of NI lab view will be helpful in data acquisition and analysis in several applications like process industries, Electric Vehicles, boiler operation and petrochemical industries.<br>**Professionally Used Software:** NI Lab view /MATLAB | | | | |
| **Textbooks**<br>1. Ravish.R.Singh, "Electrical Networks", Mcgraw Hill company,2009, 2nd Edition.<br>2. D.P. Kothari and Nagrath "Theory and Problems in electrical Engineering", PHI edition 2011 | | | | |
| **References**<br>1. V. N. Mittal and Arvind Mittal, "Basic Electrical Engineering" McGraw Hill, 2nd Edition<br>2. Vincent DelToro, "Electrical engineering Fundamentals", PHI second edition 2011<br>**Online resources**<br>1. https://www.youtube.com/results?search_query=Lecture+on+KVL<br>2. https://www.tutorialspoint.com/network_theory/index.htm<br>3. https://nptel.ac.in/courses/108/105/108105159/<br>4. https://puniversity.informaticsglobal.com | | | | |

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| **Topics relevant to "SKILLS DEVELOPMENT":** Analysis of series RL and RC circuits with AC excitation for developing **Skill Development** through **Problem Solving methodologies**. This is attained through assessment component mentioned in Course Plan. | |
| **Catalogue prepared by** | Mr Bishakh Paul |
| **Recommended by the Board of Studies on** | BoS No: 12th, held on 27/07/2021 |
| **Date of Approval by the Academic Council** | 16th Academic Council meeting held on 23/10/2021 |

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| **Course Code: EEE1004** | **Course Title: Fundamentals of Industrial Automation**<br>**Type of Course: Open Elective & Theory only** | | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 1.0 | | | | | | |
| **Course Pre-requisites** | **NIL** | | | | | | |
| **Anti-requisites** | **NIL** | | | | | | |
| **Course Description** | This course deals with the PLC hardware/software and their importance in automation. SCADA deals with communication protocols and real time control of power systems using EMS. The course is both conceptual and analytical in nature. It develops programming and simulation skills. | | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of **Fundamentals of Industrial Automation** and attain **Skill Development** through **Participative Learning** techniques. | | | | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>**1)** Evaluate network protocols that provide interoperability and communication technologies<br>**2)** Write PLC codes for automation applications requiring special functions.<br>**3)** Use PLC for an automatic control system confining to standards.<br>**4)** Apply SCADA for various utilities. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1** | Introduction to Programmable Logic Controllers: | Assignment | List all the PLC applications in industries like Siemens, ABB, Schneider Electric | **8 Sessions** | | | |
| Topics: Advantages & disadvantages of PLC with respect to relay logic, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC. | | | | | | | |
| **Module 2** | PLC Programming Methodologies: | Quiz | Programming | **7 Sessions** | | | |
| Topics: Ladder diagram, STL, functional block diagram, SFC, Instruction List. Creating ladder diagram from process control descriptions, Introduction to IEC61131 international standard for PLC. | | | | | | | |
| **Module 3** | Introduction to SCADA | Assignment | Simulation | **7 Sessions** | | | |
| Topics: Data acquisition system, Evolution of SCADA, Communication Technologies, Monitoring and Supervisory Functions. | | | | | | | |
| **Module 4** | Distributed Control Systems: | Case study | Simulation | **11 Sessions** | | | |
| DCS detail engineering, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface, control, display etc. Enhanced functions viz. Advance Process Control, Batch application, Historical Data Management, OPC support, Security and Access Control etc. Performance Criteria for DCS and other automation tools. | | | | | | | |
| **Targeted Application is Siemens, ABB, Power-grid, Yokogawa Electric**<br>**Tools that can be used: NI Lab-VIEW** | | | | | | | |
| **Text Books** | | | | | | | |

<table>
<tr><td colspan="2">1. W.Boldon, 'Programmable logic controllers', 5th Edition, Elsevier India Pvt. Ltd., New Delhi, 2011.<br>2. Stuart A.Boyer, "SCADA: 'Supervisory control and Data Acquisition', 4th Edition, ISA, 2010.</td></tr>
<tr><td colspan="2">References<br>1. Robert Radvanovsky, Jacob Brodsky, "Handbook of SCADA/Control Systems Security", 2nd edition, CRC press, 2016.<br>2. G. K. McMillan, Douglas Considine, "Process/Industrial Instruments Hand book", 5th edition, McGraw Hill, New York, 2009.<br>Online learning resources<br>1.Seminar https://electrical-engineering-portal.com/resources/plc-programming-training<br>2. Case Study: https://puniversity.informaticsglobal.com<br>3.Ebook:https://electrical-engineering-portal.com/download-center/books-and-guides/electrical-engineering/plc-book</td></tr>
<tr><td colspan="2">Topics relevant to "SKILLS DEVELOPMENT": PLC programming, SCADA fordevelopingSkill DevelopmentthroughParticipative Learning techniques. This is attained through assessment component mentioned in Course Plan.</td></tr>
<tr><td>Catalogue prepared by</td><td>Mr. Bishakh Paul</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td>BoS No: 12th BoS held on 27/7/21</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td>Academic Council Meeting No.16, Dated 23/10/21</td></tr>
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<tr><td>Course Code: EEE1005</td><td>Course Title: Electric Vehicles & Battery Technology<br>Type of Course: Open Elective and Theory only</td><td>L-T-P C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td colspan="6">The Course is designed with an objective of giving an overview of Electric Vehicles and battery technology. The Course discusses the history, configurations of Electric vehicles and the electrical characteristics of batteries. The Course is conceptual and analytical in nature and needs fair knowledge of mathematical computation. The course develops the critical thinking and analytical skills.</td></tr>
<tr><td>Course objective</td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of Electric Vehicles & Battery Technology and attain Entrepreneurial Skills through Problem Solving methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">On successful completion of this course the students shall be able to:<br><br>1. Explain the working of Electric Vehicles and recent trends<br>2. Explain the working of Hybrid Electric Vehicles and recent trends<br>3. Describe about the battery characteristic & parameters.<br>4. Summarize the importance of battery management system.</td></tr>
<tr><td>Course Content:</td><td colspan="6"></td></tr>
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| Module 1 | Electric Vehicles | Assignment | Computation and Data Analysis |
| Topics:<br>History of Electric vehicles, Configuration of Electric Vehicles, Performance of Electric Vehicles,Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption. | | | |
| Module 2 | Hybrid Electric Vehicles | Case Study | Data collection and Analysis |
| Topics:<br>Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. | | | |
| Module 3 | Energy storage for EV and HEV | Assignment | Any energy storage device |
| Topics:<br>Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells. | | | |
| Module 4 | Battery Management Systems (BMS | Assignment | Case study |
| Topics:<br>Introduction to Battery Management Systems (BMS), important terminology used to describe battery cells, Architecture of BMS, Classification of BMS, principles of operation of standard electrochemical battery cells. | | | |

**Targeted Application & Tools that can be used:**

Application: Automotive industry.

Software tools: Matlab-Simulink

**Text Book**

1. Mehrdad Ehsani, YiminGao, sebastien E. Gay and Ali Emadi, —Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design‖, CRC Press, 2009.
2. Iqbal Husain, —Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2011.

**References**

1. James Larminie and John Loury, —Electric Vehicle Technology-Explained‖, John Wiley & Sons Ltd., 2003.
2.C.C. Chan and K.T. ChanuModern Electric Vehicle Technology, OXFORD University, 2011
3.Sheldon S. Williamson,- Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer,2013
4. Chris Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.

**Online resources:**

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://nptel.ac.in/courses/108/106/108106170/
3. Text book of Electric and Hybrid Vehicles : Power Sources, Models, Sustainability, Infrastructure and the Market, Gianfranco Pistoia, 1st ed. Amsterdam : Elsevier. 2010https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=0&sid=52da4e6e-8813-45d5-87f9-

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| 73b9f493f358%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=342445&db=nlebk<br>4. Seminar<br>https://puniversity.informaticsglobal.com:2069/search/searchresult.jsp?newsearch=true&queryText=electric%20vehicles<br>5. Case Study: Data collection/Quiz based on the basics of batteries and the characteristics of energy storage devices used in EVs. |
| **Topics relevant to "ENTREPRENEURIAL SKILLS":**Vehicle fundamentals, total tractive effort and design of drive train for different vehicle architectures fordeveloping**Entrepreneurial Skills**through**Problem Solving methodologies**. This is attained through assessment component mentioned in Course Plan.<br>**Topics relevant to "ENVIRONMENT AND SUSTAINABILITY":** Types of Batteries, Materials of battery used, Fuel cell. |

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| **Catalogue prepared by** | Mr. K Sreekanth Reddy |
| **Recommended by the Board of Studies on** | BoS No:14th BoS held on 22/2/2022 |
| **Date of Approval by the Academic Council** | 18th Academic Council meeting held on 03/8/2022 |

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| **Course Code: EEE1006** | **Course Title: Smart Sensors for Engineering Applications**<br>**Type of Course: Open Elective &Theory Only** | **L-T- P-C** | 3 | 0 | 0 | 3 |
| **Version No.** | 2.0 | | | | | |
| **Course Pre-requisites** | Nil | | | | | |
| **Anti-requisites** | Nil | | | | | |
| **Course Description** | The course highlights the basics of sensors & transducers and on the integration of electronics and sensors to create a smart transducers or a system on a chip with multiple integrated devices. It also provides inputs in the selection of appropriate sensor based on requirement and application. The course is being analytical one it requires basic mathematical and computing knowledge. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of **Smart Sensors for Engineering Applications** and attain **Skill Development** through **Participative Learning** techniques. | | | | | |
| **Course Out Comes** | On successful completion of the course the students shall be able to:<br>1) Discuss the need of Transducers , their classification and principle<br>2) Explain the principle of various types of sensors<br>3) Describe the fundamentals and general architecture of smart sensors.<br>4) Summarize the applications area of smart sensors. | | | | | |
| **Course content:** | | | | | | |
| **Module 1** | Introduction to sensors &Transducers | Assignment | Quiz | **12 sessions** | | |
| Introduction, Classification of Transducers , Basic Principle, Different types of Transducers : Resistive Transducers , capacitive Transducers , piezoelectric Transducers , Temperature Transducers | | | | | | |

<table>
<tr><td>Module 2</td><td>Sensor fundamentals</td><td>Assignment</td><td>Case study</td><td>12 sessions</td></tr>
<tr><td colspan="5">Sensor types and classification, Sensors parameters, Selection of sensors, Light sensing, technology, Proximity sensors: Inductive and capacitive, Pneumatic sensors, Motion sensors, Miscellaneous sensors</td></tr>
<tr><td>Module 3</td><td>Components & Architecture of Smart Sensors</td><td>Mini project</td><td>Developing a measurement system /Programming task</td><td>12 sessions</td></tr>
<tr><td colspan="5">Smart Sensors, Components of Smart Sensors, General Architecture of Smart Sensors, Evolution of Smart Sensors, Advantages, Telemetry</td></tr>
<tr><td>Module 4</td><td>Application area of Smart Sensors</td><td>Mini project continued</td><td>Developing a measurement system /Programming task</td><td>9 sessions</td></tr>
<tr><td colspan="5">Home Automation, Industrial, Medical, Robotics, Automobile, Aircrafts</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:<br>Application: Various types of Industries, Robotics, Automation of machines<br>List of Open Source Software/learning website: NPTEL, Matlab-Simulink, LabVIEW (NI),</td></tr>
<tr><td colspan="5">Text Books<br>1. Sensor Systems: Fundamentals and Applications, Clarence W. De Silva, CRC press, 1st edition, 2016.<br>2. Understanding Smart Sensors- Randy Frank, 2nd Edition. Artech House Publications, 2013.<br>3. Lecture notes(L1) /PPT</td></tr>
<tr><td colspan="5">References<br>1. A Course In Electrical And Electronic Measurements And Instrumentation, A. K. Sawhney, Dhanpat Rai publications, 4th edition<br>2. Smart sensor systems, Gerard C.M. Meijer, Willey Publications,2008, First Edition<br>3. G. K. Anantha suresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat, V. K. Aatre, Micro and Smart<br>Systems: Technology and modeling, Willey Publications,2012<br>4. Measurement and Instrumentation: Theory and Applications By Alan S Morris, Reza Langari, Academic press, Elsevier, 2015.<br>5. Data Acquisition and Signal Processing for Smart Sensors by Nikolay Kirianaki, Sergey Yurish, Nestor Shpak, Vadim Deynega, John Wiley & Sons Ltd<br>Online resources:<br>1. https://nptel.ac.in/courses/108/108/108108147/<br>2. https://nptel.ac.in/courses/112/108/112108092/<br>3. https://www.coursera.org/lecture/smart-device-mobile-emerging-technologies/2-4-sensors-0EIl<br>4. https://puniversity.informaticsglobal.com</td></tr>
<tr><td colspan="5">Topics relevant to "SKILLS DEVELOPMENT": Study of various types of smart sensors & Transducers used for practical applications for developing Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in Course Plan.</td></tr>
<tr><td colspan="2">Catalogue prepared by</td><td colspan="3">Ms. Ragasudha C P</td></tr>
<tr><td colspan="2">Recommended by the Board of Studies on</td><td colspan="3">BoS No: 14th BoS held on 22/02/22</td></tr>
<tr><td colspan="2">Date of Approval by the</td><td colspan="3">18th Academic council Meeting held on 03/08/2022</td></tr>
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| **Academic Council** | |