



CURRICULUM AND SYLLABI
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
REGULATION R2020
(For 2021-2025 Batch)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To provide the students with high quality technical education in the field of Electrical and Electronics Engineering enabling them to become competent and responsible engineers with employability and entrepreneurial skills.

MISSION

M1: Equip the students with adequate knowledge in the field of Electrical and Electronics Engineering and professional skills necessary to face the future challenges with confidence and courage.

M2: Engineer them to engage in research activities leading to innovative applications of technology.

M3: Enable them to become responsible citizens of the country with a willingness to serve the society.

Programme Outcomes (POs)

At the time of their graduation students of Electrical and Electronics Engineering Programme should be in possession of the following Programme Outcomes

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

PO2. Problem analysis: Identify, formulate, review research literature, and analyze electrical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex electrical 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 modeling to complex electrical 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.

Program Educational Objectives (PEOs)

PEO1: Graduates will have successful career in industry that meets the needs of Indian and multinational companies.

PEO2: Graduates will have the ability to synthesize data and develop technical concepts for application to product design and to solve contemporary problems

PEO3: Graduates will work as part of teams on multidisciplinary projects with good technical, communication and interpersonal skills.

PEO4: Graduates will fulfill the roles and responsibilities of professional electrical engineers in their chosen career with an attitude to serve the industry and society.

PEO5: Graduates will undertake research, pursuing higher studies, thereby adopting extended learning, keeping pace with the technological developments and codes of professional practice.

Mapping of PO's to PEO's

| Programme Educational Objectives | Programme Outcomes | | | | | | | | | | | |
|----------------------------------|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| PEO 1 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 3 |
| PEO 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| PEO 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 |
| PEO 4 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 |
| PEO 5 | 2 | 2 | 2 | 1 | 1 | 3 | 2 | 3 | 3 | 2 | 2 | 2 |

| | | | | | |
|---|-------------------|---|-------------------|---|-----------------|
| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|-------------------|---|-------------------|---|-----------------|

Program Specific Outcome (PSOs)

After the successful completion of the B.E. Electrical and Electronics Engineering programme, the graduates will be able to:

PSO1: Analyze basic scientific concepts and provide solutions to Electrical and Electronics Engineering problems with a specific focus on emerging energy challenges.

PSO2: Use relevant software apply current techniques for data processing problems in the field of modern electronic systems for sustainable development.

PSO3: Develop products/software to cater to the societal & Industrial needs and adapt ethical values so as to become successful electrical engineering professionals.

| Year | Sem | Course Code / Course Title | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|--------|-------------|---|------------------|---|---|---|---|---|---|---|---|----|----|----|---------------------------|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| Year I | Semester I | 21SB101 - Engineering Biology | 2 | 2 | 2 | 2 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 |
| | | 21MA101 - Engineering Mathematics I | 3 | 2 | 3 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 1 | 0 |
| | | 21PH102 - Physics for Electrical Science | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 2 | 1 | 0 |
| | | 21EE101 - Analog Electronics | 3 | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 0 |
| | | 21CS111 - Problem Solving using C Programming | 3 | 2 | 3 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 0 |
| | | 21ME103 - Engineering Practices Laboratory | 3 | 2 | 3 | 1 | 2 | 0 | 2 | 1 | 1 | 1 | 0 | 1 | 2 | 0 | 0 |
| | | 21MC101 - Induction Programme | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 3 | 0 | 3 | 0 | 0 | 3 |
| | Semester II | 21GE201- Universal Human Values | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 2 | 0 | 3 | 0 | 0 | 3 |
| | | 21MA201 - Engineering Mathematics II | 3 | 2 | 3 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 1 | 0 |
| | | 21EN101 - Technical Communication Skills | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 3 | 2 | 3 | 0 | 3 | 0 | 0 | 3 |
| | | 21CH101- Engineering Chemistry | 2 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| | | 21EE201 - Basics of Electrical Circuits | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 |
| | | 21ME111 - Engineering Graphics | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 2 | 0 | 2 | 0 | 0 |
| | | 21MC102 - Environmental Sciences | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 0 | 0 | 3 | 0 | 0 | 3 |

| Year | Sem | Course Code / Course Title | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---------|--------------|---|------------------|---|---|---|---|---|---|---|---|----|----|----|---------------------------|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| Year II | Semester III | 21MA303 – Transforms and Numerical Methods | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | | 21EE301 - Electrical Machines I | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 |
| | | 21EE302 - Linear and Digital Integrated Circuits | 3 | 2 | 1 | 1 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 3 | 0 | 0 |
| | | 21EE303 - Measuring Instruments and Smart Sensors | 3 | 2 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 |
| | | 21CS303 - Managing Data using RDBMS | 3 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 3 | 2 | 2 |
| | | 21CS304 - Problem Solving using C++ and Data Structures | 3 | 3 | 2 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 2 | 2 | 3 | 2 | 2 |
| | | 21EE304 - Electrical Machines - I Laboratory | 3 | 3 | 2 | 2 | 1 | 0 | 1 | 2 | 2 | 2 | 0 | 0 | 3 | 0 | 3 |
| | | 21EE305 - Linear and Digital Integrated Circuits Laboratory | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 2 | 0 | 2 | 1 | 3 | 3 | 0 |
| | Semester IV | 21MA403 - Applied Mathematics | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | | 21EE401 - Electrical Machines II | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 3 | 0 | 3 |
| | | 21EE402 - Generation, Transmission and Distribution | 3 | 2 | 1 | 1 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 3 | 0 | 0 |
| | | 21EE403 - Control Systems | 3 | 3 | 2 | 2 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 3 | 0 | 0 |
| | | 21IT301 – Web Development using React | 3 | 3 | 3 | 2 | 3 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| | | 21CS302 - Java Programming | 3 | 3 | 3 | 2 | 3 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| | | 21EE404 - Electrical Machines - II Laboratory | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 3 | 0 | 3 |
| | | 21EE405 - Control Systems Laboratory | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 2 | 1 | 0 |
| | | 21MCXXX - Mandatory Course III | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |

| Year | Sem | Course Code / Course Title | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|----------|-------------|--|------------------|---|---|---|---|---|---|---|---|----|----|----|---------------------------|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| Year III | Semester V | 21EE501- Power Electronics | 3 | 2 | 2 | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 1 | 2 | 3 | 2 | 0 |
| | | 21EE502 - Power System Analysis | 3 | 2 | 1 | 1 | 2 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 3 | 0 | 0 |
| | | 21YYOXX - Open Elective-I | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 21EE0XX- Emerging Elective-I | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 21EE503- Microcontrollers | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 2 | 0 | 2 | 1 | 0 | 3 | 1 |
| | | 21EE504- Virtual Instrumentation Programming | 3 | 2 | 2 | 2 | 3 | 0 | 0 | 2 | 2 | 2 | 0 | 3 | 2 | 2 | 2 |
| | | 21EE505 - Power Electronics Laboratory | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 0 | 2 | 0 | 2 | 2 | 3 | 3 | 0 |
| | | 21EE506 - Power System Simulation Laboratory | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 3 | 2 | 1 | 3 | 0 | 3 | 1 |
| | | 21MCXXX - Mandatory Course IV | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | Semester VI | 21EC611- Principles of Digital Signal Processing | 3 | 2 | 2 | 2 | 3 | 0 | 0 | 0 | 2 | 0 | 2 | 2 | 2 | 2 | 0 |
| | | 21EE9XX - Professional Elective-I | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 21EE9XX - Professional Elective-II | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 21YYOXX- Open Elective-II | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 21EE0XX - Emerging Elective-II | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 21EC612 - Embedded System Programming | 3 | 2 | 2 | 2 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 3 | 0 | 0 |
| | | 21EC613 - Principles of Digital Signal Processing Laboratory | 3 | 3 | 2 | 2 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 3 | 0 |
| | | 21EE601 - Mini Project - I | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| | | 21EES01 - Employment Enhancement Skills | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |

| Year | Sem | Course Code - CourseTitle | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---------|---------------|--|------------------|---|---|---|---|---|---|---|---|----|----|----|---------------------------|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| Year IV | Semester VII | 21EE701 - Power System Protection and Switchgear | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 |
| | | 21MG701 - Engineering Economics | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 2 | 2 | 1 | 0 | 0 | 0 |
| | | 21EE9XX-Professional Elective III | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| | | 21EE9XX-Professional Elective IV | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| | | 21EE9XX- Professional Elective V | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| | | 21EE9XX - Professional Elective VI | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| | | 21EE702 - Digital Simulation for Electrical Systems Laboratory | 3 | 2 | 1 | 1 | 3 | 2 | 2 | 0 | 2 | 0 | 2 | 2 | 3 | 3 | 0 |
| | | 21EE703 - Mini Project II | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| | Semester VIII | 21EE801 - Project | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
REGULATION R2020 (For 2021-2025 Batch)
CHOICE BASED CREDIT SYSTEM
I – VIII SEMESTER CURRICULUM AND SYLLABI

| SEMESTER I | | | | | | | |
|------------------------------|--------------------|-------------------------------------|----------------|-----------------------|-----------|----------------|-------------|
| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Ext/Int | Cat. |
| Theory | | | | | | | |
| 1 | 21SB101 | Engineering Biology | 3/0/0 | 3 | 3 | 60/40 | BSC |
| Theory Cum Laboratory | | | | | | | |
| 2 | 21MA101 | Engineering Mathematics-I | 2/1/2 | 5 | 4 | 50/50 | BSC |
| 3 | 21PH102 | Physics for Electrical Science | 3/0/3 | 6 | 4.5 | 50/50 | BSC |
| 4 | 21EE101 | Analog Electronics | 3/0/2 | 5 | 4 | 50/50 | PCC |
| 5 | 21CS111 | Problem Solving using C Programming | 3/0/2 | 5 | 4 | 50/50 | ESC |
| Practical | | | | | | | |
| 6 | 21ME103 | Engineering Practices Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | ESC |
| Mandatory Course | | | | | | | |
| 7 | 21MC101 | Mandatory Course I | 3 Weeks | | 0 | 0/100 | MC |
| Total | | | 14/1/12 | 27 | 21 | 700 | |

| SEMESTER II | | | | | | | |
|------------------------------|--------------------|--------------------------------|----------------|-----------------------|-----------|----------------|-------------|
| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Ext/Int | Cat. |
| Theory | | | | | | | |
| 1 | 21GE201 | Universal Human Values | 3/0/0 | 3 | 3 | 60/40 | HSMC |
| Theory Cum Laboratory | | | | | | | |
| 2 | 21MA201 | Engineering Mathematics-II | 2/1/2 | 5 | 4 | 50/50 | BSC |
| 3 | 21EN101 | Technical Communication Skills | 2/0/2 | 4 | 3 | 50/50 | HSMC |
| 4 | 21CH101 | Engineering Chemistry | 3/0/3 | 6 | 4.5 | 50/50 | BSC |
| 5 | 21EE201 | Basics of Electrical Circuits | 3/1/2 | 6 | 5 | 50/50 | ESC |
| 6 | 21ME111 | Engineering Graphics | 1/0/3 | 4 | 2.5 | 40/60 | ESC |
| Mandatory Course | | | | | | | |
| 7 | 21MC102 | Mandatory Course II | 2/0/0 | 2 | 0 | 0/100 | MC |
| Total | | | 16/2/12 | 30 | 22 | 700 | |

| SEMESTER III | | | | | | | |
|------------------------------|-------------|---|---------------|----------------|-----------|------------|------|
| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Ext/Int | Cat. |
| Theory | | | | | | | |
| 1 | 21MA303 | Transforms and Numerical Methods | 3/0/0 | 3 | 3 | 60/40 | BSC |
| 2 | 21EE301 | Electrical Machines-I | 3/0/0 | 3 | 3 | 60/40 | PCC |
| 3 | 21EE302 | Linear and Digital Integrated Circuits | 3/0/0 | 3 | 3 | 60/40 | PCC |
| 4 | 21EE303 | Measuring Instruments and Smart Sensors | 3/0/0 | 3 | 3 | 60/40 | PCC |
| Theory Cum Laboratory | | | | | | | |
| 5 | 21CS303 | Managing Data using RDBMS | 3/0/2 | 5 | 4 | 50/50 | ESC |
| 6 | 21CS304 | Problem Solving using C++ and Data Structures | 3/0/2 | 5 | 4 | 50/50 | ESC |
| Practical | | | | | | | |
| 7 | 21EE304 | Electrical Machines-I Laboratory | 0/0/2 | 2 | 1 | 40/60 | PCC |
| 8 | 21EE305 | Linear and Digital Integrated Circuits Laboratory | 0/0/2 | 2 | 1 | 40/60 | PCC |
| Total | | | 18/0/8 | 26 | 22 | 800 | |

| SEMESTER IV | | | | | | | |
|------------------------------|-------------|---|---------------|----------------|-----------|------------|------|
| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Ext/Int | Cat. |
| Theory | | | | | | | |
| 1 | 21MA403 | Applied Mathematics | 3/0/0 | 3 | 3 | 60/40 | BSC |
| 2 | 21EE401 | Electrical Machines-II | 3/0/0 | 3 | 3 | 60/40 | PCC |
| 3 | 21EE402 | Generation, Transmission and Distribution | 3/0/0 | 3 | 3 | 60/40 | PCC |
| 4 | 21EE403 | Control Systems | 3/1/0 | 4 | 4 | 60/40 | PCC |
| Theory Cum Laboratory | | | | | | | |
| 5 | 21IT301 | Web Development using React | 3/0/2 | 5 | 4 | 50/50 | ESC |
| 6 | 21CS302 | Java Programming | 3/0/2 | 5 | 4 | 50/50 | ESC |
| Practical | | | | | | | |
| 7 | 21EE404 | Electrical Machines-II Laboratory | 0/0/2 | 2 | 1 | 40/60 | PCC |
| 8 | 21EE405 | Control Systems Laboratory | 0/0/2 | 2 | 1 | 40/60 | PCC |
| Mandatory Course | | | | | | | |
| 9 | 21MCXXX | Mandatory Course III | 2/0/0 | 2 | 0 | 0/100 | MC |
| Total | | | 20/1/8 | 29 | 23 | 900 | |

| SEMESTER V | | | | | | | |
|------------------------------|-------------|-------------------------------------|-------------------------------------|---------------------------|-----------|------------------------|------|
| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Ext/Int | Cat. |
| Theory | | | | | | | |
| 1 | 21EE501 | Power Electronics | 3/0/0 | 3 | 3 | 60/40 | PCC |
| 2 | 21EE502 | Power System Analysis | 3/0/0 | 3 | 3 | 60/40 | PCC |
| 3 | 21YYOXX | Open Elective-I | 3/0/0 (or) 0/0/6 | 3 (or) 6 | 3 | 60/40 (or) 40/60 | OEC |
| 4 | 21EE0XX | Emerging Elective-I | 3/0/0 | 3 | 3 | 60/40 | EEC |
| Theory Cum Laboratory | | | | | | | |
| 5 | 21EE503 | Microcontrollers | 3/1/2 | 6 | 5 | 50/50 | PCC |
| 6 | 21EE504 | Virtual Instrumentation Programming | 2/0/2 | 4 | 3 | 50/50 | PCC |
| Practical | | | | | | | |
| 7 | 21EE505 | Power Electronics Laboratory | 0/0/2 | 2 | 1 | 40/60 | PCC |
| 8 | 21EE506 | Power System Simulation Laboratory | 0/0/2 | 2 | 1 | 40/60 | PCC |
| Mandatory Course | | | | | | | |
| 9 | 21MCXXX | Mandatory Course IV | 2/0/0 | 2 | 0 | 0/100 | MC |
| Total | | | 19/1/08 (or) 19/1/11 | 28 (or) 31 | 22 | 900 | |

| SEMESTER VI | | | | | | | |
|------------------------------|-------------|---|------------------------|----------------|---|------------------------|------|
| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Ext/Int | Cat. |
| Theory | | | | | | | |
| 1 | 21EC611 | Principles of Digital Signal Processing | 2/1/0 | 3 | 3 | 60/40 | PCC |
| 2 | 21EE9XX | Professional Elective-I | 3/0/0 | 3 | 3 | 60/40 | PEC |
| 3 | 21EE9XX | Professional Elective-II | 3/0/0 | 3 | 3 | 60/40 | PEC |
| 4 | 21YYOXX | Open Elective-II | 3/0/0 (or) 0/0/6 | 3 (or) 6 | 3 | 60/40 (or) 40/60 | OEC |
| 5 | 21EE0XX | Emerging Elective-II | 3/0/0 | 3 | 3 | 60/40 | EEC |
| Theory Cum Laboratory | | | | | | | |
| 6 | 21EC612 | Embedded System Programming | 3/0/2 | 5 | 4 | 50/50 | PCC |
| Practical | | | | | | | |

| | | | | | | | |
|----------------------------|---------|--|-------------------------------------|---------------------------|-----------|------------|------|
| 7 | 21EC613 | Principles of Digital Signal Processing Laboratory | 0/0/2 | 2 | 1 | 40/60 | PCC |
| Mini Project | | | | | | | |
| 8 | 21EE601 | Mini Project-I | 0/0/2 | 2 | 1 | 40/60 | PROJ |
| Industrial Practice | | | | | | | |
| 9 | 21EES01 | Employment Enhancement Skills | | | 2 | - | EES |
| Total | | | 17/1/06 (or) 17/1/09 | 24 (or) 27 | 23 | 900 | |

| SEMESTER VII | | | | | | | |
|---------------------|--------------------|---|---------------|-----------------------|-----------|----------------|-------------|
| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Ext/Int | Cat. |
| Theory | | | | | | | |
| 1 | 21EE701 | Power System Protection and Switchgear | 3/0/0 | 3 | 3 | 60/40 | PCC |
| 2 | 21MG701 | Engineering Economics | 3/0/0 | 3 | 3 | 60/40 | HSMC |
| 3 | 21EE9XX | Professional Elective-III | 3/0/0 | 3 | 3 | 60/40 | PEC |
| 4 | 21EE9XX | Professional Elective-IV | 3/0/0 | 3 | 3 | 60/40 | PEC |
| 5 | 21EE9XX | Professional Elective-V | 3/0/0 | 3 | 3 | 60/40 | PEC |
| 6 | 21EE9XX | Professional Elective-VI | 3/0/0 | 3 | 3 | 60/40 | PEC |
| Practical | | | | | | | |
| 7 | 21EE702 | Digital Simulation of Electrical Systems Laboratory | 0/0/2 | 2 | 1 | 40/60 | PCC |
| Mini Project | | | | | | | |
| 8 | 21EE703 | Mini Project-II | 0/0/2 | 2 | 1 | 40/60 | PROJ |
| Total | | | 18/0/4 | 22 | 20 | 800 | |

| SEMESTER VIII | | | | | | | |
|----------------------|--------------------|---------------------|---------------|-----------------------|-----------|----------------|-------------|
| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Ext/Int | Cat. |
| 1 | 21EE801 | Project | 0/0/24 | 24 | 12 | 40/60 | PROJ |
| Total | | | 0/0/24 | 24 | 12 | 100 | |

SCHEME OF CREDIT DISTRIBUTION - SUMMARY

| S.No | Stream | Credits/Semester | | | | | | | | Credits | Courses | | | % |
|--------------|--|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-------------------|-----------|------------|
| | | I | II | III | IV | V | VI | VII | VIII | | Theory | Theory Cum Lab | Lab | |
| 1. | Humanities and Social Sciences Including Management (HSMC) | | 6 | | | | | 3 | | 9 | 2 | 1 | | 5.45 |
| 2. | Basic Science Courses (BSC) | 11.5 | 8.5 | 3 | 3 | | | | | 26 | 3 | 4 | | 15.75 |
| 3. | Engineering Science Courses (ESC) | 5.5 | 7.5 | 8 | 8 | | | | | 29 | | 6 | 2 | 17.57 |
| 4. | Professional Core Courses (PCC) | 4 | | 11 | 12 | 16 | 8 | 4 | | 55 | 10 | 4 | 8 | 33.33 |
| 5. | Professional Elective Courses (PEC) | | | | | | 6 | 12 | | 18 | 6 | | | 10.90 |
| 6. | Open Elective Course (OEC) / Emerging Elective Course (EEC) | | | | | 6 | 6 | | | 12 | 4 | | | 7.27 |
| 7. | Project Work (PROJ) / Employability Enhancement Skills (EES) | | | | | | 3 | 1 | 12 | 16 | | | 3 | 9.69 |
| 8. | Mandatory Courses (MC) | - | - | | - | - | | | | 0 | 4 | | | - |
| Total | | 21 | 22 | 22 | 23 | 22 | 23 | 20 | 12 | 165 | 31 | 13 | 15 | 100 |

CURRICULUM STRUCTURE FOR UG DEGREE PROGRAMME

| S.No | Course Work - Subject Area | AICTE Suggested Breakdown of Credits | SKCET Credits |
|---|---|--------------------------------------|---------------|
| 1. | Humanities and Social Sciences (HS), including Management Courses | 12* | 9 |
| 2. | Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology | 26* | 26 |
| 3. | Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/ Electronics/ Mechanical/ Computer Engineering, Instrumentation | 20* | 29 |
| 4. | Professional Subjects - Core (PC), relevant to the chosen specialization/branch | 53* | 55 |
| 5. | Professional Subjects - Electives (PE), relevant to the chosen specialization/ branch; | 18* | 18 |
| 6. | Open Subjects- Electives (OE), from other technical and/or emerging subject areas | 18* | 12 |
| 7. | Project Work, Seminar and/or Internship in Industry or elsewhere | 11* | 14 |
| 8. | Employability Enhancement Skills | - | 2 |
| 9. | Mandatory Courses (MC) | Non-credit | Non-credit |
| Total | | 158* | 165 |
| <i>*Minor Variations is allowed as per need of the respective disciplines</i> | | | |

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (9 Credits)

| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Cat. |
|------|-------------|--------------------------------|-------|----------------|---|------|
| 1. | 21GE201 | Universal Human Values | 3/0/0 | 3 | 3 | HSMC |
| 2. | 21EN101 | Technical Communication Skills | 2/0/2 | 4 | 3 | HSMC |
| 3. | 21MG701 | Engineering Economics | 3/0/0 | 3 | 3 | HSMC |

BASIC SCIENCE COURSES (26 Credits)

| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Cat. |
|------|-------------|----------------------------------|-------|----------------|-----|------|
| 1. | 21SB101 | Engineering Biology | 3/0/0 | 3 | 3 | BSC |
| 2. | 21MA101 | Engineering Mathematics I | 2/1/2 | 5 | 4 | BSC |
| 3. | 21PH102 | Physics for Electrical Science | 3/0/3 | 6 | 4.5 | BSC |
| 4. | 21MA201 | Engineering Mathematics II | 2/1/2 | 5 | 4 | BSC |
| 5. | 21CH101 | Engineering Chemistry | 3/0/3 | 6 | 4.5 | BSC |
| 6. | 21MA303 | Transforms and Numerical Methods | 3/0/0 | 3 | 3 | BSC |
| 7. | 21MA403 | Applied Mathematics | 3/0/0 | 3 | 3 | BSC |

ENGINEERING SCIENCE COURSES (29 Credits)

| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Cat. |
|------|-------------|---|-------|----------------|-----|------|
| 1. | 21CS111 | Problem Solving using C Programming | 3/0/2 | 5 | 4 | ESC |
| 2. | 21ME103 | Engineering Practices Laboratory | 0/0/3 | 4 | 1.5 | ESC |
| 3. | 21EE201 | Basics of Electrical Circuits | 3/1/2 | 6 | 5 | ESC |
| 4. | 21ME111 | Engineering Graphics | 1/0/3 | 4 | 2.5 | ESC |
| 5. | 21CS303 | Managing Data using RDBMS | 3/0/2 | 5 | 4 | ESC |
| 6. | 21CS304 | Problem Solving using C++ and Data Structures | 3/0/2 | 5 | 4 | ESC |
| 7. | 21IT301 | Web Development using React | 3/0/2 | 5 | 4 | ESC |
| 8. | 21CS302 | Java Programming | 3/0/2 | 5 | 4 | ESC |

PROFESSIONAL CORE COURSES (55 Credits)

| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Cat. |
|------|-------------|--|-------|----------------|---|------|
| 1. | 21EE101 | Analog Electronics | 3/0/2 | 5 | 4 | PCC |
| 2. | 21EE301 | Electrical Machines-I | 3/0/0 | 3 | 3 | PCC |
| 3. | 21EE302 | Linear and Digital Integrated Circuits | 3/0/0 | 3 | 3 | PCC |
| 4. | 21EE303 | Measuring Instruments and Smart Sensors | 3/0/0 | 3 | 3 | PCC |
| 5. | 21EE304 | Electrical Machines-I Laboratory | 0/0/2 | 2 | 1 | PCC |
| 6. | 21EE305 | Linear and Digital Integrated Circuits Laboratory | 0/0/2 | 2 | 1 | PCC |
| 7. | 21EE401 | Electrical Machines-II | 3/0/0 | 3 | 3 | PCC |
| 8. | 21EE402 | Generation, Transmission and Distribution | 3/0/0 | 3 | 3 | PCC |
| 9. | 21EE403 | Control Systems | 3/1/0 | 4 | 4 | PCC |
| 10. | 21EE404 | Electrical Machines-II Laboratory | 0/0/2 | 2 | 1 | PCC |
| 11. | 21EE405 | Control Systems Laboratory | 0/0/2 | 2 | 1 | PCC |
| 12. | 21EE501 | Power Electronics | 3/0/0 | 3 | 3 | PCC |
| 13. | 21EE502 | Power System Analysis | 3/0/0 | 3 | 3 | PCC |
| 14. | 21EE503 | Microcontrollers | 3/1/2 | 6 | 5 | PCC |
| 15. | 21EE504 | Virtual Instrumentation Programming | 2/0/2 | 4 | 3 | PCC |
| 16. | 21EE505 | Power Electronics Laboratory | 0/0/2 | 2 | 1 | PCC |
| 17. | 21EE506 | Power System Simulation Laboratory | 0/0/2 | 2 | 1 | PCC |
| 18. | 21EC611 | Principles of Digital Signal Processing | 2/1/0 | 3 | 3 | PCC |
| 19. | 21EC612 | Embedded System Programming | 3/0/2 | 5 | 4 | PCC |
| 20. | 21EC613 | Principles of Digital Signal Processing Laboratory | 0/0/2 | 2 | 1 | PCC |
| 21. | 21EE701 | Power System Protection and Switchgear | 3/0/0 | 3 | 3 | PCC |
| 22. | 21EE702 | Digital Simulation for Electrical Systems Laboratory | 0/0/2 | 2 | 1 | PCC |

PROFESSIONAL ELECTIVE COURSES (18 Credits)

| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Cat. |
|---|-------------|---|-------|----------------|---|------|
| Elective Stream I - Power System | | | | | | |
| 1. | 21EE901 | Smart Grid Technology | 3/0/0 | 3 | 3 | PEC |
| 2. | 21EE902 | Power System Restructuring | 3/0/0 | 3 | 3 | PEC |
| 3. | 21EE903 | Energy Auditing, Conservation and Management | 3/0/0 | 3 | 3 | PEC |
| 4. | 21EE904 | Power System Operation and Control | 3/0/0 | 3 | 3 | PEC |
| 5. | 21EE905 | Power Quality | 3/0/0 | 3 | 3 | PEC |
| 6. | 21EE906 | High Voltage Engineering | 3/0/0 | 3 | 3 | PEC |
| 7. | 21EE907 | Renewable Energy and Storage Systems | 3/0/0 | 3 | 3 | PEC |
| 8. | 21EE908 | Distribution Automation Systems | 3/0/0 | 3 | 3 | PEC |
| 9. | 21EE909 | HVDC Transmission Systems | 3/0/0 | 3 | 3 | PEC |
| Elective Stream II - Applied Electronics | | | | | | |
| 1. | 21EC941 | Data Communication and Networks | 3/0/0 | 4 | 3 | PEC |
| 2. | 21EE910 | Introduction to Soft Computing | 3/0/0 | 3 | 3 | PEC |
| 3. | 21EC942 | VLSI Design and Technology | 3/0/0 | 3 | 3 | PEC |
| 4. | 21EC921 | Wireless Sensor Networks | 3/0/0 | 3 | 3 | PEC |
| 5. | 21EC943 | Digital Control Systems | 3/0/0 | 3 | 3 | PEC |
| 6. | 21EE911 | Automotive Electronics | 3/0/0 | 3 | 3 | PEC |
| 7. | 21EC944 | Aviation Electronics Technology | 3/0/0 | 3 | 3 | PEC |
| 8. | 21EC945 | Principles of Communication Engineering | 3/0/0 | 3 | 3 | PEC |
| 9. | 21EC946 | Nano Electronics | 3/0/0 | 3 | 3 | PEC |
| Elective Stream III - Power Electronics | | | | | | |
| 1. | 21EE913 | Design of Electrical Machines | 3/0/0 | 3 | 3 | PEC |
| 2. | 21EE914 | Special Electrical Machines | 3/0/0 | 3 | 3 | PEC |
| 3. | 21EE915 | PLC and Automation | 3/0/0 | 3 | 3 | PEC |
| 4. | 21EE916 | Servo Drives in Robotics | 3/0/0 | 3 | 3 | PEC |
| 5. | 21EE917 | Flexible AC Transmission Systems | 3/0/0 | 3 | 3 | PEC |
| 6. | 21EE918 | Digital Simulation of Power Electronic Circuits | 3/0/0 | 3 | 3 | PEC |
| 7. | 21EE919 | Electric Drives and Control | 3/0/0 | 3 | 3 | PEC |
| 8. | 21EE920 | Active PWM Rectifiers | 3/0/0 | 3 | 3 | PEC |
| 9. | 21EE921 | Electric and Hybrid Vehicles | 3/0/0 | 3 | 3 | PEC |

OPEN ELECTIVE COURSES (6 Credits)

| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Cat. |
|--------------------|-------------|------------------------------|-------|----------------|---|------|
| Stream - I | | | | | | |
| 1. | 21EE001 | Power Generation systems | 3/0/0 | 3 | 3 | OEC |
| 2. | 21EE002 | Autonomous Vehicles | 3/0/0 | 3 | 3 | OEC |
| 3. | 21EE003 | Special Purpose Machines | 3/0/0 | 3 | 3 | OEC |
| Stream - II | | | | | | |
| 4. | 21EE004 | Renewable Energy Sources | 3/0/0 | 3 | 3 | OEC |
| 5. | 21EE005 | Servo and Robot Drives | 3/0/0 | 3 | 3 | OEC |
| 6. | 21EE006 | Industrial Electrical system | 3/0/0 | 3 | 3 | OEC |

EMERGING ELECTIVE COURSES (6 Credits)

| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Cat. |
|--------------------|-------------|---|-------|----------------|---|------|
| Stream - I | | | | | | |
| 1. | 21EE007 | Machine Learning Applications in Energy Systems | 3/0/0 | 3 | 3 | EEC |
| 2. | 21EE008 | Big Data Analytics for Smart Grid | 3/0/0 | 3 | 3 | EEC |
| 3. | 21EE009 | Advanced Processors | 3/0/0 | 3 | 3 | EEC |
| Stream - II | | | | | | |
| 4. | 21EE010 | Internet of Things and its Applications | 3/0/0 | 3 | 3 | EEC |
| 5. | 21EE011 | Real Time Systems | 3/0/0 | 3 | 3 | EEC |
| 6. | 21EE012 | Modern Power Converters | 3/0/0 | 3 | 3 | EEC |

MANDATORY COURSES (0 credits)

| S.No | Course Code | Course Title | L/T/P | Contact Hrs/Wk | C | Cat. |
|------|-------------|---|---------|----------------|---|------|
| 1. | 21MC101 | Induction Program | 3 weeks | | 0 | MC |
| 2. | 21MC102 | Environmental Sciences | 2/0/0 | 2 | 0 | MC |
| 3. | 21MC103 | Soft Skills | 2/0/0 | 2 | 0 | MC |
| 4. | 21MC104 | Management Organizational Behavior | 2/0/0 | 2 | 0 | MC |
| 5. | 21MC105 | General Aptitude | 2/0/0 | 2 | 0 | MC |
| 6. | 21MC106 | Life Skills and Ethics | 2/0/0 | 2 | 0 | MC |
| 7. | 21MC107 | Stress Management | 2/0/0 | 2 | 0 | MC |
| 8. | 21MC108 | Constitution of India | 2/0/0 | 2 | 0 | MC |
| 9. | 21MC109 | Essence of Indian Traditional Knowledge | 2/0/0 | 2 | 0 | MC |
| 10. | 21MC110 | Design and Analysis of Algorithms | 2/0/0 | 2 | 0 | MC |

VALUE ADDED COURSES

| S.No | Course Code | Course Title | Credits |
|------|-------------|--|---------|
| 1. | 21VA301 | Solar Energy Technology | 2 |
| 2. | 21VA302 | Industry 4.0 using Industrial Internet of Things | 2 |
| 3. | 21VA303 | Microgrid Technology | 2 |
| 4. | 21VA304 | FPGA-based Switched Mode Power Converters | 2 |
| 5. | 21VA305 | Phase-Locked Loop Circuit Design | 2 |
| 6. | 21VA306 | Substation Designing | 2 |
| 7. | 21VA307 | Contemporary Digital Techniques | 2 |
| 8. | 21VA308 | Recent Power Electronics and Control | 2 |
| 9. | 21VA309 | Neuro-Instrumentation | 2 |
| 10. | 21VA160 | Agile Product Development and Web Application Design | 2 |
| 11. | 21VA130 | Effective Communication Skills | 2 |

EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)

| S.No | Name of the Course | L/T/P | Contact Hrs/Wk | C | Cat. |
|------|--|-------|----------------|---|------|
| 1. | Employability Enhancement Skills (Internship / Journal Publication) | - | 4 Weeks | 2 | EES |

SEMESTER WISE CREDIT DISTRIBUTION

| Semester | I | II | III | IV | V | VI | VII | VIII | Total |
|----------|----|----|-----|----|----|----|-----|------|-------|
| Credits | 21 | 22 | 22 | 23 | 22 | 23 | 20 | 12 | 165 |

Total Credits: 165

L: Lecture **T:** Tutorial **P:** Practical **C:** Credit **Cat.:** Category

HSMC : Humanities and Social Sciences
(including Management Courses)

OEC : Open Elective Courses

BSC : Basic Science Courses

PROJ : Project Work

ESC : Engineering Science Courses

EEC : Emerging Elective Courses

PCC : Professional Core Courses

MC : Mandatory Course

PEC : Professional Elective Courses

EES : Employability Enhancement Skills

| | | | |
|---|---|--------------------|---------|
| 21SB101 | Engineering Biology | | 3/0/0/3 |
| Nature of Course | | C (Theory Concept) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To grasp and apply biological engineering principles, procedures needed to solve real-world problems. | | |
| 2 | To give a basic knowledge of the applications of biological systems in relevant Industries | | |
| 3 | To understand the mutual dependence of modern biology and engineering | | |
| 4 | To give a basic knowledge of artificial organs and physiological assist devices. | | |
| 5 | To understand about the use of various nanomaterials towards biological applications | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C101.1 | Explain the structure of human physiology | | [U] |
| C101.2 | Compare biological and artificial neural networks. | | [A] |
| C101.3 | Realize the basic concepts of brain computer interface. | | [U] |
| C101.4 | Apply the concept of Brain computer interface in different applications. | | [AP] |
| C101.5 | Recognize the compatibility and functioning of artificial organs inside the human being. | | [U] |
| C101.6 | Integrate the knowledge core of modern physiological assist device and its functionalities. | | [AP] |
| C101.7 | Comprehend the concepts of Nanomaterials for biotechnology | | [U] |
| Course Contents: | | | |
| Module 1: Human Physiology and Artificial Organ | | | 15 Hrs |
| Cell and their structure -Transport of ions through cell, Different systems of human body. Biological neural networks - Artificial neural networks, applications of neural networks - Artificial Kidney, Artificial Pancreas, Artificial liver, Artificial heart valves. | | | |
| Module 2: Biological Concepts Instrument (BCI) | | | 15 Hrs |
| Fundamentals of BCI - Working of BCI, Classification of BCI, measuring of surgical and non - surgical BCI, Neuro feedback Training for BCI Control, signal processing and application. | | | |
| Module 3: Nano biology | | | 15 Hrs |
| Introduction to Nano biology, Bioremediation - removal of bacteria and microbes. Nanomaterials for antimicrobial coatings- medical implants - medical and defense textiles. Biosensors - bio devices and implantable devices. Nanomaterials for diagnosis and therapy - Implications of Drug delivery- various forms of Nano carriers - Polymeric Nanoparticles as drug carriers - Drug release mechanism- Targeted drug delivery. Point-of-care and Personalized medicine. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Leslie Cromwell. Bomedical Instrumentation and measurements-PrenticeHall,2011 | | |
| 2 | Bernhard Graimann, Brenden Allison, GertPfurtscheller, Computer Interfaces: Revolutionizing Human-Computer Interaction, Springer 2010 | | |
| 3 | M Arumugam , Bio medical instrumentation, Anuradha Publications,2002 | | |
| 4 | B. Bhushan, Springer Handbook of Nanotechnology, Springer-Verlag, 2004 | | |
| Reference Books: | | | |
| 1 | Malcom Carpenter, Textbook of Neuroanatomyll, Mc. Graw hill Edition, 1996. | | |
| 2 | Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis,2011 | | |
| 3 | Matews G.G, Neurobiology, Second Edition, Blackwell Science, UK,2000 | | |

| Web References: | |
|-----------------|---|
| 1 | https://ocw.mit.edu/courses/biological-engineering/20-010j-introduction-to-bioengineering-be-010j-spring-2006/videos/Lecture-1-bioengineering/ |
| 2 | https://www.technicalsymposium.com/alllecturenotes_biomed.html |
| 3 | https://ocw.mit.edu/courses/biology/7-28-molecular-biology-spring-2005/ |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | | |
| 16 | 24 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|--|-------|
| Formative assessment based on Capstone Model (16%) | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
| C101.1 | Understand | Assignment | 4 |
| C101.2 | Analyze | | |
| C101.3 | Understand | Group Assignment | 4 |
| C101.4 | Apply | | |
| C101.5 | Understand | Class Presentation | 4 |
| C101.6 | Apply | Quiz | 4 |
| C101.7 | Understand | | |

| Assessment based on Continuous and End Semester Examination | | | |
|---|-----------------------------|--------------------------|--|
| Bloom's Level | Continuous Assessment (24%) | | End Semester Examination (60%) [60 Marks] |
| | CIA1 [12 Marks] | CIA2 [12 Marks] | |
| Remember | 10 | 10 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 20 | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Formative Assessment | Summative Assessment | | Total |
| | Continuous Assessment | End Semester Examination | |
| 16 | 24 | 60 | 100 |

| Summative Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-------------------------|--------------------------|-----------------|-------------------------|--------------------------------|-------------------------------|
| Continuous Assessment (40%) | | | | | End Semester Examination (60%) | |
| CA 1 : 20 Marks | | | CA 2 : 20 Marks | | | Theory Examination (60 Marks) |
| SA 1 (12 Marks) | FA 1 (8 Marks) | | SA 2 (12 Marks) | FA 2 (8 Marks) | | |
| | Component - I (4 Marks) | Component - II (4 Marks) | | Component - I (4 Marks) | Component - II (4 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|------------------|--------------------------|---------|---------|---------|----------|--------------------------|---------|---------|---------|----------|----------|------------------------|----------|----------|----------|
| C101.1 | 2 | 1 | 2 | 1 | | 3 | 2 | | | | | 3 | 2 | | |
| C101.2 | 3 | 3 | 3 | 3 | | 3 | 2 | | | | | 3 | 3 | | |
| C101.3 | 2 | 1 | 2 | 1 | | 3 | 2 | | | | | 3 | 2 | | |
| C101.4 | 3 | 2 | 3 | 3 | | 3 | 2 | | | | | 3 | 3 | | |
| C101.5 | 2 | 1 | 2 | 1 | | 3 | 2 | | | | | 3 | 2 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|---|---------|
| 21MA101 | Engineering Mathematics I (Common to MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS) | | 2/1/2/4 |
| Nature of Course | | J (Problem analytical) | |
| Course Pre-requisites | | Concept of Differentiation and Matrices | |
| Course Objectives: | | | |
| 1 | To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications. | | |
| 2 | To know about system of linear equations and its solution set and how to write down the coefficient matrix and augmented matrix of a linear system | | |
| 3 | To familiarize with functions of several variables applicable in many branches of engineering. | | |
| 4 | To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C101.1 | Recall the concepts of matrices, ordinary and partial derivatives. | | [R] |
| C101.2 | Express square matrix in the diagonal form. | | [U] |
| C101.3 | Solve systems of linear equations numerically and to find inverse matrices. | | [AP] |
| C101.4 | Apply numerical techniques effectively to analyse and visualize data to solve basic engineering-related problems. | | [AP] |
| C101.5 | Find the extreme values of the given functions to solve engineering problems. | | [AP] |
| C101.6 | Find the solution of second and higher order differential equations connected with electric circuits and simple harmonic motion. | | [AP] |
| Course Contents: | | | |
| Module 1: Matrices | | | 14 Hrs |
| Definition - Types of matrices - Characteristic equation - Eigenvalues and eigenvectors of a real matrices and their properties (statement only) - Cayley-Hamilton theorem (statement only) - Verification and application to find inverse and powers of real matrices - Orthogonal transformation of a real symmetric matrix to diagonal form - Reduction of quadratic form to canonical form by Orthogonal transformation. | | | |
| Module 2: Solution of Equations and Eigenvalue Problems | | | 16 Hrs |
| Newton-Raphson method - Fixed point iteration method - Gauss-Elimination method -Gauss-Jordan method - Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalue of a matrix by Power method and Jacobimethod. | | | |
| Module 3: Calculus | | | 15 Hrs |
| Concepts of limits and continuity - Functions of several variables - Total derivatives - Differentiation of implicit functions - Jacobians - Taylor series expansion - Maxima and Minima - Method of Lagrangian multipliers - Ordinary differential equations - Higher orderlinear differential equations with constant coefficients - Euler Cauchy's equations - Applications of ODE: Solving electrical circuits and simple harmonic motion. | | | |
| Lab Component | | | |
| S.No | List of Experiments | CO Mapping | BT |
| 1 | Entering row vector, column vector, accessing blocks of elements in MATLAB. | C101.1 | [AP] |
| 2 | Entering matrices, to locate matrix elements and Correcting any entrythrough indexing in MATLAB | C101.2 | [AP] |
| 3 | Sum, product, transpose, inverse, determinant and rank of a matrices usingMATLAB. | C101.3 | [AP] |

| | | | |
|--------------------|--|--------|-----------|
| 4 | Eigenvalues and eigenvectors of a matrix using MATLAB. | C101.4 | [AP] |
| 5 | System of linear equations in MATLAB using Gaussian elimination. | C101.4 | [AP] |
| 6 | System of linear equations in MATLAB using matrix inverse method. | C101.4 | [AP] |
| 7 | System of linear equations in MATLAB using linsolve | C101.5 | [AP] |
| 8 | First and second derivative of single variable functions using MATLAB. | C101.5 | [AP] |
| 9 | Maxima and Minima of a function using MATLAB | C101.6 | [AP] |
| 10 | Higher Order Equations of constant coefficients using MATLAB | C101.6 | [AP] |
| Total Hours | | | 75 |

Text Books:

| | |
|---|--|
| 1 | G. B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 14 th Edition, Pearson, Reprint, 2018 |
| 2 | Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018. |
| 3 | Grewal. B.S, "Higher Engineering Mathematics", 43 rd edition, Khanna Publications, Delhi, 2018. |

Reference Books:

| | |
|---|---|
| 1 | Veerarajan. T, "Engineering Mathematics I", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018. |
| 2 | Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, 4 th edition, 2012. |
| 3 | N.P.Bali and Dr.ManishGoyal,"A Text book of Engineering Mathematics" 9 th edition, Laxmi publications ltd, 2014. |
| 4 | Veerarajan. T, "Engineering Mathematics I", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018. |

Web References:

| | |
|---|---|
| 1 | http://www.nptel.ac.in/courses/111105035 |
| 2 | http://www.nptel.ac.in/courses/122104017 |
| 3 | http://nptel.ac.in/courses/122102009 |
| 4 | http://nptel.ac.in/courses/111107063 |

Online Resources:

| | |
|---|---|
| 1 | https://www.coursera.org/learn/linearalgebra2 |
| 2 | https://www.coursera.org/learn/differentiation-calculus |
| 3 | https://www.coursera.org/learn/single-variable-calculus |

| Continuous Assessment | | End Semester Examination | Total |
|------------------------------|-----------------------------|---------------------------------|--------------|
| Formative Assessment | Summative Assessment | | |
| 8 | 42 | 50 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory

Formative Assessment based on Capstone Model (8%)

| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
|-----------------------|----------------------|---|--------------|
| C101.1 | Remember | Quiz | 2 |
| C101.2 | Understand | Assignment | 2 |

| | | | |
|--------|-------|----------|---|
| C101.3 | Apply | Seminar | 2 |
| C101.4 | Apply | | |
| C101.5 | Apply | Tutorial | 2 |
| C101.6 | Apply | | |

Summative Assessment based on Continuous and End Semester Examination - Theory

| Bloom's Level | Continuous Assessment (12%) | | End Semester Examination (50%) [50 Marks] |
|---------------|-----------------------------|-----------------|--|
| | CIA1: (6 Marks) | CIA2: (6 Marks) | |
| Remember | 30 | 30 | 20 |
| Understand | 50 | 40 | 50 |
| Apply | 20 | 30 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |

Summative Assessment based on Continuous and End Semester Examination - Practical

| Bloom's Level | Continuous Assessment (30%) | |
|---------------|-----------------------------|---------------|
| | FA: (22 Marks) | SA: (8 Marks) |
| Remember | 20 | 20 |
| Understand | 30 | 30 |
| Apply | 50 | 50 |
| Analyse | - | - |
| Evaluate | - | - |
| Create | - | - |

Summative Assessment based on Continuous and End Semester Examination

| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
|-----------------------------|-----------------------|------------------------|-----------------|-----------------------|------------------------|---------------------------|--------------------------------|---------|
| CA 1 (10 Marks) | | | CA 2 (10 Marks) | | | Practical Exam (30 Marks) | Theory Examination (50 Marks) | |
| SA 1 (6M) | FA 1 | | SA 2 (6M) | FA 2 | | FA (22M) | | SA (8M) |
| | Component-I (2 Marks) | Component-II (2 Marks) | | Component-I (2 Marks) | Component-II (2 Marks) | | | |

| No. of the CO | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C101.1 | 1 | 1 | 1 | 1 | 2 | | | | 2 | | | | 1 | | |
| C101.2 | 3 | 2 | 3 | 2 | 2 | | | | 2 | | | | 3 | | |
| C101.3 | 3 | 3 | 3 | 3 | 2 | | | | 2 | | | | 3 | | |
| C101.4 | 3 | 2 | 3 | 2 | 2 | | | | 2 | | | | 3 | | |
| C101.5 | 3 | 3 | 3 | 3 | 2 | | | | 2 | | | | 3 | | |
| C101.6 | 3 | 3 | 3 | 3 | 2 | | | | 2 | | | | 3 | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|---|---|------------------------|-----------|
| 21PH102 | Physics for Electrical Science (EEE) | | 3/0/3/4.5 |
| Nature of Course | | E (Theory skill based) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To gain knowledge of the basics of conducting materials, semiconducting materials, magnetic materials, superconducting materials and nanomaterials. | | |
| 2 | To familiarize the principles of electrostatics and electrodynamics. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C102.1 | Describe the knowledge of conducting materials. | | [U] |
| C102.2 | Outline the semiconductor physics and functioning of semiconductor devices. | | [U] |
| C102.3 | Interrelate electric and magnetic fields behaviour of electrostatics and electrodynamics. | | [AP] |
| C102.4 | Infer changes in the properties of superconducting materials and their applications. | | [AP] |
| C102.5 | Recall the basic concepts of magnetic materials, smart materials and nano materials in different Engineering applications. | | [R] |
| C102.6 | Apply the gained knowledge to solve the problems related to their field of study. | | [AP] |
| Course Contents: | | | |
| Module 1: Conducting Materials and Semiconducting Materials 15 Hrs | | | |
| Conducting Materials: Classical free electron theory: Drude - Lorentz theory, electrical conductivity and thermal conductivity, Wiedemann - Franz law - Origin of band theory - Classification of solid materials based on band theorem - Fermi distribution function. Semiconducting materials: direct and indirect band gap semiconductors - Intrinsic semiconductors: density of electrons, density of holes, Fermi Energy - Doping - Extrinsic semiconductor: n-type and p-type carrier semiconductor, carrier concentration derivation, Fermi energy - Conductivity of semiconductors - Law of mass action - Hall effect: Hall coefficient measurement, applications - Application of semiconductors: solar cell. | | | |
| Module 2: Electrostatics and Magnetism 15 Hrs | | | |
| Electrostatics: Coulomb's law – Gauss's law and applications of Gauss's law: Electric field around a plane, sheet of conductor and charged sphere - Electric field in matter: dielectric, polarization, susceptibility, types of polarization - Internal field - Claussius-Mosotti equation - Capacitors. Magnetism: Definitions of fundamental terms - Magnetic field around a current carrying conductor – Direction of magnetic field and current – Biot - Savart law and its applications: magnetic field due to circular current loop - Ampere's law and its applications: magnetic field due to a solenoid and a toroid - Magnetic Lorentz force: force experienced by a current carrying conductor in a magnetic field - Force between two long parallel current carrying conductors - Electromagnetic induction Faraday's law of induction - Lenz law - Expression for induced emf in a conductor - Time varying magnetic fields. Maxwell's equations (equations only) - Propagation of electromagnetic waves in dielectric medium. | | | |
| Module 3: Materials 15 Hrs | | | |
| Magnetic materials: definition of terms permeability (absolute and relative), magnetic permeability, magnetic field intensity, magnetic moment of a bar magnet, intensity of magnetization, magnetic lines of force, magnetic flux - classification of magnetic materials: dia, para, ferro and anti-ferro magnetic materials and its properties – Domain theory of | | | |

ferromagnetism, hysteresis, hard and soft magnetic materials - Applications. **Superconductors:** properties of superconductor: resistivity, Meissner effect, persistent current, heat capacity, entropy, isotope effect, effect of heavy current, effect of temperature and effect of magnetic field - Type I and II superconductors - BCS theory (qualitative) - High temperature superconductors - Josephson effect — Quantum interference (qualitative), SQUID - Applications of superconductors. **Metallic Glasses:** Properties, Preparation and applications - Shape memory alloys, Characteristics and properties of Ni-Ti alloy and applications. **Nanomaterials:** Introduction and properties, Moore's law Quantum confinement, Quantum well, wire and dot. (Definitions) - Synthesis: chemical vapor deposition and ball milling - Applications. Carbon nanotubes: structure, properties and applications.

| Lab Component | | | |
|-------------------------|--|------------|-----|
| S.No | List of Experiments | CO Mapping | BT |
| 1 | Determination of thermal conductivity of a bad conductor – Lee’s disc. | C102.1 | [U] |
| 2 | Determination of a bandgap of semiconductor. | C102.2 | [U] |
| 3 | Determination of Hall co-efficient – Hall Effect. | C102.3 | [U] |
| 4 | Characteristics curves of solar cell. | C102.4 | [U] |
| 5 | Time constant of RC circuits. | C102.4 | [U] |
| 6 | Magnetic field along the axis of current carrying coil- Stewart and Gee method. | C102.4 | [U] |
| 7 | LCR circuits. | C102.5 | [U] |
| 8 | Faraday’s electromagnetic induction law – simulation lab. | C102.5 | [U] |
| 9 | Hysteresis loss. | C102.6 | [U] |
| 10 | Determine the mass susceptibility of a diamagnetic material – Quincke’s method. | C102.6 | [U] |
| Life Skills Experiments | | | |
| 1 | How does a fuel (gas/liquid) pump nozzle shut off? | | [U] |
| 2 | How does a circuit breaker work? | | [U] |
| 3 | How to Check Earthing at Home? | | [U] |
| Total Hours | | | 90 |
| Text Books: | | | |
| 1 | Rajendran, V “Engineering Physics” Mc Graw Hill Publications Ltd, New Delhi, 2016. | | |
| 2 | David Halliday, Robert Resnick, Jearl Walker “Fundamentals of Physics” Wileyplus.2018. | | |
| Reference Books: | | | |
| 1 | Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS “A Text Book of Engineering Physics”S.Chand& Co Ltd, 2018. | | |
| 2 | Richard P. Feynman. Robert B. Leighton, Matthew Sands “The Feynman Lectures on Physics Vol. II”: The New Millennium Edition.2015 | | |
| 3 | David Griffiths ‘Introduction to Electrodynamics’ 4th Edition, Cambridge University Press 2017. | | |
| 4 | David Jiles “Introduction to Magnetism and Magnetic Materials”, 3 rd Edition, Taylor & Francis Group, 2015 | | |
| Web References: | | | |
| 1 | https://www.electronics-tutorials.ws/diode/diode_1.html | | |
| 2 | https://nptel.ac.in/courses/115/104/115104109/ | | |

| | |
|--------------------------|---|
| 3 | https://nptel.ac.in/courses/115/102/115102025/ |
| 4 | http://www.phys.ufl.edu/~korytov/phy2049/old_notes/all_chapters.pdf |
| Online Resources: | |
| 1 | http://www.eas.uccs.edu/~mwickert/ece3110/lecture_notes/N3110_4.pdf |
| 2 | https://www.tcd.ie/Physics/research/groups/magnetism/files/lectures/5006/5006-2.pdf |
| 3 | https://www.askiitians.com/iit-jee-magnetism/magnetic-properties-of-materials/ |
| 4 | https://nptel.ac.in/courses/115/101/115101012/ |
| 5 | https://nptel.ac.in/courses/118/104/118104008/ |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | | |
| 8 | 42 | 50 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory | | | |
|--|---------------|--|-------|
| Formative Assessment based on Capstone Model (8%) | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
| C102.1 | Understand | Quiz | 2 |
| C102.2 | Understand | Assignment | 2 |
| C102.3 | Apply | Seminar | 2 |
| C102.4 | Apply | | |
| C102.5 | Remember | Tutorial | 2 |
| C102.6 | Apply | | |

| Summative Assessment based on Continuous and End Semester Examination - Theory | | | |
|---|-----------------------------|-----------------|--|
| Bloom's Level | Continuous Assessment (12%) | | End Semester Examination (50%) [50 Marks] |
| | CIA1: (6 Marks) | CIA2: (6 Marks) | |
| Remember | 30 | 30 | 20 |
| Understand | 50 | 40 | 50 |
| Apply | 20 | 30 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Summative Assessment based on Continuous and End Semester Examination - Practical | | | |
| Bloom's Level | Continuous Assessment (30%) | | |
| | FA: (22 Marks) | SA: (8 Marks) | |
| Remember | 20 | 20 | |
| Understand | 30 | 30 | |
| Apply | 50 | 50 | |
| Analyse | - | - | |
| Evaluate | - | - | |
| Create | - | - | |

| Summative Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|-----------------------|------------------------|-----------------|-----------------------|------------------------|---------------------------|--------------------------------|-------------------------------|
| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
| CA 1 (10 Marks) | | | CA 2 (10 Marks) | | | Practical Exam (30 Marks) | | Theory Examination (50 Marks) |
| SA 1 (6M) | FA 1 | | SA 2 (6M) | FA 2 | | FA (22M) | SA (8M) | |
| | Component-I (2 Marks) | Component-II (2 Marks) | | Component-I (2 Marks) | Component-II (2 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C102.1 | 2 | 1 | 2 | 1 | 2 | | | | 2 | | | 1 | 2 | | |
| C102.2 | 2 | 1 | 2 | 1 | 2 | | | | 2 | | | 1 | 2 | 2 | |
| C102.3 | 3 | 3 | 3 | 3 | 2 | | | | 2 | | | 1 | 3 | | |
| C102.4 | 3 | 3 | 3 | 3 | 2 | | | | 2 | | | 1 | 3 | | |
| C102.5 | 1 | 1 | 1 | 1 | 2 | | | | 2 | | | 1 | 1 | 2 | |
| C102.6 | 3 | 2 | 3 | 2 | | | | | | | | 1 | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|------------------------|---------|
| 21EE101 | Analog Electronics | | 3/0/2/4 |
| Nature of Course | | D (Theory application) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To remember the basic PN junction diode and its applications. | | |
| 2 | To understand the basic structure, operation and characteristics of Electronic Devices and apply BJT to act as amplifier. | | |
| 3 | To gain knowledge about differential amplifiers. | | |
| 4 | To analyze the small signal characteristics of transistor amplifiers and oscillators. | | |
| 5 | To remember the basic PN junction diode and its applications. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C101.1 | Describe the basic PN junction diode and its applications | | [U] |
| C101.2 | Analyse the basic structure, operation and characteristics of Electronic Devices. | | [A] |
| C101.3 | Apply the characteristics of transistors for amplifier operations | | [AP] |
| C101.4 | Analyse the characteristics of feedback amplifiers | | [A] |
| C101.5 | Infer the operation of phase shift and Wien bridge oscillator | | [U] |
| Course Contents: | | | |
| Module 1: Diodes | | 20 Hrs | |
| Theory of PN junction - PN Junction Diode –Structure, Operation and V-I Characteristics - Rectifiers - Half Wave and Full Wave Rectifiers, Diode clippers and clippers - Operation and V- I Characteristics of Zener diode - Structure, Operation of LED and LCD - Structure, Operation of Charge Coupled Display (CCD). | | | |
| Module 2: Electronic Devices and their Characteristics | | 20 Hrs | |
| Bipolar Junction Transistors (BJT) - Types - Structure and Operation - Input and Output Characteristics - Transistor as a switch - Biasing of BJT. Junction Field Effect Transistors (JFET) - Types - Structure and Operation - Drain and Transfer Characteristics - FET as Variable Resistor - Metal Oxide Semiconductor Field Effect Transistor(MOSFET) - Types - Structure, Operation and V-I Characteristics of n-channel MOSFET-Biasing of MOSFET. Uni Junction Transistor (UJT) - Structure, Operation and V-I Characteristics. | | | |
| Module 3: Amplifier Circuits and Oscillators | | 20 Hrs | |
| BJT small signal model - Analysis of CE amplifier, Gain and Frequency response - Differential Amplifier - Multi-stage amplifier - Common mode and Differential mode analysis - Current mirror circuits. Basic concepts of Feedback amplifier- types - positive feedback - Stability of Feedback Amplifier. Condition for oscillations - Phase shift Oscillator - Wien bridge Oscillator. | | | |
| Lab Component | | | |
| S.No | List of Experiments | CO Mapping | BT |
| 1 | Characteristics of PN diode | C101.1 | [U] |
| 2 | Line and load regulation of Zener regulator | C101.1 | [AP] |
| 3 | Design of half wave, full wave and bridge rectifier circuits | C101.2 | [AP] |
| 4 | Diode as clipper and clamper | C101.2 | [AP] |
| 5 | Characteristics of BJT in CE configuration | C101.2 | [AP] |
| 6 | Characteristics of JFET | C101.2 | [U] |

| | | | |
|------------------|--|--------|------|
| 7 | UJT triggering circuit for Power Switch. | C101.3 | [AP] |
| 8 | Frequency Response of Common Emitter BJT Amplifier for a public addressingsystem. | C101.3 | [AP] |
| 9 | Transistorized Differential amplifier | C101.4 | [AP] |
| 10 | Analyze the basic electronic circuits by simulation | C101.4 | [A] |
| 11 | Wien bridge oscillator | C101.5 | [U] |
| Total Hours | | | 75 |
| Text Books: | | | |
| 1 | David A. Bell, 'Electronic Devices and Circuits', Oxford University Press, 5 th Edition, reprint, 2015. | | |
| 2 | Floyd, Thomas.L 'Electronic Devices, Prentice Hall,9 th Edition, 2012 | | |
| 3 | S. Salivahanan, N.Suresh Kumar, 'Electronic Devices and Circuits' Tata McGraw Hill , 6 th edition, 2015 | | |
| Reference Books: | | | |
| 1 | Robert Diffenderfer, 'Electronic Devices: Systems and Applications', Cengage Learning, 2010. | | |
| 2 | Robert L.Boylestad, 'Electronic Devices and Circuit theory', Pearson Education, 2013, | | |
| 3 | Jacob Millman, Christos.C.Halkias and SatyabrataJit, 'Electronic Devices and Circuits', Tata McGraw Hill, 2010. | | |
| 4 | Theodore F. Bogart, Jeffery S. Beasley and Guillermo Rico, 'Electronic Devices and Circuits', Pearson Education , 6 th edition, 2019. | | |
| Web References: | | | |
| 1 | https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf | | |
| 2 | https://nptel.ac.in/video.php?subjectId=117103063 | | |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | | |
| 8 | 42 | 50 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory | | | |
|--|---------------|--|-------|
| Formative Assessment based on Capstone Model (8%) | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
| C101.1 | Understand | Quiz | 2 |
| C101.2 | Analyze | Assignment | 2 |
| C101.3 | Apply | Seminar | 2 |
| C101.4 | Analyze | Tutorial | 2 |
| C101.5 | Understand | | |

| Summative Assessment based on Continuous and End Semester Examination - Theory | | | |
|--|-----------------------------|-----------------|---|
| Bloom's Level | Continuous Assessment (12%) | | End Semester Examination (50%) [50 Marks] |
| | CIA1: (6 Marks) | CIA2: (6 Marks) | |
| Remember | 10 | 10 | 10 |
| Understand | 40 | 40 | 40 |
| Apply | 20 | 20 | 20 |
| Analyse | 30 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Summative Assessment based on Continuous and End Semester Examination - Practical | | | |
|---|-----------------------------|---------------|--|
| Bloom's Level | Continuous Assessment (30%) | | |
| | FA: (22 Marks) | SA: (8 Marks) | |
| Remember | 10 | 10 | |
| Understand | 20 | 20 | |
| Apply | 50 | 50 | |
| Analyse | 20 | 20 | |
| Evaluate | - | - | |
| Create | - | - | |

| Summative Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------|------------------------|-----------------|-----------------------|------------------------|---------------------------|--------------------------------|
| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) |
| CA 1 (10 Marks) | | | CA 2 (10 Marks) | | | Practical Exam (30 Marks) | Theory Examination (50 Marks) |
| SA 1 (6M) | FA 1 | | SA 2 (6M) | FA 2 | | FA (22M) | |
| | Component-I (2 Marks) | Component-II (2 Marks) | | Component-I (2 Marks) | Component-II (2 Marks) | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C101.1 | 2 | 1 | | | 2 | | | | | | | 2 | 3 | 3 | |
| C101.2 | 3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 3 | 3 | |
| C101.3 | 3 | 2 | 1 | 1 | 2 | | | | | | | 2 | 3 | 3 | |
| C101.4 | 3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 3 | 3 | |
| C101.5 | 2 | 1 | | | 2 | | | | | | | 2 | 3 | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|---|--|------------------------|---------|
| 21CS111 | Problem Solving Using C Programming | | 3/0/2/4 |
| Nature of Course | | F (Theory Programming) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To understand problem solving using structured programming language to gain knowledge about the control structures in C. | | |
| 2 | To develop logics and write C programs using arrays | | |
| 3 | To gain familiarity in inbuilt functions, structures and unions in C. | | |
| 4 | Apply concept and techniques for implementation in respective domain | | |
| 5 | To understand problem solving using structured programming language to gain knowledge about the control structures in C. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C111.1 | Apply problem solving techniques to solve real world problems | [AP] | |
| C111.2 | Understand C fundamental constructs and control structures | [U] | |
| C111.3 | Use the concept of pointers and arrays in designing programs | [AP] | |
| C111.4 | Design C programs using the concepts of strings and functions | [C] | |
| C111.5 | Develop programs using structures and Unions in C | [AP] | |
| C111.6 | Apply the suitable programming concept for the given computational problem | [AP] | |
| Course Contents: | | | |
| Module 1: Problem Solving Techniques and C Fundamentals | | | 15Hrs |
| Problem Solving Techniques: Algorithm, Pseudo-code and Flowchart. Creative Thinking and Problem solving skills in everyday life. Understanding Compiler and interpreter. Program Development Life Cycle. C Fundamentals: Structure of C program, Character Set - identifiers and Keywords - Data Types - Constants - Variables and Arrays - Declarations - Operators and Expressions - Precedence of operators and associativity. Data input and output - Preparing and running a Complete C Program. | | | |
| Module 2: Control Structures, Arrays, Strings | | | 15 Hrs |
| Control Structures: Branching: if-else- Looping - while - do while - for - Nested control structures - switch - break - continue - comma - goto. Arrays - Defining an array - Processing an array - Multi dimensional arrays - Strings: Defining a string - Null character - initialization of strings - reading and writing a string - processing the string. | | | |
| Module 3: Pointers, Functions, Structures and Unions | | | 15 Hrs |
| Pointers: fundamentals - Pointer Declaration and Usage - Dynamic Memory Allocation. Functions: Defining a Function - Accessing a function - Function Prototype Functions - Pointer to Function - Functions Returning Pointers. - Pointers and Strings - Passing arguments to a function - Recursion. Structures and Unions: The Type Definition (type def) - Enumerated types - Structure - Type Definition - Initialization - Accessing Structures - Unions. | | | |
| Lab Component | | | |
| S.No | List of Experiments | CO Mapping | BT |
| 1 | Formulate simple algorithm and flowchart using Raptor Tool for simple and complex problem | C111.1 | [U] |
| 2 | Program to process data types, format input and output and to evaluate an expression | C111.1 | [AP] |
| 3 | Program using decision making statements | C111.2 | [AP] |
| 4 | Program using looping statements | C111.2 | [AP] |

| | | | |
|------------------|---|--------|------|
| 5 | Program using single and two dimensional arrays | C111.2 | [AP] |
| 6 | Program with Strings | C111.2 | [AP] |
| 7 | Program using Pointers. | C111.3 | [AP] |
| 8 | Program using Recursion | C111.3 | [AP] |
| 9 | Program using structures | C111.4 | [AP] |
| 10 | Branch specific application program | C111.5 | [A] |
| Total Hours | | | 75 |
| Text Books: | | | |
| 1 | Sprankle M, "Problem Solving and Programming Concepts", 9 th Edition, Pearson Education, New Delhi, 2013 | | |
| 2 | Yashavant Kanetkar, "Let Us C", 16 th Edition, BPB Publication, 2017. | | |
| 3 | Byron, S. Gottfreid, "Programming with C", McGraw Hill, Schaum's outlines, 4 th Edition, 2018. | | |
| 4 | Reema Thareja Computer Fundamentals and Programming in C, 2nd edition, OXFORD publications, 2016 | | |
| 5 | Brian W. Kernighan, Dennis Ritchie, "The C Programming Language", 2 nd Edition Pearson Publicaitons, 2015 | | |
| Reference Books: | | | |
| 1 | Yashavant Kanetkar, "101 Challenges in C Programming" Edition, BPB Publication, 2017 | | |
| 2 | Herbert Schildt, "The Complete Reference C", 4 th Edition, McGraw Hill, 2015 | | |
| 3 | Venugopal K R and Sudeep R. Prasad, "Mastering C", 2 nd Edition, McGraw Hill, 2017 | | |
| 4 | Jeri. R Hanly, and Elliot B Koffman, "Problem solving and programming Design in C", 8 th Edition, Pearson 2016 | | |
| Web References: | | | |
| 1 | http://raptor.martincarlisle.com/ | | |
| 2 | https://nptel.ac.in/courses/106/104/106104128/ | | |
| 3 | https://nptel.ac.in/courses/106/105/106105171/ | | |
| 4 | https://www.coursera.org/specializations/c-programming | | |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | | |
| 8 | 42 | 50 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory | | | |
|--|---------------|--|-------|
| Formative Assessment based on Capstone Model (8%) | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
| C111.1 | Apply | Quiz | 2 |
| C111.2 | Understand | Assignment | 2 |
| C111.3 | Apply | | |
| C111.4 | Create | Group assignment | 2 |
| C111.5 | Apply | Case Study | 2 |
| C111.6 | Apply | | |

| Summative Assessment based on Continuous and End Semester Examination - Theory | | | |
|---|-----------------------------|-----------------|---|
| Bloom's Level | Continuous Assessment (12%) | | End Semester Examination (50%) [50 Marks] |
| | CIA1: (6 Marks) | CIA2: (6 Marks) | |
| Remember | 10 | 10 | 10 |
| Understand | 30 | 30 | 30 |
| Apply | 50 | 50 | 50 |
| Analyse | 10 | 10 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Summative Assessment based on Continuous and End Semester Examination - Practical | | | |
| Bloom's Level | Continuous Assessment (30%) | | |
| | FA: (22 Marks) | SA: (8 Marks) | |
| Remember | 20 | 20 | |
| Understand | 30 | 30 | |
| Apply | 30 | 30 | |
| Analyse | 20 | 20 | |
| Evaluate | - | - | |
| Create | - | - | |

| Summative Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|-----------------------|------------------------|-----------------|-----------------------|------------------------|---------------------------|--------------------------------|-------------------------------|
| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
| CA 1 (10 Marks) | | | CA 2 (10 Marks) | | | Practical Exam (30 Marks) | | Theory Examination (50 Marks) |
| SA 1 (6M) | FA 1 | | SA 2 (6M) | FA 2 | | FA (22M) | SA (8M) | |
| | Component-I (2 Marks) | Component-II (2 Marks) | | Component-I (2 Marks) | Component-II (2 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C111.1 | 2 | 1 | | | 2 | | | | | | | 2 | 3 | 3 | |
| C111.2 | 3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 3 | 3 | |
| C111.3 | 3 | 2 | 1 | 1 | 2 | | | | | | | 2 | 3 | 3 | |
| C111.4 | 3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 3 | 3 | |
| C111.5 | 2 | 1 | | | 2 | | | | | | | 2 | 3 | 3 | |
| C111.6 | 3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 3 | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|--|---|------------|-----------|
| 21ME103 | Engineering Practices Laboratory | | 0/0/3/1.5 |
| Nature of Course | Practical application | | |
| Course Pre-requisites | Nil | | |
| Course Objectives: | | | |
| 1 | To learn the use of basic hand tools and to know the need for safety in work place and to gain hands on experience in Carpentry, Sheet metal, Plumbing, Welding and Foundry. | | |
| 2 | To learn about basic electrical devices, meters and electronics devices and to gain knowledge about the fundamentals of various electrical and electronic gadgets their working and trouble shooting. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C103.1 | Identify and solve the basic engineering problems at home and in workplace. | [AP] | |
| C103.2 | Develop the surfaces and make simple components like tray and funnel. | [C] | |
| C103.3 | Make simple metal joints using welding equipment and wooden joints using carpentry tools. | [AP] | |
| C103.4 | Prepare pipe connections and sand moulds. | [AP] | |
| C103.5 | Understand the fundamentals of hot forging and injection moulding | [U] | |
| C103.6 | Examine and troubleshoot electrical and electronic circuits | [A] | |
| Course Contents: | | | |
| GROUP A (CIVIL & MECHANICAL) | | | |
| Manufacturing Methods - Sheet metal operations - Welding - arc welding, gas welding, Study of TIG & MIG welding. Study of foundry, Demonstration of Smithy and Injection moulding - Carpentry work using power tools - Plumbing components and pipelines. | | | |
| S.No | List of Experiments | CO Mapping | RBT |
| 1 | Preparation of butt joints and lap joints using arc welding | C103.3 | [AP] |
| 2 | Sheet metal Forming and Bending, Model making – Trays and funnels. | C103.2 | [AP] |
| 3 | Preparation of wooden joints by sawing, planning and cutting. | C103.3 | [AP] |
| 4 | Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. | C103.4 | [AP] |
| 5 | Demonstration of foundry operations like mould preparation for solid and split piece pattern. | C103.4 | [U] |
| 6 | Demonstration of Smithy operations | C103.5 | [AP] |
| 7 | Demonstration of assembly of pump / Demonstration of Injection moulding | C103.5 | [AP] |
| GROUP B (ELECTRICAL AND ELECTRONICS ENGINEERING) | | | |
| List of Experiments: | | | |
| Basic Circuit Elements: Resistor, inductor, capacitor. Introduction to measuring equipment: Moving iron meter, moving coil meter, Wattmeter, Energy meter, CRO, Multi-meter. Digital logic circuits, PCB design, fuse, relay, circuit breaker, wire, Earthing, fan, fluorescent lamp, iron box, mixer grinder, study of FM radio and mobile phone. | | | |
| S.No | List of Experiments | CO Mapping | BT |
| 1 | Study and identification of electronic components with specification. | C103.6 | [A] |
| 2 | Testing of CRO and Electronic components using Multimeter. | C103.6 | [A] |
| 3 | Generation and measurement of signals using CRO. | C103.6 | [A] |
| 4 | Familiarization of digital basic gate IC's. | C103.6 | [A] |
| 5 | Soldering practice-components devices and circuits-using general purpose PCB. | C103.6 | [A] |

| | | | |
|--------------------|--|-----------|-----|
| 6 | Demonstration of meters and electrical components. | C103.6 | [A] |
| 7 | Safety precautions with electrical components. | C103.6 | [A] |
| 8 | Residential house wiring. | C103.6 | [A] |
| 9 | Measurement of power and energy. | C103.6 | [A] |
| 10 | Trouble shooting of electrical equipment. | C103.6 | [A] |
| Total Hours | | 45 | |

Reference Books:

| | |
|---|---|
| 1 | Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). |
| 2 | Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promoters Pvt Ltd., 2014. |
| 3 | Suyambazhagan S, "Engineering practices" PHI Learning private limited, New Delhi, 2012. |
| 4 | D.P.Kothari and I.J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. |
| 5 | E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. |

Web References:

| | |
|---|---|
| 1 | www.nptel.ac.in |
| 2 | www.sme.org |
| 3 | http://www.allaboutcircuits.com/education/ |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | | |
| 45 | 15 | 40 | 100 |

Summative Assessment based on Continuous and End Semester Examination

| Bloom's Level | Continuous Assessment (60%) | | End Semester Examination (40%) |
|---------------|-----------------------------|---------------|----------------------------------|
| | FA (45 Marks) | SA (15 Marks) | Practical Examination (40 Marks) |
| Remember | 10 | 10 | 10 |
| Understand | 10 | 10 | 10 |
| Apply | 40 | 40 | 40 |
| Analyse | 20 | 20 | 20 |
| Evaluate | 10 | 10 | 10 |
| Create | 10 | 10 | 10 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C103.1 | 3 | 3 | 3 | | 3 | | 3 | | 3 | 2 | | 1 | 3 | | |
| C103.2 | 3 | 3 | 3 | | 3 | | 3 | | 3 | 2 | | 1 | 3 | | |
| C103.3 | 2 | 1 | 3 | 2 | 3 | | | 3 | 2 | | 1 | 1 | 2 | | |
| C103.4 | 3 | 2 | 3 | 2 | | | 3 | | | | | 1 | 2 | | |
| C103.5 | 2 | 1 | 2 | 1 | | | | | | | | 1 | 2 | | |
| C103.6 | 2 | 1 | 2 | 1 | 3 | | 2 | | | | | 1 | 2 | 2 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|---|---|--|---------|
| 21GE201 | Universal Human Values (All Branches) | | 3/0/0/3 |
| Nature of Course | | C (Theory Concept) | |
| Course Pre-requisites | | Interpersonal Communication and Value Sciences | |
| Course Objectives: | | | |
| 1 | Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence. | | |
| 2 | Understanding (or developing clarity) of the harmony in the human being, family, society and nature / existence. | | |
| 3 | Strengthening of self-reflection. | | |
| 4 | Development of commitment and courage to act. | | |
| 5 | Helping the students to appreciate the essential complementarity between VALUES and SKILLS to ensure sustained happiness and prosperity, which are the core aspirations of all human beings. | | |
| 6 | Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C201.1 | Understand about themselves and their surroundings (family, society, nature). | | [U] |
| C201.2 | Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human Nature in mind. | | [U] |
| C201.3 | Apply responsibilities towards their commitments (human values, human relationship and human society). | | [AP] |
| C201.4 | Apply what they have learnt to their own self in different day-to-day settings in real life, atleast a beginning would be made in this direction. | | [AP] |
| C201.5 | Analyse ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work. | | [AN] |
| C201.6 | Understand the harmony in nature and existence, and work out mutually on fulfilling participation in the nature. | | [U] |
| Course Contents: | | | |
| Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being - Harmony in Myself! 15 Hrs | | | |
| Purpose and motivation for the course. Self – Exploration - Its content and process; “Natural Acceptance” and Experiential Validation - as the process for self-exploration. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Understanding human being as a co-existence of the sentient „I” and the „Material Body”. Understanding the needs of Self (“I”) and Body - happiness and physical Facility. Understanding the Body as an instrument of “I” (I being the doer, seer and enjoyer). Understanding the characteristics and activities of “I” and harmony in “I”. Understanding the harmony of “I” with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail- Programs to ensure Sanyam and Health. | | | |
| Module 2: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding Harmony in the Nature and Existence - Whole existence as Coexistence 15 Hrs | | | |
| Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect | | | |

as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and Competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

Module 3: Implications of the above Holistic Understanding of Harmony on Professional Ethics **15 Hrs**

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems. Case studies of typical holistic technologies, management models and eco-friendly production systems. Strategy for transition from the present state to Universal Human Order: a. Individual level: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up.

Total Hours **45**

Text Books:

| | |
|---|--|
| 1 | Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010. |
| 2 | Rajni Setia, Priyanka Sharma, "Human Values", Genius Publication", Jaipur, 2019. |

Reference Books:

| | |
|---|---|
| 1 | Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. |
| 2 | The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi. |
| 3 | India Wins Freedom - Maulana Abdul Kalam Azad. |

Web References:

| | |
|---|---|
| 1 | https://examupdates.in/professional-ethics-and-human-values/ |
| 2 | http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html |
| 3 | https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|------------|
| Formative Assessment | Summative Assessment | | |
| 16 | 24 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model (16 Marks)

| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
|----------------|---------------|--|----------|
| C201.1 | Understand | Group Discussion | 4 |
| C201.2 | Understand | Book Review | 4 |
| C201.3 | Apply | Role Play | 4 |
| C201.4 | Apply | | |
| C201.5 | Analyze | Formal Presentation | 4 |
| C201.6 | Understand | | |

| Assessment based on Continuous and End Semester Examination | | | |
|---|-----------------------------|-------------------|--|
| Bloom's Level | Continuous Assessment (24%) | | End Semester Examination (60%) [60 Marks] |
| | CIA1 : [12 Marks] | CIA2 : [12 Marks] | |
| Remember | 10 | 10 | 10 |
| Understand | 10 | 20 | 20 |
| Apply | 40 | 40 | 40 |
| Analyse | 40 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Summative Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-------------------------|--------------------------|-----------------|-------------------------|--------------------------------|-------------------------------|
| Continuous Assessment (40%) | | | | | End Semester Examination (60%) | |
| CA 1 : 20 Marks | | | CA 2 : 20 Marks | | | Theory Examination (60 Marks) |
| SA 1 (12 Marks) | FA 1 (8 Marks) | | SA 2 (12 Marks) | FA 2 (8 Marks) | | |
| | Component - I (4 Marks) | Component - II (4 Marks) | | Component - I (4 Marks) | Component - II (4 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C201.1 | | | | | | 3 | 3 | 3 | 2 | 2 | | 3 | | | 3 |
| C201.2 | | | | | | 3 | 3 | 3 | 2 | 2 | | 3 | | | 3 |
| C201.3 | | | | | | 3 | 3 | 3 | 2 | 2 | | 3 | | | 3 |
| C201.4 | | | | | | 3 | 3 | 3 | 2 | 2 | | 3 | | | 3 |
| C201.5 | | | | | | 3 | 3 | 3 | 2 | 2 | | 3 | | | 3 |
| C201.6 | | | | | | 3 | 3 | 3 | 2 | 2 | | 3 | | | 3 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | | |
|--|---|--|------|---------|
| 21MA201 | Engineering Mathematics II (COMMON TO MECH, MCT, CIVIL, ECE, EEE, CSE, IT, AIDS) | | | 2/1/2/4 |
| Nature of Course | | J (Problem analytical) | | |
| Course Pre-requisites | | Concepts of Differentiation and Integration. | | |
| Course Objectives: | | | | |
| 1 | To gain knowledge in integrals, which are needed in engineering applications. | | | |
| 2 | To develop logical thinking and analytical skills in evaluating multiple integrals. | | | |
| 3 | To acquaint with the concepts of vector calculus needed for problems in all engineering disciplines. | | | |
| 4 | To impart the knowledge of Laplace transform, to find solutions of initial value problems for linear ordinary differential equations. | | | |
| Course Outcomes: | | | | |
| Upon completion of the course, students shall have ability to | | | | |
| C201.1 | Determine the area and volume by applying the techniques of double and triple integrals. | | | [R] |
| C201.2 | Finding the values of integrals through different numerical methods. | | | [U] |
| C201.3 | Differentiate and integrate a vector-valued function to solve real world applications. | | | [AP] |
| C201.4 | Calculate grad, div, curl and use Gauss, Stokes and Greens theorem to simplify the calculations of integrals. | | | [AP] |
| C201.5 | Apply Laplace transform techniques in system modelling, digital signal processing, process control, solving boundary value problems. | | | [AP] |
| C201.6 | Apply Laplace transform methods for solving linear differential equations. | | | [AP] |
| Course Contents: | | | | |
| Module 1: Integral calculus | | | | 18 Hrs |
| Definite integrals: Evaluation of definite integrals using Bernoulli's formula - Multiple Integrals: Double integration in Cartesian coordinates - Area as double integral - Change of order of Integration - Triple integration in Cartesian co-ordinates - Volume as triple integral - Beta and Gamma functions - Relation between Beta and Gamma Functions - Evaluation of Integrals using Beta and Gamma Functions - Numerical integration: Trapezoidal rule and Simpson's rule for single and double integrals. | | | | |
| Module 2: Vector Calculus | | | | 14 Hrs |
| Vector differential operator - Gradient of a scalar point function - Directional derivatives -Divergence and Curl of a vector point function - Irrotational and solenoidal vector fields - Simple problems - Vector integration - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (theorems statements only) - Simple applications involving cubes and rectangular parallelepipeds. | | | | |
| Module 3: Laplace Transform | | | | 16 Hrs |
| Convergence of Laplace transform - Transform of some standard functions - Unit step function - Unit Impulse function - Properties - Initial and final value theorem - Inverse Laplace transform - Partial fraction method - Convolution theorem - Application of Laplace transform for solving second order ordinary differential equation. | | | | |
| Lab Component | | | | |
| S.No | List of Experiments | CO Mapping | BT | |
| 1 | Double integrals evaluation in cartesian coordinates using MATLAB. | C201.1 | [AP] | |
| 2 | Triple integral calculations using MATLAB in cartesian and cylindrical coordinates | C201.2 | [AP] | |
| 3 | Double integral evaluation in MATLAB by Trapezoidal rule. | C201.3 | [AP] | |

| | | | |
|--------------------|---|--------|-----------|
| 4 | Evaluation of gradient, curl and divergence in MATLAB. | C201.4 | [AP] |
| 5 | Line integral over a vector field using MATLAB | C201.4 | [AP] |
| 6 | Applying Green's theorem to solve integrals in MATLAB. | C201.4 | [AP] |
| 7 | Relation between Laplace transform of function and its derivative using MATLAB. | C201.5 | [AP] |
| 8 | Laplace transform of Dirac delta and Heaviside functions in MATLAB. | C201.5 | [AP] |
| 9 | Solving Differential Equations in MATLAB using Laplace Transform. | C201.6 | [AP] |
| 10 | Inverse Laplace Transform of symbolic expressions using MATLAB. | C201.6 | [AP] |
| Total Hours | | | 75 |

Text Books:

| | |
|---|--|
| 1 | G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14 th Edition, Pearson, Reprint, 2018. |
| 2 | Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018. |
| 3 | Grewal. B.S, "Higher Engineering Mathematics", 43 rd edition, Khanna Publications, Delhi, 2014. |

Reference Books:

| | |
|---|--|
| 1 | Veerarajan. T, "Engineering Mathematics II", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018. |
| 2 | Glyn James, —Advanced Modern Engineering Mathematics, Education, 4 th edition, 2012. |
| 3 | N.P.Bali and Dr. Manish Goyal, "A Text book of Engineering Mathematics" 9 th edition, Laxmi publications Ltd, 2014. |

Web References:

| | |
|---|---|
| 1 | http://nptel.ac.in/video.php?subjectId=122107037 |
| 2 | http://nptel.ac.in/courses/122107036/ |
| 3 | http://nptel.ac.in/video.php?subjectId=117102060 |

Online Resources:

| | |
|---|---|
| 1 | https://www.coursera.org/learn/pre-calculus |
| 2 | https://www.coursera.org/learn/linearalgebra1 |
| 3 | https://alison.com/courses/Advanced-Mathematics-1 |
| 4 | https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x |

| Continuous Assessment | | End Semester Examination | Total |
|------------------------------|-----------------------------|---------------------------------|--------------|
| Formative Assessment | Summative Assessment | | |
| 8 | 42 | 50 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory

Formative Assessment based on Capstone Model (8%)

| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
|-----------------------|----------------------|---|--------------|
| C201.1 | Remember | Quiz | 2 |
| C201.2 | Understand | Assignment | 2 |
| C201.3 | Apply | Seminar | 2 |

| | | | |
|--------|-------|----------|---|
| C201.4 | Apply | | |
| C201.5 | Apply | Tutorial | 2 |
| C201.6 | Apply | | |

Summative Assessment based on Continuous and End Semester Examination - Theory

| Bloom's Level | Continuous Assessment (12%) | | End Semester Examination (50%) [50 Marks] |
|---------------|-----------------------------|-----------------|--|
| | CIA1: (6 Marks) | CIA2: (6 Marks) | |
| Remember | 30 | 30 | 20 |
| Understand | 50 | 40 | 50 |
| Apply | 20 | 30 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |

Summative Assessment based on Continuous and End Semester Examination - Practical

| Bloom's Level | Continuous Assessment (30%) | |
|---------------|-----------------------------|---------------|
| | FA: (22 Marks) | SA: (8 Marks) |
| Remember | 20 | 20 |
| Understand | 30 | 30 |
| Apply | 50 | 50 |
| Analyse | - | - |
| Evaluate | - | - |
| Create | - | - |

Summative Assessment based on Continuous and End Semester Examination

| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
|-----------------------------|-----------------------|------------------------|-----------------|-----------------------|------------------------|---------------------------|--------------------------------|---------|
| CA 1 (10 Marks) | | | CA 2 (10 Marks) | | | Practical Exam (30 Marks) | Theory Examination (50 Marks) | |
| SA 1 (6M) | FA 1 | | SA 2 (6M) | FA 2 | | FA (22M) | | SA (8M) |
| | Component-I (2 Marks) | Component-II (2 Marks) | | Component-I (2 Marks) | Component-II (2 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C201.1 | 1 | 1 | 1 | 1 | 2 | | | | 2 | | | | 1 | | |
| C201.2 | 2 | 1 | 2 | 1 | 2 | | | | 2 | | | | 2 | | |
| C201.3 | 3 | 2 | 3 | 2 | 2 | | | | 2 | | | | 3 | | |
| C201.4 | 3 | 2 | 3 | 2 | 2 | | | | 2 | | | | 3 | | |
| C201.5 | 3 | 2 | 3 | 2 | 2 | | | | 2 | | | | 3 | 3 | |
| C201.6 | 3 | 2 | 3 | 2 | 2 | | | | 2 | | | | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|---|--|----------------------------|---------|
| 21EN101 | Technical Communication Skills (MECH/MCT/IT/CIVIL/CSE) | | 2/0/2/3 |
| Nature of Course | | E (Theory Skill Based) | |
| Course Pre-requisites | | Basics of English Language | |
| Course Objectives: | | | |
| 1 | To enhance learners' LSRW skills. | | |
| 2 | To develop effective communication skills. | | |
| 3 | To facilitate learners to acquire effective technical writing skills. | | |
| 4 | To prepare learners for placement and competitive exams. | | |
| 5 | To facilitate effective language skills for academic purposes and real-life. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C101.1 | Remember language skills for technical communication. | | [R] |
| C101.2 | Apply communication skills in corporate environment. | | [AP] |
| C101.3 | Understand and communicate effectively in personal and professional situation. | | [AP] |
| C101.4 | Understand and analyse a variety of reading strategies to foster comprehension and to construct meaningful and relevant connections to the text. | | [U] |
| C101.5 | Apply technical writing skills to write letters, emails and prepare technical documents. | | [AP] |
| C101.6 | Apply language skills with ease in academic and real-life situations. | | [AP] |
| Course Contents: | | | |
| Module 1: Listening and Speaking 17 Hrs | | | |
| Introduction to Effective Communication- Basics of English Language - Importance of LSRW Skills - Self Introduction - Introducing Others - Listening to Short Conversations or Monologues - Listening to Speeches / Talks - Listening and Responding -- Longer Listening Tasks -Recognise Functions Speaking- Speaking about Giving Directions / Instruction – Talk about Preferences-Agree and Disagree - Giving Opinions - Speaking Practices by Giving Examples, Reasons and Additional Information- Short Talk on Business Topics- Non Verbal Communication- Presentation using Digital Tools- Effectiveness of Narration- Leadership, Conflict and Persuasion. | | | |
| Module 2: Reading 13 Hrs | | | |
| Reading Short Texts - Skimming and Scanning - Comparing Facts and Figures - Reading and Understanding Specific Information in a Text - Cloze Reading - Identifying Reasons and Consequences Through Reading Practices - Comprehension - Collocations. | | | |
| Module 3: Grammar and Writing 15 Hrs | | | |
| Parts of Speech- Tenses - Subject Verb Agreement - Sentence Structures - Connectives -Modal Verbs - Question Formation - If Conditionals- Active and Passive - Impersonal Passive Voice - Vocabulary Building - Business Vocabulary - Synonyms, Antonyms - British and American Words - One Word Substitution - Identifying Common Errors. | | | |
| Writing Formal Letters (Accepting and Declining Invitations) - Writing Business Letters (Calling for Quotation, Seeking Clarification, Placing an Order and Complaint Letter) - Email Writing - Memo - Circular - Agenda and Minutes of the Meeting - Job Application Letter - Resume Writing - Paragraph Writing - Proof Reading and Editing - Technical Instructions and Recommendations- Jumbled Sentences - Technical Definitions - Report Phrases - Report Writing - Technical Proposal - Transcoding (Bar Chart, Flow Chart). | | | |
| Lab Component | | | |

| S.No | List of Experiments | CO Mapping | BT |
|------------------|---|------------|-----|
| 1 | Listening Comprehension | C101.1 | [E] |
| 2 | Pronunciation, Intonation, Stress and Rhythm | C101.3 | [E] |
| 3 | Situational Dialogues | C101.4 | [E] |
| 4 | Formal Presentation | C101.2 | [E] |
| 5 | Group Discussion | C101.6 | [E] |
| 6 | Interview Skills- Online and Offline | C101.5 | [E] |
| Total Hours | | | 60 |
| Text Books: | | | |
| 1 | Practical English Usage. Michael Swan. OUP. 1995. | | |
| 2 | Remedial English Grammar. F.T. Wood. Macmillan.2007 | | |
| 3 | On Writing Well. William Zinsser. Harper Resource Book. 2001 | | |
| 4 | Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015. | | |
| Reference Books: | | | |
| 1 | Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006. | | |
| 2 | Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011. | | |
| 3 | Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press. | | |
| Web References: | | | |
| 1 | http://www.academiccourses.com/Courses/English/Business-English | | |
| 2 | https://steptest.in | | |
| 3 | https://www.coursera.org/specializations/business-english | | |
| 4 | http://www.academiccourses.com/Courses/English/Business-English | | |
| 5 | https://scoop.eduncle.com/one-word-substitution-list | | |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | | |
| 8 | 42 | 50 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory | | | |
|--|---------------|--|-------|
| Formative Assessment based on Capstone Model (8%) | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
| C101.1 | Remember | Quiz | 2 |
| C101.2 | Apply | | |
| C101.3 | Apply | Impromptu speaking | 2 |
| C101.4 | Understand | | |
| C101.5 | Apply | Reading comprehension | 2 |
| C101.6 | Apply | Group assignment | 2 |

| Summative Assessment based on Continuous and End Semester Examination - Theory | | | |
|---|-----------------------------|-----------------|---|
| Bloom's Level | Continuous Assessment (12%) | | End Semester Examination (50%) [50 Marks] |
| | CIA1: (6 Marks) | CIA2: (6 Marks) | |
| Remember | 20 | 20 | 20 |
| Understand | 40 | 40 | 40 |
| Apply | 40 | 40 | 40 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Summative Assessment based on Continuous and End Semester Examination - Practical | | | |
| Bloom's Level | Continuous Assessment (30%) | | |
| | FA: (22 Marks) | SA: (8 Marks) | |
| Remember | 20 | 20 | |
| Understand | 40 | 40 | |
| Apply | 40 | 40 | |
| Analyse | - | - | |
| Evaluate | - | - | |
| Create | - | - | |

| Summative Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|-----------------------|------------------------|-----------------|-----------------------|------------------------|---------------------------|--------------------------------|-------------------------------|
| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
| CA 1 (10 Marks) | | | CA 2 (10 Marks) | | | Practical Exam (30 Marks) | | Theory Examination (50 Marks) |
| SA 1 (6M) | FA 1 | | SA 2 (6M) | FA 2 | | FA (22M) | SA (8M) | |
| | Component-I (2 Marks) | Component-II (2 Marks) | | Component-I (2 Marks) | Component-II (2 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C101.1 | | | | | | | | | 2 | 3 | | 2 | | | |
| C101.2 | | | | | | | | | 2 | 3 | | 2 | | | |
| C101.3 | | | | | | | | | 2 | 3 | | 2 | | | |
| C101.4 | | | | | | | | | | 3 | | 2 | | | |
| C101.5 | | | | | | | | | 2 | 3 | | | | | |
| C101.6 | | | | | | | | | 2 | 3 | | 2 | | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|---|---|-----------------------|------------|
| 21CH101 | Engineering Chemistry (Common to all I Year B.E./B.Tech) | | 3 /0/3/4.5 |
| Nature of Course | | E(Theory skill based) | |
| Course Pre-requisites | | NIL | |
| Course Objectives: | | | |
| 1 | To make the students conversant with water treatment, boiler feed water techniques. | | |
| 2 | To learn the effect of corrosion in materials and the methods for prevention of corrosion. | | |
| 3 | To understand the principles and applications of electrochemistry and to learn electro analytical methods. | | |
| 4 | To understand the basic concepts, synthesis, and applications of nano materials. | | |
| 5 | To explore the synthesis and properties of important engineering plastics, energy sources and drug molecules. | | |
| 6 | To understand the concepts of photo physical and photochemical processes in spectroscopy. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C101.1 | Recall the requirements of water treatment procedures and boiler feed water for industries. | | [R] |
| C101.2 | Apply the various corrosion control techniques in real time industrial environments. | | [AP] |
| C101.3 | Understand the principle and working of reference electrodes and conductivity meters as an analyzer. | | [U] |
| C101.4 | Understand the basic concepts and applications of Nanochemistry. | | [U] |
| C101.5 | Use the knowledge of polymers, various energy sources and storage devices in engineering field. | | [AP] |
| C101.6 | Understand the principle and working of certain analytical techniques, and synthesis of some common drug molecules. | | [U] |
| Course Contents: | | | |
| Module 1: Water chemistry and Corrosion 25 Hrs | | | |
| Water treatment - characteristics of water - hardness - types and estimation of hardness by EDTA method with numerical problems. Boiler feed water - requirements - disadvantages of hard water. Domestic water treatment - disinfection methods (chlorination, Ozonation, UV treatment) - demineralization process - desalination - reverse osmosis. Corrosion - types - mechanism of dry and wet corrosion - galvanic corrosion - differential aeration corrosion - protective coatings - electroplating of gold - electrolysis plating of nickel. | | | |
| Module 2: Electrochemistry and Energy sources 25 Hrs | | | |
| Electrochemical cells - electrolytic cell - reversible and irreversible cells - Free energy and emf, cell potentials, Nernst equation and applications. Oxidation and reduction potentials - standard hydrogen electrode, saturated calomel electrode, glass electrode - pH measurement. Nanochemistry - Basics - Comparison of molecules, nanomaterials and bulk materials; Types - nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: Electrochemical deposition and electro spinning. Applications of nanomaterials in medicine. Energy Sources - Fuel cells (H ₂ -O ₂). Storage Devices –Batteries - Alkaline - Lead acid, Nickel cadmium and Lithium - ion batteries. | | | |
| Module 3: Polymer chemistry, Spectroscopic techniques and Synthesis of drug molecule 25 Hrs | | | |
| Introduction - monomers and polymers - classification of polymers – Polymerization -types. Mechanism of addition polymerization (free radical mechanism). Plastics – classification - preparation, properties and uses of Nylon 6,6, Nylon 6, PVC, Bakelite and PET. Moulding methods - moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays (Compression moulding) and PET bottles (Blow | | | |

moulding). Spectroscopy - Beer Lambert's law, principle, instrumentation, and applications of Electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and Flame emission spectroscopy (FES). Synthesis of a commonly used drug molecule-Asprin, p-nitroaniline from acetanilide.

Field work:

Industrial visit- Water treatment plant / Sewage treatment plant / Reverse osmosis plant

Lab Component

| S.No | List of Experiments | CO Mapping | BT |
|--------------------|---|------------|-----------|
| 1 | Estimation of hardness of water by EDTA method | C101.1 | [E] |
| 2 | Estimation of alkalinity of water sample | C101.1 | [E] |
| 3 | Determination of chloride content in bleaching powder | C101.2 | [E] |
| 4 | Estimation of dissolved oxygen in water | C101.2 | [E] |
| 5 | Potentiometry- determination of redox potentials and emf's | C101.3 | [E] |
| 6 | Conductometric titration-mixture of acids vs NaOH | C101.3 | [E] |
| 7 | Determination of strength of strong acid by pH metry | C101.4 | [E] |
| 8 | Corrosion rate of mild steel in acid medium | C101.4 | [E] |
| 9 | Electroplating of nickel over copper | C101.5 | [E] |
| 10 | Spectrophotometry-Estimation of iron in water | C101.5 | [E] |
| 11 | Separation of mixture of amino acids by thin layer chromatography | C101.6 | [E] |
| 12 | Synthesis of Nylon 66 | C101.6 | [E] |
| Total Hours | | | 90 |

Text Books:

| | |
|---|---|
| 1 | Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition by S. Chand & Company Ltd., New Delhi 2015. |
| 2 | Jain P. C. & Monica Jain., "Engineering Chemistry", 16 th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015. |
| 3 | Fundamentals of Molecular Spectroscopy, 4 th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994. |
| 4 | Physical Chemistry, 11 th Edition by P. W. Atkins Publishing Oxford University Press (P) Ltd, United Kingdom, 2018. |
| 5 | Nanochemistry, 2 nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013. |
| 6 | N.Krishna Murthy, Vallinayagam D., "Engineering Chemistry" 3 rd Edition by PHI Learning Pvt Ltd., 2014 |
| 7 | Sunita Rattan, A Text Book of Engineering Chemistry, Student Edition by SK Kataria Publishers, 2013. |
| 8 | R.V.Gadag, A.Nithyananda Shetty "Engineering Chemistry" 3 rd Edition PHI Learning Pvt Ltd., 2014. |

Reference Books:

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|---|--|
| 1 | Shikha Agarwal., "Engineering Chemistry and Applications", Cambridge University press, 2016. |
| 2 | Liliya., Bazylak.I., Gennady.E., Zaikov., Haghvi.A.K., "Polymers Composites" CR Press, 2014. |
| 3 | Lefrou., Christine., Fabry., Pierre., Poignet., Jean-claude., "Electrochemistry – The Basics, with examples" 2012 ., Springer. |

| | |
|-------------------------|--|
| 4 | Zaki Ahmad, Digby Macdonald, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science, 2nd Edition 2012. |
| 5 | Perez, Nestor, "Electrochemistry and Corrosion Science", Springer, 2016. |
| 6 | Introduction to Nano: basics to Nanoscience and Nanotechnology, by Sengupta, Amretashis, Sarkar, Chandan Kumar, Springer Publisher, 2015. |
| 7 | Ghazi A.Karim. "Fuels, Energy and the Environment", CRC Press, Taylor and Francis group, 2012. |
| Web References: | |
| 1 | http://www.analyticalinstruments.in/home/index.html |
| 2 | www.springer.com »Home»Chemistry»Electrochemistry |
| 3 | https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electro-chemistry |
| 4 | www.edx.org/ |
| 5 | https://www.ntnu.edu/studies/courses |
| 6 | www.corrosionsource.com/ |
| Online Resources | |
| 1 | nptel.ac.in/courses/105104102/hardness.htm |
| 2 | https://ocw.mit.edu/courses/chemistry |
| 3 | nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf https://alison.com- |
| 4 | Spectroscopic technique, Colorimetry |
| 5 | https://ocw.mit.edu/courses/chemistry |
| 6 | nptel.ac.in/courses/113108051 |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | | |
| 8 | 42 | 50 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory | | | |
|--|---------------|--|-------|
| Formative Assessment based on Capstone Model (8%) | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
| C101.1 | Remember | Classroom or online Quiz | 2 |
| C101.2 | Apply | Group Assignment | 2 |
| C101.3 | Apply | Presentation | 2 |
| C101.4 | Understand | Group Activities | 2 |
| C101.5 | Apply | | |
| C101.6 | Understand | | |

| Summative Assessment based on Continuous and End Semester Examination - Theory | | | |
|--|-----------------------------|-----------------|--|
| Bloom's Level | Continuous Assessment (12%) | | End Semester Examination (50%) [50 Marks] |
| | CIA1: (6 Marks) | CIA2: (6 Marks) | |
| Remember | 30 | 30 | 20 |
| Understand | 20 | 40 | 50 |
| Apply | 50 | 30 | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |

| Summative Assessment based on Continuous and End Semester Examination - Practical | | | |
|---|-----------------------------|---------------|--|
| Bloom's Level | Continuous Assessment (30%) | | |
| | FA: (22 Marks) | SA: (8 Marks) | |
| Remember | 20 | 20 | |
| Understand | 30 | 30 | |
| Apply | 50 | 50 | |
| Analyse | - | - | |
| Evaluate | - | - | |
| Create | - | - | |

| Summative Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|-----------------------|------------------------|-----------------|-----------------------|------------------------|---------------------------|--------------------------------|-------------------------------|
| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
| CA 1 (10 Marks) | | | CA 2 (10 Marks) | | | Practical Exam (30 Marks) | | Theory Examination (50 Marks) |
| SA 1 (6M) | FA 1 | | SA 2 (6M) | FA 2 | | FA (22M) | SA (8M) | |
| | Component-I (2 Marks) | Component-II (2 Marks) | | Component-I (2 Marks) | Component-II (2 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C101.1 | 1 | 1 | 1 | 1 | | | 1 | | | | | | 1 | | |
| C101.2 | 3 | 2 | 3 | 2 | | | 1 | | | | | | 3 | | |
| C101.3 | 2 | 1 | 2 | 1 | | | 1 | | | | | | 2 | | |
| C101.4 | 2 | 1 | 2 | 1 | | | 1 | | | | | | 2 | | |
| C101.5 | 3 | 2 | 3 | 2 | | | 1 | | | | | | 3 | | |
| C101.6 | 2 | 1 | 2 | 1 | | | 1 | | | | | | 2 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|---|---|-----------------------|---------|
| 21EE201 | Basics of Electrical Circuits | | 3/1/2/5 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | NIL | |
| Course Objectives: | | | |
| 1 | To understand DC and AC circuits | | |
| 2 | To learn network theorems and two port networks for circuit analysis. | | |
| 3 | To explore the transient and resonance response of different electrical circuit | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C201.1 | Analyse basic DC and AC electric circuits | | [A] |
| C201.2 | Derive the sinusoidal steady-state (single-phase and three-phase) response of AC Circuits | | [AP] |
| C201.3 | Analyze two port circuit behaviour | | [A] |
| C201.4 | Apply network theorems for the analysis of electrical circuits. | | [AP] |
| C201.5 | Analyze the transient and resonance response of electrical circuits | | [A] |
| Course Contents: | | | |
| Module 1: DC Circuits and AC Circuits | | | 25 Hrs |
| Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, Resistor in series and parallel, voltage division, Current division, Star-delta transformation, Mesh and Nodal analysis. Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), Three phase balanced circuits – voltage, current, power relations in star and delta connections. | | | |
| Module 2: Network Theorems and Two Port Networks | | | 20 Hrs |
| Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Concept of duality and dual networks. Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters, hybrid parameters. Two-terminal network synthesis. Properties of Hurwitz polynomial and Positive real function. | | | |
| Module 3: Transients and Resonance Analysis | | | 15 Hrs |
| Steady State and Transient response - DC response of RL, RC and RLC Circuits using Laplace transforms.AC Transients response of RL and RC Circuits. Resonance: Series Resonance - Bandwidth of an RLC circuit, Q factor, Magnification in Resonance. Parallel Resonance - Resonant frequency for a tank circuit factor of parallel resonance, magnification. Self and mutually induced emf, coefficient of coupling, dot convention in coupled circuits. | | | |
| Lab Component | | | |
| S.No | List of Experiments | CO Mapping | BT |
| 1 | Estimation of voltage and current by KVL and KCL in Electric Circuits | C201.1 | [U] |
| 2 | Determination of mesh current and node voltage by Mesh and Nodal Analysis | C201.1 | [U] |
| 3 | Apply Superposition Theorem in Electrical Circuits | C201.4 | [AP] |
| 4 | Apply Reciprocity Theorem in Electrical Circuits | C201.4 | [AP] |

| | | | |
|------------------|---|--------|------|
| 5 | Application of thevenin's theorem for Maximum Power Transfer | C201.4 | [AP] |
| 6 | Apply Norton and Compensation Theorem in Electrical Circuits | C201.4 | [AP] |
| 7 | Determination of series and parallel resonance frequency response of circuits. | C201.5 | [U] |
| 8 | Determination of transient current in RL, RC and RLC circuits | C201.5 | [U] |
| 9 | Verification of circuit analysis by simulation | C201.5 | [A] |
| 10 | Measurement of three phase power | C201.5 | [U] |
| Total Hours | | | 90 |
| Text Books: | | | |
| 1 | William H.Hayt, JackE. Kemmerly and Steven M.Durbin,“ Engineering Circuits Analysis”,TMHpublishers,8thedition, NewDelhi,2017 | | |
| 2 | Joseph A. Edminister, Mahmood Nahvi,“Electric circuits”,Schaum"s series, Mc Graw-Hill, New Delhi, 5 th edition,2013 | | |
| 3 | M. E. Van Valkenburg, “Network Analysis”, Phi Learning, 3/ E,3 rd Edition, 2014. | | |
| Reference Books: | | | |
| 1 | Charles K. Alexander, Mathew N.O. Sadik, “Fundamentals of Electric Circuits”, 3 rd Edition, McGraw Hill, reprint 2011. | | |
| 2 | Robins & Miller, „Circuit analysis theory and practice“, Delmar Publishers, 5 th Edition, 2012. | | |
| 3 | Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, Tata McGraw Hill, 2017. | | |
| Web References: | | | |
| 1 | http://www.electrical4u.com/circuit-analysis.htm | | |
| 2 | http://www.technologystudent.com | | |
| 3 | http://www.allaboutcircuits.com | | |
| 4 | http://www.nptel.ac.in | | |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | | |
| 8 | 42 | 50 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) – Theory | | | |
|--|---------------|--|-------|
| Formative Assessment based on Capstone Model (8%) | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | Marks |
| C201.1 | Analyze | Assignment | 2 |
| C201.2 | Apply | Tutorial | 2 |
| C201.3 | Analyze | Quiz | 2 |
| C201.4 | Apply | Simulation | 2 |
| C201.5 | Analyze | | |

| Summative Assessment based on Continuous and End Semester Examination - Theory | | | |
|--|-----------------------------|-----------------|---|
| Bloom's Level | Continuous Assessment (12%) | | End Semester Examination (50%) [50 Marks] |
| | CIA1: (6 Marks) | CIA2: (6 Marks) | |
| Remember | 10 | 10 | 10 |
| Understand | 10 | 30 | 30 |
| Apply | 40 | 50 | 30 |
| Analyse | 40 | 10 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Summative Assessment based on Continuous and End Semester Examination - Practical | | | |
|---|-----------------------------|---------------|--|
| Bloom's Level | Continuous Assessment (30%) | | |
| | FA: (22 Marks) | SA: (8 Marks) | |
| Remember | 10 | 10 | |
| Understand | 30 | 30 | |
| Apply | 20 | 20 | |
| Analyse | 40 | 40 | |
| Evaluate | - | - | |
| Create | - | - | |

| Summative Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|-----------------------|------------------------|-----------------|-----------------------|------------------------|---------------------------|--------------------------------|-------------------------------|
| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
| CA 1 (10 Marks) | | | CA 2 (10 Marks) | | | Practical Exam (30 Marks) | | Theory Examination (50 Marks) |
| SA 1 (6M) | FA 1 | | SA 2 (6M) | FA 2 | | FA (22M) | SA (8M) | |
| | Component-I (2 Marks) | Component-II (2 Marks) | | Component-I (2 Marks) | Component-II (2 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C201.1 | 3 | 3 | 3 | 3 | | | | | 1 | | | | 3 | | |
| C201.2 | 3 | 3 | 3 | 3 | | | | | 1 | | | | 3 | | |
| C201.3 | 3 | 3 | 3 | 3 | | | | | 1 | | | | 3 | | |
| C201.4 | 3 | 3 | 3 | 3 | | | | | 1 | | | | 3 | | |
| C201.5 | 3 | 3 | 3 | 3 | | | | | 1 | | | | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|--------------------------------------|-----------|
| 21ME111 | Engineering Graphics | | 1/0/3/2.5 |
| Nature of Course | | Practical application | |
| Pre-requisites | | Basic Drawing and Computer Knowledge | |
| Course Objectives: | | | |
| 1 | To know the method to construct the conic curves used in engineering applications. | | |
| 2 | To develop an understanding of Isometric to orthographic views and vice versa. | | |
| 3 | To learn the basic projection of straight lines and plane surfaces. | | |
| 4 | To develop the imagination of solids inclined to one reference plane. | | |
| 5 | To know the development of surfaces used in various fields. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C111.1 | Understand the basic concepts of Engineering Graphics. | | [U] |
| C111.2 | Sketch isometric, orthographic projections and projection of lines and planes | | [AP] |
| C111.3 | Develop lateral surfaces of solids including prisms and pyramids. | | [AP] |
| C111.4 | Construct projections of lines, planes, solids and isometric views using modelling software. | | [A] |
| Course Contents: | | | |
| Conic curves and special curves – Isometric projections, Isometric to orthographic projection-Orthographic to Isometric projection-Projection of lines and plane surfaces-Projection of solids-Development of surfaces-Introduction to perspective projection. | | | |
| S.No | List of Experiments | CO Mapping | RBT |
| 1. | Introduction to drafting software. | C111.1 | [U] |
| 2. | Construction of conic curves (Ellipse, Parabola and Hyperbola) | C111.1 | [U] |
| 3. | Construction of special curves (Cycloid and Involute) | C111.1 | [U] |
| 4. | Isometric to orthographic projections – manual sketches | C111.2 | [AP] |
| 5. | Isometric to orthographic projections – software sketches | C111.4 | [A] |
| 6. | Projection of lines - inclined to HP, VP and Both HP & VP | C111.4 | [A] |
| 7. | Projection of plane surface`45282145d44562ds (Hexagon, Pentagon and circle) –inclined to any one of the principle | C111.4 | [AP] |
| 8. | Projection of solids (Prism and Pyramid) – inclined to HP | C111.3 | [AP] |
| 9. | Projection of solids (Cone and Cylinder) – inclined to VP | C111.3 | [A] |
| 10. | Development of surfaces (Prism, Pyramid, Cone and Cylinder) | C111.4 | [A] |
| 11. | Introduction to perspective projection | C111.2 | [U] |
| Total Hours | | 60 | |
| Reference Books: | | | |
| 1 | Charles K. Alexander, Mathew N.O. Sadik, “Fundamentals of Electric Circuits”, 3 rd Edition, McGraw Hill, reprint 2011. | | |
| 2 | Robins & Miller, „Circuit analysis theory and practice”, Delmar Publishers, 5th edition,2012 | | |
| 3 | Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, Tata McGraw Hill, 2017. | | |
| 4 | Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P), Limited, 2013. | | |
| Web References: | | | |
| 1 | http://nptel.ac.in/courses/112102101/ | | |

| Continuous Assessment | | End Semester Examination | Total |
|-----------------------|----------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | | |
| 45 | 15 | | |
| | | 40 | 100 |

| Summative Assessment based on Continuous and End Semester Examination | | | |
|---|-----------------------------|---------------|----------------------------------|
| Bloom's Level | Continuous Assessment (60%) | | End Semester Examination (40%) |
| | FA (45 Marks) | SA (15 Marks) | Practical Examination (40 Marks) |
| Remember | 0 | 0 | 0 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | 0 | 0 | 0 |
| Create | 20 | 20 | 20 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C111.1 | 2 | 2 | 1 | | | | | 2 | 3 | | 2 | | 3 | | |
| C111.2 | 2 | 2 | 1 | | | | | 2 | 3 | | 2 | | 3 | | |
| C111.3 | 2 | 2 | 1 | | | | | 2 | 3 | | 2 | | 3 | | |
| C111.4 | 2 | 2 | 1 | | | | | 2 | 3 | | 2 | | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|------------------------|---------|
| 21MA303 | Transforms and Numerical Methods ECE / EEE | | 3/0/0/3 |
| Nature of Course | | J (Problem analytical) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To understand the different possible forms of Fourier series and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data. | | |
| 2 | To acquaint the student with transform techniques which are used in variety of engineering fields. | | |
| 3 | To study the concept of mathematical formulation of certain practical problems in terms of partial differential equations and solving for physical interpretation. | | |
| 4 | To find the numerical solution for partial differential equations. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C303.1 | Recall the basic integration concepts and partial derivatives | | [R] |
| C303.2 | Interpret Fourier series solutions to the engineering problems | | [U] |
| C303.3 | Apply continuous transforms techniques to evaluate definite integrals | | [AP] |
| C303.4 | Apply the Z transform techniques in discrete sequences | | [AP] |
| C303.5 | Apply analytical methods to solve the partial differential equations | | [AP] |
| C303.6 | Apply numerical methods to solve wave and heat equation with boundary conditions | | [AP] |
| Course Contents: | | | |
| Module 1: Fourier Series | | | 15 Hrs |
| Dirichlet's conditions-General Fourier Series-Odd and Even Functions- Half range sine series and cosine series - Parseval's Identity-Harmonic analysis | | | |
| Module 2: Fourier Transform and Z Transform | | | 15 Hrs |
| Fourier Transform: Complex form of Fourier Transforms – Fourier sine and cosine transforms - Properties - Transforms of simple functions – Convolution theorem and Parseval's Identity (Statement only) - Evaluation of integrals using Parseval's Identity. Z- Transform: Convergence of Z transform -Z-transform of Standard functions-Properties -Inverse Z- transform-Convolution theorem(Statement only)-Partial fraction method - Formation of difference equations - Solution of difference equations using Z-transform Techniques. | | | |
| Module 3: Partial Differential Equations | | | 15 Hrs |
| Introduction to PDE – Solving PDE by Lagrange's linear equations-Linear homogeneous partial differential equations of second and higher order with constant coefficients-Classifications-Numerical Solution to Partial differential Equation-Elliptic equations- Laplace equation - Liebmann's Iteration Process -Poisson equation -Parabolic Equation (one dimensional heat equation) - Bender-Schmidt's Difference Scheme – Crank-Nicholson's Difference Scheme- Hyperbolic Equation (one dimensional wave equation). | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Erwin E., "Advanced Engineering Mathematics", John Wiley and Sons (Asia) Limited, Hoboken, 2020. | | |
| 2 | Grewal. B.S, "Higher Engineering Mathematics", 44th edition, Khanna Publications, Delhi, 2018. | | |
| 3 | Jain M.K. Iyengar, K & Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers, 6th edition, 2016. | | |
| Reference Books: | | | |
| 1 | Veerarajan. T, "Transforms and Partial differential equations", 3rd edition, Tata McGraw-Hill Publishing Company Ltd., reprint, 2016. | | |
| 2 | N.P.Bali, "A Text book of Engineering Mathematics Sem-III/IV" 13th edition, Laxmi | | |

| | |
|--------------------------|---|
| | Publications Ltd, 2017. |
| 3 | Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th edition, 2016. |
| 4 | P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2015. |
| Web References: | |
| 1 | https://www.youtube.com/watch?v=iNC0jxb0OxE |
| 2 | https://www.youtube.com/watch?v=iRXXmtcocAQ |
| 3 | https://www.youtube.com/watch?v=OGT59INH3Y |
| Online Resources: | |
| 1 | https://nptel.ac.in/courses/111/106/111106111/ |
| 2 | https://nptel.ac.in/courses/111/107/111107111/ |
| 3 | https://nptel.ac.in/courses/111/107/111107107/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
|----------------|---------------|--|---------------------|
| C303.1 | Remember | Quiz | 20 |
| C303.2 | Understand | Seminar | 20 |
| C303.3 | Apply | Tutorial | 20 |
| C303.4 | Apply | | |
| C303.5 | Apply | Assignment | 20 |
| C303.6 | Apply | | |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 30 | 30 | 30 |
| Apply | 50 | 50 | 50 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| | | | |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|------------------|-------------------|---------|---------|---------|-------------------|---------|---------|---------|-----------------|----------|----------|----------|----------|----------|----------|
| C303.1 | 2 | 2 | 1 | | | | | | | | | | 1 | | |
| C303.2 | 2 | 2 | 2 | | | | | | | | | | 2 | | |
| C303.3 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| C303.4 | 2 | 2 | 2 | | | | | | | | | | 1 | | |
| C303.5 | 2 | 2 | 2 | | | | | | | | | | 2 | | |
| C303.6 | 2 | 2 | 2 | | | | | | | | | | 1 | | |
| 1 | Reasonably Agreed | | | 2 | Moderately Agreed | | | 3 | Strongly Agreed | | | | | | |

| | | | |
|---|---|-------------------------------|-------------|
| 21EE301 | Electrical Machines - I | | 3/0/0/3 |
| Nature of Course | | G (Theory and Analytical) | |
| Course Pre-requisites | | Basics of Electrical Circuits | |
| Course Objectives: | | | |
| 1 | To study the basic concepts of magnetic field. | | |
| 2 | To understand the construction, working principle of DC machines and analyse their performance. | | |
| 3 | To familiarize with the construction details of different types of transformers, working | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C301.1 | Examine the basic concepts of magnetic circuits. | | [U] |
| C301.2 | Analyse the operation of various DC machine configurations. | | [A] |
| C301.3 | Interpret the constructional details of different type of transformers, working principle and their performance | | [U] |
| C301.4 | Analyse the performance of single-phase transformer by various testing methods. | | [A] |
| C301.5 | Choose an appropriate DC motor for any industrial application and appraise its significance. | | [AP] |
| Course Contents: | | | |
| Module 1: Magnetic Fields and Magnetic Circuits | | | 15 Hrs |
| Nature of magnetic field - Electromagnetism - Leakage flux and fringing effect - Reluctance and Permeance - BH Characteristics - Analysis of series and parallel magnetic circuit - Properties of magnetic material - Faraday's law of electromagnetic induction - Induced voltage and Induction - Eddy current and hysteresis losses - Singly and Double excited magnetic system. | | | |
| Module 2: DC Machines | | | 15 Hrs |
| DC Generator - Construction, Principle of Operation – EMF equation - Types, Characteristics, commutation - Interpoles - Armature reaction - Armature circuit equation for motoring and generation. | | | |
| DC Motor - Principle of operation - Torque equation - Types - Electrical and mechanical characteristics - Need for starters - Types of starters - Soft starters - Braking - Speed control methods - Testing of DC motors - Case study: selection of DC motors for various industrial application. | | | |
| Module 3: Single Phase and Three Phase Transformers | | | 15 Hrs |
| Single Phase Transformers - Principle of operation - Types - Basic construction - Equivalent circuit - Phasor diagram - Regulation and efficiency - Separation of Hysteresis and Eddy current losses - Testing of Transformers - Open circuit and short circuit tests, polarity test, back-to-back test. Three - phase Transformers - Construction - Types of connection and their comparative features - Auto transformer - All day efficiency - Parallel operation of transformers. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | Stephen J. Chapman, "Electric Machinery Fundamentals", Tata McGraw Hill International Edition, New Delhi, 5th Edition 2011. | | |
| 2 | Robert L. Boylestad, "Introductory Circuit Analysis", Pearson Education India, 13 th Edition, 2016. | | |
| 3 | D.P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, 2017. | | |
| Reference Books: | | | |
| 1 | P. S. Bimbhra, "Electrical Machines", Khanna Publishers,2nd edition 2017 | | |
| 2 | J B Gupta, "Theory andPerformance of Electrical machines", SK Kataria andsons, 2015. | | |
| 3 | Allan H. Robbins and Wilhelm C, Miller, "Circuit Analysis Theory and Practice", Cengage Learning, 2013. | | |

| Web References: | |
|-----------------|---|
| 1 | https://courses.lumenlearning.com/boundless-physics/chapter/magnetism-and-magnetic-fields/ |
| 2 | https://library.automationdirect.com/selecting-motors-industrial-applications/ |
| 3 | https://electrical-engineering-portal.com/erection-procedure-for-power-transformer |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|--|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
| C301.1 | Understand | Quiz | 20 |
| C301.2 | Analyze | Class Presentation | 20 |
| C301.3 | Understand | Assignment | 20 |
| C301.4 | Analyze | Case Study | 20 |
| C301.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|------------------|--------------------------|---------|---------|---------|----------|--------------------------|---------|---------|---------|----------|----------|------------------------|----------|----------|----------|
| C301.1 | 3 | 1 | 1 | 1 | | | | | | | | | | 2 | |
| C301.2 | 3 | 2 | 2 | 1 | | | | | | | | | | 2 | |
| C301.3 | 3 | 2 | 1 | | | | | | | | | 3 | | 2 | |
| C301.4 | 3 | 3 | 3 | 2 | | 1 | 1 | | | | | 2 | | 3 | |
| C301.5 | 3 | 3 | 3 | 2 | | 1 | 1 | | | | | 2 | | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|-----------------------|---------|
| 21EE302 | Linear and Digital Integrated Circuits | | 3/0/0/3 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | NIL | |
| Course Objectives: | | | |
| 1 | To study the IC Fabrication, Op-amp characteristics and its applications | | |
| 2 | To simplify the expressions using Boolean functions | | |
| 3 | To study about Combinational Circuits and Synchronous Sequential circuits. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C302.1 | Understand the op-amp's basic construction, characteristics, parameter limitations and various configurations. | [U] | |
| C302.2 | Analyze and design of op-amp circuits, linear circuits, non-linear circuits and 555 timers. | [A] | |
| C302.3 | Interpret the concepts of basic number system used to represent the digits and fundamentals of ALU operation. | [U] | |
| C302.4 | Illustrate the designing procedure of combinational circuits. | [A] | |
| C302.5 | Understand the operation of memory devices | [U] | |
| C302.6 | Analyze the designing procedure of synchronous sequential circuits. | [A] | |
| Course Contents: | | | |
| Module 1: Linear Integrated Circuits | | 15 Hrs | |
| IC fabrication - op-amp characteristics - Inverting, Non-inverting and voltage follower - applications of op-amp - Summer, Difference Amplifier, Differentiator and Integrator - Instrumentation amplifier - V/I and I/V converters - Comparators - Peak detectors - S/H circuits - D/A converter - R-2R ladder and weighted resistor types - A/D converter - Dual slope, successive approximation - Functional blocks and applications of ICs: 555 timer - Astable and Monostable operation. Case Study: Application of ADC and op-amp | | | |
| Module 2: Digital Circuits | | 15 Hrs | |
| Number systems - Boolean algebra: De-Morgan's theorem, switching functions, simplification using K-maps, Quine Mc Cluskey method - Combinational circuits - Design of Logic gates - Design of adder, Subtractor, Comparators, Code converters, Encoders, Decoders, Multiplexers and Demultiplexers. | | | |
| Module3: Flip-Flops | | 15 Hrs | |
| SR, D, JK and T Flip-Flops - Level triggering and edge triggering - Shift register - Types - Analysis and design of synchronous sequential circuits - Counters – Sequence Generator, State diagram, State reduction and State assignment. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | A.Anand kumar, 'Fundamental of Digital Circuits', PHI Learning Private Ltd, 4th Edition, 2014. | | |
| 2 | James M.Fiore, 'Opamps and Linear Integrated Circuits', Cengage Learning India Pvt. | | |
| 3 | M. Morris R. Mano, Michael D. Ciletti, 'Digital Logic Design', Prentice Hall,5th Edition,2013. | | |
| Reference Books: | | | |
| 1 | Muhammed H.Rashid, 'Microelectronics circuit analysis and design', Cengage Learning India Pvt Ltd,, 2 nd edition,2011 . | | |
| 2 | Floyd, 'Digital Fundamentals', Pearson education, 11 th edition, 2015. | | |
| 3 | David A.Bell, 'Operational amplifiers and Linear ICs', Oxford University Press, 2 nd edition, 2011. | | |
| Web References: | | | |
| 1 | http://nptel.ac.in/courses/117103064/ | | |
| 2 | http://nptel.ac.in/courses/117106114/ | | |
| 3 | http://nptel.ac.in/courses/108106069/ | | |
| 4 | http://nptel.ac.in/courses/117106086 | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
|----------------|---------------|--|---------------------|
| C302.1 | Understand | Online Quiz | 20 |
| C302.2 | Analyze | Class Presentation | 20 |
| C302.3 | Understand | Group Assignment | 20 |
| C302.4 | Analyze | Case Study | 20 |
| C302.5 | Understand | | |
| C302.6 | Analyze | | |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C302.1 | 3 | 2 | 1 | 1 | 2 | | | | 1 | | | | 2 | | |
| C302.2 | 3 | 2 | 1 | 1 | 2 | | | | 1 | | | | 2 | | |
| C302.3 | 3 | 3 | 2 | 2 | 3 | | | | 1 | | | | 3 | | |
| C302.4 | 3 | 3 | 2 | 2 | 3 | 1 | | | 1 | 1 | | | 3 | | |
| C302.5 | 3 | 2 | 1 | 1 | 2 | 1 | | | 1 | 2 | | | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|------------------------|---------|
| 21EE303 | Measuring Instruments and Smart Sensors | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To state the fundamental concepts of measurements and instruments. | | |
| 2 | To explore the operation of different bridges and transducers in real time. | | |
| 3 | To design aspects and performance criterion of optical and advanced sensors and instruments employed in industry. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C303.1 | Summarize the general measurement instruments techniques. | | [U] |
| C303.2 | Identify the instruments for measuring various electrical parameters. | | [U] |
| C303.3 | Analyze the operating principle of different bridges and transducers. | | [A] |
| C303.4 | Analyze the functioning of various optical sensors in real time. | | [A] |
| C303.5 | Apply suitable advanced sensors in industry based applications. | | [AP] |
| Course Contents: | | | |
| Module 1: Introduction to Measurements and Instruments | | | 15 Hrs |
| Introduction to measurements and Instruments - classifications, applications, Elements of a generalized measurement system, Static and dynamic characteristics, Analog and Digital Instruments - PMMC, Attraction and Repulsion type Moving Iron Instruments, Induction type-dynamometer type Wattmeters, Single and Three Phase Energy Meter - Instrumentation Transformers - Megger - Tachometer - Torque meter - Flow meter. | | | |
| Module 2: Bridges and Transducers | | | 10 Hrs |
| DC and AC Bridges - Wheatstone bridge, Kelvin's double bridge, Maxwell L/C and Wien bridges. Transducers - Characteristics, Requirements, Classifications, Selection Criteria, Displacement Transducers - LVDT, Potentiometers, Pressure Transducers - Bourdon tube, Strain Gauge, Temperature Transducers - RTD, Thermistors, Thermocouples. | | | |
| Module 3: Optical devices and Advanced Sensors in Real Time | | | 20 Hrs |
| Oscilloscopes - Basic principle, Block diagram of oscilloscope, Types, Digital storage oscilloscope, Introduction to MSO, UV and IR spectrometry, Photo Plethysmo Graphy (PPG), RFID sensors, Introduction to MEMS, Introduction to Metal Oxide (MOS) gas sensors, Moisture Sensors, Collision Detection Sensor. Case Studies - Inertial Sensors (Accelerometer and gyroscope). | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpatrai and Co., 19 th Edition, 2016. | | |
| 2 | A.D.Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2016. | | |
| 3 | D.V.S. Murthy, "Transducers and Instrumentation", PHI Learning, 2nd Edition, 2013. | | |
| Reference Books: | | | |
| 1 | H.S Kalsi, "Electronics Instrumentation", Tata McGraw Hill, Higher education, 3 rd edition, 2010. | | |
| 2 | E. O. Doebelin and D. N. Manik, "Measurement Systems — Application and Design", Tata McGraw-Hill, New Delhi, 2011. | | |
| 3 | M.M.S. Anand, 'Electronics Instruments and Instrumentation Technology', Prentice Hall India, New Delhi, 2009. | | |
| 4 | J.J. Carr, "Elements of Electronic Instrumentation and Measurement", Pearson | | |

| | |
|------------------------|---|
| | Education India, New Delhi, 2011. |
| Web References: | |
| 1 | https://nptel.ac.in/courses/108/105/108105153/ |
| 2 | https://www.bosch-sensortec.com/ |
| 3 | http://www.shortcoursesportal.com |
| 4 | https://learn.ni.com/teach/resources/1014/measurements-and-instrumentation |
| 5 | https://the-eye.eu/public/Books/Electronic%20Archive/OliverCageElectronicMeasurementsAndInstrumentation-text.pdf |
| 6 | https://lecturenotes.in/subject/265/electrical-measurement-and-instrumentation-emi |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|--|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
| C303.1 | Analyze | Quiz | 20 |
| C303.2 | Analyze | Class Presentation | 20 |
| C303.3 | Apply | Assignment | 20 |
| C303.4 | Understand | Case Study | 20 |
| C303.5 | Analyze | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C303.1 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 2 | |
| C303.2 | 2 | 1 | 1 | 1 | 2 | | | | | | | 2 | 2 | | |
| C303.3 | 3 | 3 | 2 | 2 | 2 | | | | | | | 2 | | 2 | |
| C303.4 | 2 | 1 | 1 | 1 | 2 | | | | | | | 1 | | 2 | |
| C303.5 | 3 | 3 | 3 | 2 | 1 | | | | | | | 1 | | 2 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | | |
|---|---|-------------------------|------|---------|
| 21CS303 | Managing Data using RDBMS | | | 3/0/2/4 |
| Nature of Course | | D (Theory Applications) | | |
| Course Pre-requisites | | Nil | | |
| Course Objectives: | | | | |
| 1 | To describe information and data models and relational databases. | | | |
| 2 | To explain an Entity Relationship Diagram and design a relational database for a specific use case. | | | |
| 3 | To implement different relational model constraints. | | | |
| 4 | To manage database using SQL commands | | | |
| Course Outcomes: | | | | |
| Upon completion of the course, students shall have ability to | | | | |
| C303.1 | Conceptualize data using the data models. | | | [U] |
| C303.2 | Improve the database design through normalization. | | | [U] |
| C303.3 | Manipulate a database using SQL. | | | [AP] |
| C303.4 | Implement advanced SQL concepts on database. | | | [AP] |
| C303.5 | Infer the transactions management and storage structures in a database environment. | | | [A] |
| Course Contents: | | | | |
| Module 1: Introduction 15 Hrs | | | | |
| Introduction to DBMS, Characteristics of DBMS, DBMS vs File Systems, need for DBMS, Three Level DBMS Architecture, Data Models – Introduction, Benefits, and Phases, ER Diagrams - Symbols, Components, Relationships, Weak entities, Attributes, Cardinality, Relational Algebra, Domain Relational Calculus, Tuple Relational Calculus, Normalization - 1NF, 2NF, 3NF, BCNF, 4NF | | | | |
| Module 2: Constraints and SQL Commands 15 Hrs | | | | |
| DDL Commands - Create, Drop, Alter, Truncate, Rename, Keys - Primary Key, Foreign Key DML Commands - Select, Insert, Update, Delete, Any, All, In, Exists, Non Exists, Union, Intersection, Subqueries - nested, correlated, Joins- Inner, Outer, and Equi, Functions - SUM, COUNT, AVG, MIN, MAX, Clauses - Group By, Having By, Embedded SQL, Dynamic SQL, Transaction Concepts - Transaction model - ACID Properties - Serializability - Transactions as SQL statements. | | | | |
| Module 3: Queries and Transactions 15 Hrs | | | | |
| Creation and Dropping of Views, Creation and Execution of Stored Procedures Cursors and Triggers - Opening, Fetching and Closing, Creation , Insertion, Deletion and Updating Database Applications: Payroll Processing Systems, Railway Reservation Systems, Bank Management System Introduction, Storage media and file structures, B+ Tree Hashing – static and Dynamic, Introduction to Query Processing – Issues in query optimization – Steps in query processing, Concurrency control and transactions, Lock based protocols Recovery System – Failure classification. | | | | |
| Lab Component | | | | |
| S.No | List of Experiments | CO Mapping | BT | |
| 1 | Conceptual Database design using E-R DIAGRAM | C303.1 | [U] | |
| 2 | Implementation of SQL commands DDL, DML, DCL and TCL | C303.2 | [AP] | |
| 3 | Queries to demonstrate implementation of Integrity Constraints | C303.2 | [AP] | |
| 4 | Practice of Inbuilt functions | C303.2 | [AP] | |
| 5 | Implementation of Join and Nested Queries AND Set operators | C303.3 | [AP] | |
| 6 | Implementation of virtual tables using Views | C303.3 | [U] | |
| 7 | Practice of Procedural extensions (Procedure, Function, Cursors, Triggers) | C303.4 | [AP] | |

| | | | |
|-------------------|---|--------|------|
| 8 | Document Database creation using MongoDB | C303.4 | [AP] |
| 9 | Study of Cloud Storage | C303.5 | [AP] |
| 10 | Mini Project (Application Development) i) IT Training Group Database ii) Blood Donation System iii) Salary Management System iv) Traffic Light Information System | C303.5 | [A] |
| Total Hours | | | 75 |
| Text Books: | | | |
| 1 | Abraham Silberschatz, Henry F Korth, S Sudarshan, “Data base System Concepts”, 7th edition, McGraw hill, 2020. | | |
| 2 | Vijay Krishna Pallaw, “Database Management Systems”, 2nd Edition Asian Books Private Limited, 2010. | | |
| 3 | Mark L. Gillenson, "Fundamentals of Database Systems", 7th Edition, Wiley India Pvt. Limited, 2008. | | |
| Reference Books: | | | |
| 1 | Raghu Ramakrishnan, Johannes Gehrke, Raghu Ramakrishnan, Johannes Gehrke , "Database Management Systems", McGraw-Hill Education, 2017 | | |
| 2 | C. Date, "SQL and Relational Theory", O'Reilly Media, Incorporated, 2011. | | |
| Web References: | | | |
| 1 | http://www.sqlcourse.com/ | | |
| 2 | https://www.w3schools.com/sql/ | | |
| 3 | https://www.geeksforgeeks.org/dbms/ | | |
| Online Resources: | | | |
| 1 | https://www.coursera.org/learn/database-management | | |
| 2 | https://www.udemy.com/database-management-system/ | | |
| 3 | https://onlinecourses.swayam2.ac.in/cec22_cs18/preview | | |

| Continuous Assessment | | | | | | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------|----------------------|----------------------|-----------|-------------|-----------------------------|--------------------------|-------|
| Theory | | | | Practical | | | Total (A+B) | Total Continuous Assessment | | |
| Formative Assessment | Summative Assessment | Total | Total (A) | Formative Assessment | Summative Assessment | Total (B) | | | | |
| 80 | 120 | 200 | 100 | 75 | 25 | 100 | 200 | 50 | 50 | 100 |

| Formative Assessment based on Capstone Model - Theory | | | |
|---|--|--|--------------------------------|
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (10%) [80 Marks] |
| C303.1 | Understand | Quiz | 20 |
| C303.2 | Understand | Assignment | 20 |
| C303.3 | Apply | Group Assignment | 20 |
| C303.4 | Apply | Case Study | 20 |
| C303.5 | Analyze | | |
| Assessment based on Summative and End Semester Examination - Theory | | | |
| Bloom's Level | Summative Assessment (15%) [120 Marks] | | End Semester Examination (35%) |

| | CIA1: (60 Marks) | CIA2: (60 Marks) | [100 Marks] |
|--|--|------------------|--|
| Remember | 10 | 10 | 20 |
| Understand | 40 | 40 | 30 |
| Apply | 30 | 30 | 40 |
| Analyse | 20 | 20 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Assessment based on Continuous and End Semester Examination – Practical | | | |
| Bloom's Level | Continuous Assessment (25%) [100 Marks] | | End Semester Examination (15%) [100 Marks] |
| | FA: (75 Marks) | SA: (25 Marks) | |
| Remember | 20 | 10 | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 40 | 40 | 40 |
| Analyse | 20 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|------------------------|-------------------------|------------------|------------------------|-------------------------|----------------------------|----------|---|
| Continuous Assessment (50%) | | | | | | | | End Semester Examination (50%) |
| CA 1 (100 Marks) | | | CA 2 (100 Marks) | | | Practical Exam (100 Marks) | | Theory Examination (35%) Practical Examination (15%) |
| SA 1 (60M) | FA 1 | | SA 2 (60M) | FA 2 | | FA (75M) | SA (25M) | |
| | Component-I (20 Marks) | Component-II (20 Marks) | | Component-I (20 Marks) | Component-II (20 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C303.1 | 3 | 1 | | | 1 | | | | | 1 | | 1 | 2 | | 1 |
| C303.2 | 3 | 3 | 3 | 3 | | | | | 2 | 2 | | 3 | 3 | 2 | 2 |
| C303.3 | 3 | 3 | 2 | 1 | | | | | 2 | 1 | 2 | 3 | 3 | 2 | 2 |
| C303.4 | 3 | 3 | 2 | 2 | 2 | | | | 2 | 1 | 2 | 2 | 3 | 2 | 2 |
| C303.5 | 3 | 2 | 2 | | 2 | | | | 1 | 2 | 2 | 3 | 2 | 2 | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|------------------------|---------|
| 21CS304 | Problem solving using C++ and Data Structures (Common to ECE and EEE) | | 3/0/2/4 |
| Nature of Course | | F (Theory Programming) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To learn basics of OOPS programming and its basics. | | |
| 2 | To analyze different types of constructor, Inheritance, polymorphism and File concepts. | | |
| 3 | To Study the design and applications of linear structures and its applications | | |
| 4 | To understand the various non-linear data structures like Trees and Graphs along with its applications. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C304.1 | Design, develop and test C++ programs using classes, conditionals, loops and branching statements | | [AP] |
| C304.2 | Demonstrate the fundamental concepts of object oriented programming such as constructor, Inheritance and polymorphism | | [AP] |
| C304.3 | Discuss the basis of Abstract Classes, interface and Files. | | [U] |
| C304.4 | Explore the concepts of Linear structures and apply to any real time applications. | | [AP] |
| C304.5 | Implement the concepts of Trees and Graph in real time examples. | | [AP] |
| Course Contents: | | | |
| Module 1: Beginning with C++ 15 Hrs C vs C++, Basic of OOPS, The main () function, Header files, Basic Input and Output (I/O) using cin and cout, Variable, Constant. Operators - Arithmetic Operators, Assignment Operators, Relational Operators, Logical Operators, Bitwise Operators, Other Operators, Operator Precedence. Control Statements - if, if...else and Nested if...else, switch case, break and continue Loops - for loop, while loop, do while loop, goto. Arrays and Strings - 1D array, 2D array, Strings, String functions. Function – Basics, Call by value, Call by reference and return by reference, Inline function, overloading Functions, inline Functions, Recursive Functions. Pointers - Pointer, Dynamic Memory Allocation | | | |
| Module 2: Inheritance and Polymorphism 15 Hrs Classes and Objects, public, private, protected Constructors and destructors - Overloaded Constructor, Copy Constructor, Shallow Copying Deep Copying. Overloading - this' Pointer, Structs vs Classes, Friends of a class, Operator Overloading Inheritance, Overloading vs overriding, Polymorphism, Virtual Functions, Pure Virtual Functions and Abstract Classes. Abstract Classes as Interfaces, Exception, Files, Streams and I/O, STL, Generic Programming, Lambda Expression. | | | |
| Module 3: Linear and Non-Linear Data Structure 15 Hrs Order complexity analysis, Time complexity analysis of iterative and recursive algorithms, Space complexity analysis and its notations, Euclidean algorithm, Sieve of Eratosthenes, Prime factorization, Modular arithmetic, Euler totient function Linked List - Array vs Linked list, Types of linked list - Singly, Doubly and Circular Linked list, Applications of linked list, Problems on Linked list Stack and Queue - Array implementation, Linked list implementation, Expression Evaluation - Infix, Prefix and Postfix, Evaluation of Postfix expression and Problems on Stack, Array implementation, Linked list implementation, Priority Queue and Problems on Queue Trees - Binary Tree, Binary Search Tree - Insertion, Deletion, Traversal - Inorder, Preorder and Postorder, Level order traversal and Problems on Trees Graphs - Matrix and list implementation, Traversal - BFS and DFS, | | | |

| | | | |
|---|---|------------|------|
| Weighted and Directed graphs, Cycle, Detection in graphs, Problems on Graphs. | | | |
| Lab Component | | | |
| S.No | List of Experiments | CO Mapping | BT |
| 1 | Write a C++ program to demonstrate the Looping and Functions. | C304.1 | [U] |
| 2 | Write a C++ program to demonstrate constructor and this pointer. | C304.1 | [AP] |
| 3 | Write a C++ program to implement the Inheritance concepts. | C304.2 | [AP] |
| 4 | Write a C++ program to implement the Compile time and Runtime polymorphism. | C304.2 | [AP] |
| 5 | Write a C++ program to implement the abstract Class, interfaces and File Stream classes. | C304.3 | [AP] |
| 6 | Write a C++ program to implement the Singly Linked List and Doubly Linked List. | C304.3 | [U] |
| 7 | Write a C++ program to implement the Conversion of Infix to Postfix Expression. | C304.4 | [AP] |
| 8 | Write a C++ program to implement Priority Queue. | C304.4 | [AP] |
| 9 | Write a C++ program to implement Binary Search tree traversal using integer and Character. | C304.5 | [AP] |
| 10 | Write a C++ program to implement Breadth first traversal and Depth first traversal. | C304.5 | [A] |
| Total Hours | | | 75 |
| Text Books: | | | |
| 1 | E. Balagurusamy , “Object Oriented Programming with C++”, 6th Edition, Tata Mc Graw Hill Publication, 2013. | | |
| 2 | Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Third Edition, Addison-Wesley, 2007. | | |
| 3 | A. V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, 2009. | | |
| Reference Books: | | | |
| 1 | B. Trivedi, “Programming with ANSI C++”, Oxford University Press, 2007. | | |
| 2 | Rohit Khurana, “Object Oriented Programming with C++”, Vikas Publishing, 2edition, 2014. | | |
| 3 | Goodrich, Michael T., Roberto Tamassia, David Mount, “Data Structures and Algorithms in C++”, 7th Edition, Wiley. 2004. | | |
| 4 | Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, “Fundamentals of Data Structures in C++”, Galgotia Publications , 2007. | | |
| 5 | Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, “Data Structures using C and C++”, 2nd ed, Prentice- Hall of India, 2009. | | |
| Web References: | | | |
| 1 | https://www.geeksforgeeks.org/c-plus-plus/ | | |
| 2 | https://www.codezclub.com/cpp-solved-programs-problems-solutions/ | | |
| 3 | https://www.javatpoint.com/data-structure-tutorial | | |
| 4 | https://www.geeksforgeeks.org/data-structures/ | | |
| Online Resources: | | | |
| 1 | https://onlinecourses.swayam2.ac.in/cec22_cs19/preview | | |
| 2 | https://www.coursera.org/learn/data-structures#syllabus | | |

| Continuous Assessment | | | | | | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------|----------------------|----------------------|-----------|-------------|-----------------------------|--------------------------|-------|
| Theory | | | | Practical | | | Total (A+B) | Total Continuous Assessment | | |
| Formative Assessment | Summative Assessment | Total | Total (A) | Formative Assessment | Summative Assessment | Total (B) | | | | |
| 80 | 120 | 200 | 100 | 75 | 25 | 100 | 200 | 50 | 50 | 100 |

| Formative Assessment based on Capstone Model - Theory | | | |
|---|---------------|--|---------------------|
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (10%) [80 Marks] |
| C304.1 | Apply | Quiz and Assignment | 20 |
| C304.2 | Apply | Assignment | 20 |
| C304.3 | Understand | Case study | 20 |
| C304.4 | Apply | Group Assignment | 20 |
| C304.5 | Apply | | |

| Assessment based on Summative and End Semester Examination - Theory | | | |
|---|---|------------------|--|
| Bloom's Level | Summative Assessment (15%) [120 Marks] | | End Semester Examination (35%) [100 Marks] |
| | CIA1: (60 Marks) | CIA2: (60 Marks) | |
| Remember | 10 | 10 | 10 |
| Understand | 40 | 40 | 40 |
| Apply | 40 | 40 | 40 |
| Analyse | 10 | 10 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Assessment based on Continuous and End Semester Examination - Practical | | | |
| Bloom's Level | Continuous Assessment (25%) [100 Marks] | | End Semester Examination (15%) [100 Marks] |
| | FA: (75 Marks) | SA: (25 Marks) | |
| Remember | 10 | 10 | 10 |
| Understand | 30 | 30 | 30 |
| Apply | 40 | 40 | 40 |
| Analyse | 20 | 20 | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|------------------------|-------------------------|------------------|------------------------|-------------------------|----------------------------|--------------------------------|---|
| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
| CA 1 (100 Marks) | | | CA 2 (100 Marks) | | | Practical Exam (100 Marks) | | Theory Examination (35%) Practical Examination (15%) |
| SA 1 (60M) | FA 1 | | SA 2 (60M) | FA 2 | | FA (75M) | SA (25M) | |
| | Component-I (20 Marks) | Component-II (20 Marks) | | Component-I (20 Marks) | Component-II (20 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C304.1 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 2 | 3 | 2 | 2 |
| C304.2 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 2 | 3 | 2 | 2 |
| C304.3 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 2 | 3 | 2 | 2 |
| C304.4 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 2 | 3 | 2 | 2 |
| C3045 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 3 | 3 | 2 | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | | | |
|---|---|-------------------------------|--|------------|------|
| 21EE304 | Electrical Machines – I Laboratory | | | 0/0/2/1 | |
| Nature of Course | | M (Practical application) | | | |
| Pre-requisites | | Basics of Electrical Circuits | | | |
| Course Objectives: | | | | | |
| 1 | To determine the characteristics of DC machines by using simulation and experimental methods. | | | | |
| 2 | To know the performance characteristics of transformers based on various tests under no load, loading conditions, open circuit and short circuit conditions. | | | | |
| 3 | To analyse the equivalent circuit parameters of transformers. | | | | |
| Course Outcomes: | | | | | |
| Upon completion of the course, students shall have ability to | | | | | |
| C304.1 | Analyze the no load and load characteristics of DC Separately excited DC generator. | | | [A] | |
| C304.2 | Illustrate the mechanical and electrical characteristics of Shunt ,Series and Compound motor. | | | [U] | |
| C304.3 | Analyze the OCC characteristics of DC shunt generator using Simulation software. | | | [A] | |
| C304.4 | Sketch the equivalent circuit of Single phase Transformer and calculate the parameters of equivalent circuit. | | | [AP] | |
| C304.5 | Demonstrate the indirect method of testing of DC machine to determine its efficiency. | | | [AP] | |
| C304.6 | Analyze the different types of three phase transformer Connections. | | | [A] | |
| Course Contents: | | | | | |
| S.No | List of Experiments | | | CO Mapping | RBT |
| 1. | Analysis of open circuit characteristics of DC shunt generator using Simulation software. | | | C304.1 | [A] |
| 2. | Analysis of no-load and load characteristics of separately excited DC generator. | | | C304.2 | [A] |
| 3. | Determination of efficiency of DC machine through Hopkinson's Test. | | | C304.3 | [U] |
| 4. | Examine the effective efficiency and speed-torque characteristic of DC shunt motor, DC series motor. | | | C304.4 | [U] |
| 5. | Determination the load characteristics of DC compound motor. | | | C304.4 | [U] |
| 6. | Predetermination of Efficiency using Swinburne's test | | | C304.5 | [U] |
| 7. | Examine the Speed Control methods of DC shunt motor by following methods i) Field Control ii) Armature control iii) Voltage Control Method / Chopper based Control | | | C304.5 | [A] |
| 8. | Sketching of the equivalent circuit parameters of a single phase transformer. | | | C304.5 | [AP] |
| 9. | Testing of transformers using Sumpner's Test. | | | C304.6 | [AP] |
| 10. | Study of Scott Connection of Two Single phase Transformers. | | | C304.6 | [R] |
| 11. | Verification of Three phase Transformer connections. | | | C304.6 | [A] |
| 12. | Separation of No load losses in single phase transformers. | | | C304.6 | [U] |
| Total Hours | | | | 30 | |

| Text Books: | |
|------------------|---|
| 1 | Stephen J. Chapman, "Electric Machinery Fundamentals", Tata McGraw Hill International Edition, New Delhi, 5th Edition 2011. |
| 2 | Matthew N. O. Sadiku, "Elements of electromagnetics", Oxford University Press, 6 th Edition, 2007. |
| 3 | D.P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, 2010 |
| Reference Books: | |
| 1 | P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011 |
| 2 | J B Gupta, "Theory and Performance of Electrical machines", SK Kataria and sons, 2015 |
| 3 | A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013. |
| Web References: | |
| 1 | https://courses.lumenlearning.com/boundless-physics/chapter/magnetism-and-magnetic-fields/ |
| 2 | https://library.automationdirect.com/selecting-motors-industrial-applications/ |
| 3 | https://electrical-engineering-portal.com/erection-procedure-for-power-transformer |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 75 | 25 | 100 | 60 | 40 | 100 |

| Assessment based on Continuous and End Semester Examination | | | |
|---|--|------------------|--|
| Bloom's Level | Continuous Assessment (60%) [100 Marks] | | End Semester Practical Examination (40%) [100 Marks] |
| | FA (75 Marks) | SA (25 Marks) | |
| Remember | 0 | 0 | 0 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | 0 | 0 | 0 |
| Create | 20 | 20 | 20 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|-------------------|------|------|------|------|-----------------|-------|-------|-------|-------|-------|-------|
| C304.1 | 3 | 3 | 2 | 2 | | | 1 | 2 | 2 | 2 | | | 3 | | 3 |
| C304.2 | 3 | 2 | 1 | 1 | | | 1 | 2 | 2 | 2 | | | 3 | | 3 |
| C304.3 | 3 | 3 | 2 | 2 | 3 | | 1 | 2 | 2 | 2 | | | 3 | | 3 |
| C304.4 | 3 | 2 | 1 | 1 | | | 1 | 2 | 2 | 2 | | | 3 | | 3 |
| C304.5 | 3 | 2 | 1 | 1 | | | 1 | 2 | 2 | 2 | | | 3 | | 3 |
| C304.6 | 3 | 3 | 2 | 2 | | | 1 | 2 | 2 | 2 | | | 3 | | 3 |
| 1 | Reasonably Agreed | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | | | |

| | | | | | |
|---|---|--------------------------------------|--|------------|------|
| 21EE305 | Linear and Digital Integrated Circuits Laboratory | | | 0/0/2/1 | |
| Nature of Course | | M (Practical application) | | | |
| Pre-requisites | | Electric Circuit Analysis, Analog EI | | | |
| Course Objectives: | | | | | |
| 1 | To implement the basic circuits using op-amp and to implement the timer IC application. | | | | |
| 2 | To design and verify the output of Combinational circuits. | | | | |
| 3 | To design and verify the output of Synchronous Sequential circuits. | | | | |
| Course Outcomes: | | | | | |
| Upon completion of the course, students shall have ability to | | | | | |
| C305.1 | Implement the basic circuits using op-amp and the timer IC application | | | [AP] | |
| C305.2 | Verify the expressions using Boolean functions and to verify the Combinational circuits | | | [A] | |
| C305.3 | Design and verify the output of Synchronous Sequential circuits | | | [A] | |
| C305.4 | Design and verify the output of Asynchronous Sequential circuits | | | [A] | |
| Course Contents: | | | | | |
| S.No | List of Experiments | | | CO Mapping | BT |
| 1. | Implementation of Inverting and Non inverting Amplifier | | | C305.1 | [AP] |
| 2. | Integrator and Differentiator using op-amp. | | | C305.1 | [AP] |
| 3. | Astable and monostable multivibrators using 555 timers | | | C305.1 | [AP] |
| 4. | Realization of logical gates using NAND and NOR logic. | | | C305.2 | [A] |
| 5. | Design of Adder and Subtractor circuits. | | | C305.2 | [A] |
| 6. | Design of Code convertors. | | | C305.3 | [A] |
| 7. | Design of Encoders and Decoders using logic gates. | | | C305.3 | [A] |
| 8. | Design of Multiplexer and Demultiplexer using logic gates. | | | C305.3 | [A] |
| 9. | Design and implementation of synchronous counter using flipflops. | | | C305.4 | [A] |
| 10. | Design and implementation of shift registers using flipflops. | | | C305.4 | [AP] |
| Total Hours | | | | 30 | |
| Text Books: | | | | | |
| 1 | A.Anandkumar, 'Fundamental of Digital Circuits', PHI Learning Private Ltd, edition, 2014. | | | | |
| 2 | James M.Fiore, 'Opamps and Linear Integrated Circuits', Cengage Learning India Pvt Ltd, 1st edition, 2010. | | | | |
| Web References: | | | | | |
| 1 | http://www.electrical4u.com/digital-electronics.htm | | | | |
| 2 | http://www.technologystudent.com/elec1/dig1.htm | | | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|------------------------------|-----------------------------|--------------|------------------------------------|---------------------------------|--------------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 75 | 25 | 100 | 60 | 40 | 100 |

| Assessment based on Continuous and End Semester Examination | | | |
|---|--|------------------|--|
| Bloom's Level | Continuous Assessment (60%) [100 Marks] | | End Semester Practical Examination (40%) [100 Marks] |
| | FA (75 Marks) | SA (25 Marks) | |
| Remember | - | - | - |
| Understand | 10 | 10 | 10 |
| Apply | 60 | 60 | 60 |
| Analyse | 30 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Course Articulation Matrix (Laboratory) | | | | | | | | | | | | | | | |
|---|--------------------------|------|------|------|------|----------|--------------------------|------|------|-------|----------|------------------------|-------|-------|-------|
| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
| C305.1 | 2 | 1 | | | 3 | | | | | | | | 3 | 2 | |
| C305.2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | 2 | 3 | 3 | |
| C305.3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | 1 | 3 | 3 | |
| C305.4 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | 2 | 3 | 3 | |
| 1 | Reasonably agreed | | | | | 2 | Moderately agreed | | | | 3 | Strongly agreed | | | |

| | | | |
|--|--|------------------------|---------|
| 21MA403 | Applied Mathematics EEE | | 3/0/0/3 |
| Nature of Course | | J (Problem analytical) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To find the numerical solutions of large system of differential equations and interpolations of the given numerical data. | | |
| 2 | To study the concept of fitting a curve of best fit to the given numerical data and to calculate the deviation of the expected value from the observed value | | |
| 3 | To understand numerical methods when the huge amounts of data are given such as series of measurements to observations or some other empirical information | | |
| 4 | To give adequate exposure in applying numerical methods in predicting missing data | | |
| 5 | To study the basic probability concepts | | |
| 6 | To understand standard distributions which can be used to study digital signal processing and power system | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C403.1 | Recall the concepts of basic probability | | [R] |
| C403.2 | Fit a polynomial or special function curve for the given data | | [U] |
| C403.3 | Apply numerical methods to find the interpolation of numerical data. | | [AP] |
| C403.4 | Analyzes the numerical solution of the large system of differential equations | | [AP] |
| C403.5 | Apply the probability concept in protocol designing problems | | [AP] |
| C403.6 | Use distribution in analysis of power system | | [AP] |
| Course Contents: | | | |
| Module 1: Interpolation and Numerical Solution to ODE | | | 18 Hrs |
| Interpolation And Approximation - Lagrangian Polynomials-Divided differences -Newton's forward and backward difference formulas- Numerical Differentiation - Differentiation using Newton forward and Backward interpolation formulae - Numerical solution to first order ordinary differential equations: Single step methods: Taylor series method - Modified Euler's Method – Runge-Kutta Method of fourth order - Multistep method: Milne's Predictor- Corrector Method- Adam-Bashforth Predictor- Corrector Method. | | | |
| Module 2: Curve Fitting | | | 10 Hrs |
| Curve Fitting-Empirical laws -Linear law - Laws reducible to Linear law- Method of group averages - straight line and parabola -Principle of Least squares -Fitting straight line, parabola and exponential curve | | | |
| Module 3: Probability | | | 17 Hrs |
| Basic concepts-Addition and Multiplication law of probability – Conditional probability - Random Variable- One dimensional random variable Discrete and continuous random variables- moment generating functions -Simple problems - Probability mass function - Probability density function - Standard distributions-Discrete distributions -Binomial, Poisson, Geometric– Continuous distributions - Uniform, Exponential, Normal distributions. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Grewal B.S., —Numerical methods in Engineering and Science. 10th edition, Khanna Publishers, 2014. | | |
| 2 | Kreyszig. E, —Advanced Engineering Mathematics, tenth Edition, John Wiley and Sons (Asia) Limited, Singapore, 2014. | | |
| 3 | Gupta, S.C., & Kapoor, V.K., — Fundamentals of Mathematical Statistics, Sultan Chand & | | |

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| | sons, 2000, Reprint 2014. |
| 4 | Palaniammal.S., —Probability and Random Processes, Prentice hall of India, New Delhi, 2014, Reprint 2015 |
| Reference Books: | |
| 1 | Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012. |
| 2 | Jain M.K. Iyengar, K & Jain R.K., —Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers 2013. |
| 3 | Kandasamy.P, Thilagavathy, K, P. Gunavathy, —"Numerical Methods", 3rd edition, S.Chand and company Pvt.Ltd., 2013 |
| 4 | Peebles Jr.P.Z., —Probability Random Variables and Random signals principles, Tata McGraw- Hill Publishers, Fourth edition, New Delhi, 2002. |
| 5 | G. Jay Kerns, — "Introduction to Probability and Statistics Using R", Lulu Publishers First Edition, 2010. |
| Web References: | |
| 1 | https://nptel.ac.in/courses/111/106/111106101/ |
| 2 | http://nptel.ac.in/courses/112106064/ |
| 3 | http://nptel.ac.in/courses/111103070/ |
| Online Resources: | |
| 1 | https://ocw.mit.edu/courses/.../18-335j-introduction-to-numerical-methods |
| 2 | www.edx.org/Probability |
| 3 | https://ocw.mit.edu/courses/.../18-440-probability-and-random-variables-spring-2014/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|--|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
| C403.1 | Remember | Quiz | 20 |
| C403.2 | Understand | Seminar | 20 |
| C403.3 | Apply | Tutorial | 20 |
| C403.4 | Apply | | |
| C403.5 | Apply | Assignment | 20 |
| C403.6 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 30 | 30 | 30 |
| Apply | 50 | 50 | 50 |

| | | | |
|----------|---|---|---|
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C403.1 | 2 | 1 | 1 | 1 | | | | | | | | | 1 | | |
| C403.2 | 1 | 2 | 2 | 1 | | | | | | | | | 2 | | |
| C403.3 | 2 | 2 | 2 | 3 | | | | | | | | | 2 | | |
| C403.4 | 1 | 1 | 2 | 2 | | | | | | | | | 2 | | |
| C403.5 | 2 | 3 | 2 | 3 | | | | | | | | | 3 | | |
| C403.6 | 2 | 3 | 2 | 3 | | | | | | | | | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|--|---------|
| 21EE401 | Electrical Machines-II | | 3/0/0/3 |
| Nature of Course | G (Theory Analytical) | | |
| Course Pre-requisites | Electrical Machines - I | | |
| Course Objectives: | | | |
| 1 | To know the concepts of Rotating Magnetic Field. | | |
| 2 | To impart the knowledge of Synchronous and Induction Machines. | | |
| 3 | To analyze the performance of Synchronous and Induction Machines. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C401.1 | Illustrate the Construction and Operation of Salient and Non-Salient Pole Alternators and Synchronous Motors. | | [U] |
| C401.2 | Examine the Performance of Synchronous Machines by various Methods | | [A] |
| C401.3 | Interpret the Construction and Operation of Single and Three Phase Induction Motor. | | [U] |
| C401.4 | Analyze the Performance of Induction Machines by various Methods. | | [A] |
| C401.5 | Investigate the operation of various starters and speed Control methods of Induction Motor. | | [A] |
| Course Contents: | | | |
| Module 1: Synchronous Machines | | | 20 Hrs |
| Introduction - MMF distribution - Rotating Magnetic Field. Alternators: Constructional details- Principle of operation and types of Rotor- EMF equation- Armature reaction - Voltage regulation - EMF, MMF and ZPF- Two Reaction Theory - Synchronization and Synchronizing Power - Parallel operation. Synchronous motors: Starting methods, Phasor diagram, V and Inverted - V Curves, Hunting and its suppression, Effect of change in Excitation, Synchronous Condenser. | | | |
| Module 2: Induction Machines | | | 15 Hrs |
| Three phase induction motors: Constructional details - Principle of operation and types of Rotor - Slip - Starting and Maximum torque - Slip-Torque Characteristics, No Load and Blocked Rotor test - Equivalent Circuit- Circle Diagram - Crawling and Cogging. | | | |
| Single- Phase Induction Motors: Constructional details - Principle of Operation and types - Double Field Revolving Theory - Equivalent Circuit and its applications. | | | |
| Module 3: Starting and Speed Control Methods of Induction Motors | | | 10 Hrs |
| Need for Starting - Types of Starters - Rotor Resistance, Star- Delta, Autotransformer and Soft Starters, Speed control - Change of Voltage, Frequency, Number of Poles, V/F Control - Braking Methods, Case study on Industry based Soft Starters. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5 th Edition, 2017. | | |
| 2 | A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013. | | |
| 3 | P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011. | | |
| Reference Books: | | | |
| 1 | P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley and Sons, Third Edition, 2013. | | |
| 2 | M.G. Say, "Alternating Current Machines", Pitman Publishing Ltd., 4 th edition, 2013. | | |
| 3 | A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 2010. | | |
| Web References: | | | |
| 1 | http://nptel.ac.in/syllabus/syllabus.php?subjectId=108105018 | | |
| 2 | http://freevidelectures.com/Course/2335/Basic-Electrical-Technology/23 | | |
| 3 | https://www.electrical4u.com/deep-bar-double-cage-induction-motor/ | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
|----------------|---------------|--|---------------------|
| C401.1 | Understand | Quiz | 20 |
| C401.2 | Analyze | Tutorial | 20 |
| C401.3 | Understand | Group Assignment | 20 |
| C401.4 | Analyze | | |
| C401.5 | Analyze | Presentation | 20 |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 30 | 30 | 30 |
| Apply | 20 | 20 | 20 |
| Analyse | 30 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C401.1 | 2 | 1 | | | | | | | 2 | | | 1 | 3 | | 3 |
| C401.2 | 3 | 3 | 2 | 2 | | | | | 2 | | | 1 | 3 | | 3 |
| C401.3 | 2 | 1 | | | | | | | 2 | 2 | | 1 | 3 | | 3 |
| C401.4 | 3 | 3 | 2 | 2 | | | | | 2 | | | 1 | 3 | | 3 |
| C401.5 | 2 | 1 | | | | | | | 2 | 2 | | 1 | 3 | | 3 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|--------|---------|
| 21EE402 | Generation, Transmission and Distribution | | 3/0/0/3 |
| Nature of Course | G (Theory Analytical) | | |
| Course Pre-requisites | Basics of Electrical Circuits | | |
| Course Objectives: | | | |
| 1 | To introduce the basic concepts of boiler cycles, Generation of power. | | |
| 2 | To enable the students to understand the calculation of transmission line parameter for different conductors. | | |
| 3 | To analyze the concepts of modelling, corona loss, efficiency of transmission line. | | |
| 4 | To realize substation, distribution system. | | |
| 5 | To learn selection of cables and insulators in power system network. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C402.1 | Analyze the concepts of Rankine cycle, Brayton cycle, Conventional generating stations. | [A] | |
| C402.2 | Estimate electrical circuit parameters and its losses in transmission line. | [A] | |
| C402.3 | Evaluate the modelling concepts of the electrical circuit parameters, Sag calculations. | [A] | |
| C402.4 | Illustrate the concept of DC distribution, Feeders, Substation layouts. | [U] | |
| C402.5 | Interpret the overhead line insulators and underground cables. | [AP] | |
| Course Contents: | | | |
| Module 1: Generation of Electric Power | | 15 Hrs | |
| Basic Rankine cycle and its modifications - Brayton cycle analysis and optimization - Layout of Modern coal power plant - Hydro Electric Power Plants - classification, typical layout, components - Nuclear power plants - Layout, subsystem, types of reactors, safety waste disposal for nuclear power plants. | | | |
| Module 2: Line Parameters, Modelling and Performance of Transmission Lines | | 18 Hrs | |
| Resistance, Inductance, Capacitance of single phase and three phase lines - symmetrical and unsymmetrical spacing - solid and bundled conductors - Effect of earth on capacitance - Introduction to transmission loss - Ferranti effect - Corona loss - Modelling of Medium and long transmission lines – efficiency, regulation - Mechanical design of transmission lines - Sag Calculation. | | | |
| Module 3: Substations, DC Distribution System, Insulators and Underground Cables | | 12 Hrs | |
| Introduction to DC distribution system - losses, Substation layout - Radial and Ring systems - Selection of Feeders and Distributors - Modern Insulators - types, string efficiency - Selection of cables - rating of cables, construction and types of cables, XLPE cable, capacitance grading, sheath loss. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | B. R. Gupta, “Generation of Electrical Energy”, S.Chand Publication, 2019. | | |
| 2 | Leonard.L. Grigsby, Electric Power Generation, Transmission and distribution, 3 rd Edition, CRC Press, 2020. | | |
| 3 | C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, 3 rd Edition, New Age International, 2019. | | |
| Reference Books: | | | |
| 1 | V.K. Mehta, Principles of Power System, S. Chand Publication, 2011. | | |
| 2 | A. S. Pabla, Electric Power Distribution, Mc Graw Hill International Edition, 2012. | | |
| 3 | S.N. Singh, Electric Power Generation, Transmission and Distribution, 2 nd Edition, Prentice-Hall of India Private Limited, New Delhi, 2011. | | |
| Web References: | | | |
| 1 | https://nptel.ac.in/courses/108105058/8 | | |

| | |
|---|---|
| 2 | http://indianpowersector.com/home/power-station/thermal-power-plant/ |
| 3 | www.altenergy.org/renewables/renewables.html |
| 4 | https://www.edx.org/course/smart-grids-electricity-future-ieee-smartgrid-x-0 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
|----------------|---------------|--|---------------------|
| C402.1 | Analyze | Quiz | 20 |
| C402.2 | Analyze | Class Presentation | 20 |
| C402.3 | Analyze | Assignment | 20 |
| C402.4 | Understand | | |
| C402.5 | Apply | Case Study | 20 |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|------|----------|--------------------------|------|------|-------|----------|------------------------|-------|-------|-------|
| C402.1 | 3 | 2 | 1 | 1 | 2 | | | | 1 | | | | 2 | | |
| C402.2 | 3 | 2 | 1 | 1 | 2 | | | | 1 | | | | 2 | | |
| C402.3 | 3 | 3 | 2 | 2 | 3 | | | | 1 | | | | 3 | | |
| C402.4 | 3 | 3 | 2 | 2 | 3 | 1 | | | 1 | 1 | | | 3 | | |
| C402.5 | 3 | 2 | 1 | 1 | 2 | 1 | | | 1 | 2 | | | 3 | | |
| 1 | Reasonably Agreed | | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|----------------------------------|---------|
| 21EE403 | Control Systems | | 3/1/0/4 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | Transforms and Numerical Methods | |
| Course Objectives: | | | |
| 1 | To understand the methods of systems representation and to derive their transfer function models. | | |
| 2 | To provide an adequate knowledge of systems in time domain and its stability analysis. | | |
| 3 | To accord basic knowledge in obtaining the open loop and closed loop frequency responses of systems. | | |
| 4 | To introduce the design of controllers and compensators | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C403.1 | Construct the mathematical models of various control systems and obtain the transfer function of a system. | | [AP] |
| C403.2 | Analyze the first and second order systems in time domain and frequency domain. | | [A] |
| C403.3 | Analyze the frequency responses using Bode Plot and Polar plot and examine the stability of the control systems using Root locus, Routh-Hurwitz Criteria methods. | | [A] |
| C403.4 | Design and realize the controllers and compensators. | | [C] |
| C403.5 | Calculate the controllers and compensators of the system and to apply basic concepts of discrete system. | | [AP] |
| Course Contents: | | | |
| Module 1: System Modelling | | | 15 Hrs |
| Basic elements of control systems - Open loop and closed loop systems - Transfer function modelling: Electrical systems and Mechanical system - Translational, Rotational - signal flow graph. | | | |
| Module 2: Time and Frequency Response Analysis | | | 20 Hrs |
| Time domain specifications - Types of test signals - First order system response - Step, Ramp, Impulse - Second Order System Response - Step input - Steady state error - Generalized error coefficients - Concept of stability - Routh Hurwitz criterion - Root locus technique - Frequency domain specifications - Bode plot - Polar plot - Gain margin and Phase margin. | | | |
| Module 3: Controllers and Compensators | | | 25 Hrs |
| Controllers: Design of P, PI and PID controllers - Compensators: Introduction to lag, lead and lag-lead networks - Lag compensator design using Bode plot - Controllability and Observability - Introduction to Digital Control Systems: Basic Elements of discrete data control systems, advantages of discrete data control systems. | | | |
| Total Hours | | | 60 |
| Text Books: | | | |
| 1 | I. J. Nagrath and M. Gopal, „Control Systems Engineering,, 6 th Edition, New Age International Publishers, 2017. | | |
| 2 | Katsuhiko Ogata, „Modern Control Engineering“, 5 th edition, Pearson, New Delhi, 2015. | | |
| 3 | Farid Golnaraghi and Benjamin C. Kuo, „Automatic Control systems“, 9 th Edition, Wiley, 2014. | | |
| Reference Books: | | | |
| 1 | Norman S. Nise, „Control Systems Engineering“, Wiley, New Delhi, 2018. | | |
| 2 | Richard Poley, „Control Theory Fundamentals“, 2 nd Edition, Createspace, 2014. | | |
| 3 | Richard C. Dorf, Robert H. Bishop, „Modern Control Engineering“, 13 th Edition, Pearson Education, New Delhi, 2016. | | |
| 4 | A. Nagoorkani, „Control Systems Engineering“, RBA Publications 2014. | | |

| Web References: | |
|-----------------|---|
| 1 | http://www.nptel.ac.in/courses/108101037/ |
| 2 | https://nptel.ac.in/courses/108101037/14 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|--|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
| C403.1 | Apply | Quiz | 20 |
| C403.2 | Analyze | Class Presentation | 20 |
| C403.3 | Analyze | Assignment | 20 |
| C403.4 | Create | | |
| C403.5 | Apply | Case Study | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C403.1 | 3 | 2 | 1 | 1 | | | | | | 1 | | 2 | 3 | | |
| C403.2 | 3 | 3 | 2 | 2 | | | | | | 1 | | 2 | 3 | | |
| C403.3 | 3 | 3 | 2 | 2 | | | | | | | | 1 | 3 | | |
| C403.4 | 3 | 3 | 3 | 3 | 3 | | | 1 | 2 | 1 | | 3 | 3 | | 1 |
| C403.5 | 3 | 2 | 1 | 1 | | | | | | | | 2 | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|--------|---------|
| 21IT301 | Web Development using React | | 3/0/2/4 |
| Nature of Course | F (Theory programming) | | |
| Course Pre-requisites | Nil | | |
| Course Objectives: | | | |
| 1 | To discuss the essence of front-end development skills. | | |
| 2 | Ability to understand and use JavaScript in client-side web applications. | | |
| 3 | To impart the knowledge of React components used in web application development platforms. | | |
| 4 | To deploy and test the React App used in Web Applications. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C301.1 | Demonstrate the client-side JavaScript application development and the React library. | | [U] |
| C301.2 | Illustrate the single page applications in React. | | [U] |
| C301.3 | Utilize the various React features including components and forms. | | [AP] |
| C301.4 | Show the functionality of front-end UI applications using React. | | [R] |
| C301.5 | Apply CSS for designing responsive React applications. | | [AP] |
| C301.6 | Identify the use Redux-Redux and Axios package. | | [AP] |
| Course Contents: | | | |
| Module - I: | | 15 Hrs | |
| JavaScript Essentials, How JavaScript works, Event loop, Stack, Heap and Queue, Node.js Fundamentals, Introduction to Node.js, Why Node.js?, Traditional Programming Limitations, React Introduction, Overview of frameworks, libraries for client side Web applications, Understanding “what” and “why” React, React Component Demonstration using code pen, Environment Setup for React Application. Understanding NPM commands, Using VS Code, VS Code extensions for ES6, React(formatting and check styles), Hello world app in React, React Essential Features and Syntax, React App Project Directory Structure, Overview of Webpack, Babel, React Component Basic, Create React Component, Understanding JSX, Limitations of JSX, Working with Components and Reusing Components. | | | |
| Module - II: | | 15 Hrs | |
| React Components - Props and State, Understanding and using Props and State, Handling Events with methods, Manipulating the State, Two way data-binding, Functional (Stateless) VS Class (Stateful) Components, Parent – Child Communication, Dynamically rendering contents, Showing Lists, List and keys, Styling Components, CSS Styling, Scoping Styles using Inline Styles, Limitations of inline styles, Inline Styles with Radium, Google Material UI, Installing Material UI, Material UI AppBar, Material UI's Toolbar, Custom React NavBar. CSS - Material UI Buttons, Using Material UI - Rendering a Button, Material UI Card, Material UI Checkbox, Material UI Grid Component, Material UI IconButton, Material UI Paper Component, Style Material UI Components with my own CSS, UI Templates for Business, Typography Usage, Debugging React Apps, Understanding React Error Messages, Handling Logical Errors, Debugging React apps using google developer tools and React DevTool. Understanding Error Boundaries, React Component life cycle, Updating life cycle hooks, Pure Components, React’s DOM Updating Strategy, Returning adjacent elements, Fragments, React Component in Details, Higher Order Components, Passing unknown Props, Validating Props, Using References, React Context API, Updated LifeCycle hooks (16.3) | | | |
| Module – III: | | 15 Hrs | |
| React Projects, Demo apps, HTTP Requests/Ajax Calls, HTTP Requests in React, Introduction of Axios package, HTTP GET Request, fetching & transforming data, HTTP POST, DELETE, UPDATE, Handling Errors, Adding/Removing Interceptors, Creating/Using | | | |

Axios instances, Redux, React Thunk, Difference between Thunk& other, React hooks, Application Using React & Redux , React Routing, Routing and SPAs, Setting Up the Router Package, react-router vs react-router-dom, Preparing the Project For Routing, Switching Between Pages. Routing-Related Props, The "withRouter" HOC & Route Props, Passing & extracting route/query parameters, Using Switch to Load a Single Route, Navigating Programmatically. React Forms and Form Validation, Creating a Custom Dynamic Input Component, Setting Up a JS Config for the Form, Dynamically Create Inputs based on JS Config, Adding a Dropdown Component. Handling User Input, Handling Form Submission, Adding Custom Form Validation, Fixing a Common Validation, Adding Validation Feedback, Showing Error Messages, Handling Overall Form Validity, Deploying React App to the Web, Testing React apps with Jasmine & implementing JEST.

Lab Component

| S.No | List of Experiments | CO Mapping | BT |
|--------------------|---|------------|-----------|
| 1 | Create a Stateless Functional Component | C301.1 | [AP] |
| 2 | Create a Stateful Class Component | C301.1 | [AP] |
| 3 | Implementation of Conditional Rendering using Class Component | C301.2 | [AP] |
| 4 | Implementation of Communication (Parent-child) between Components | C301.2 | [AP] |
| 5 | Create material UI Card using React | C301.3 | [AP] |
| 6 | Design a Custom Navigation bar using React | C301.3 | [AP] |
| 7 | Implementation of React component to handle HTTP requests | C301.4 | [AP] |
| 8 | Implementation of a Dropdown component using React | C301.4 | [AP] |
| 9 | Implementation of Routing in React | C301.5 | [AP] |
| 10 | Implementation of FORM validation in React | C301.6 | [AP] |
| Total Hours | | | 75 |

Text Books:

| | |
|---|---|
| 1 | Robin Wieruch , "The Road to React", 2022 Kindle Edition. |
| 2 | Alex Banks,Eve Porcello. "Learning React: Modern Patterns for Developing React Apps",O'Reilly Media,2020. |
| 3 | Adam Bouch, "React and React Native",Packt Publishing,3 rd Edition, 2020. |
| 4 | KirupaChinnathambi , "Learning React : A Hands-On Guide to Building Web Applications Using React and Redux",Pearson Education, Second Edition,2018. |

Reference Books:

| | |
|---|---|
| 1 | Adam Boduch, Roy Derks "React and React Native: A Complete Hands-on Guide to Modern Web and Mobile Development with React.js",Packt Publishing, 2020. |
| 2 | Carlos Santana Roldan, "React Cookbook",Packt Publishing,2018. |
| 3 | Lionel Lopez, "React: Quickstart Step-by-step Guide to Learning React Javascript Library (React.js, Reactjs, Learning React Js, React Javascript, React Programming)",CreateSpace Independent Publishing Platform,2017. |

Web References:

| | |
|---|---|
| 1 | https://www.coursera.org/learn/front-end-react |
| 2 | https://www.geeksforgeeks.org/full-stack-development-with-react-node-js-live/ |
| 3 | https://www.edx.org/learn/front-end-web-development |
| 4 | https://www.w3schools.com/REACT/DEFAULT.ASP |

Online Resources:

| | |
|---|---|
| 1 | https://reactjs.org/ |
| 2 | https://www.youtube.com/watch?v=3HMtarQAt3A |

| Continuous Assessment | | | | | | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------|----------------------|----------------------|-----------|-------------|-----------------------------|--------------------------|-------|
| Theory | | | | Practical | | | Total (A+B) | Total Continuous Assessment | | |
| Formative Assessment | Summative Assessment | Total | Total (A) | Formative Assessment | Summative Assessment | Total (B) | | | | |
| 80 | 120 | 200 | 100 | 75 | 25 | 100 | 200 | 50 | 50 | 100 |

| Formative Assessment based on Capstone Model – Theory | | | |
|---|---------------|--|---------------------|
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (10%) [80 Marks] |
| C301.1 | Understand | Assignment I | 20 |
| C301.2 | Understand | Quiz | 20 |
| C301.3 | Apply | Assignment II | 20 |
| C301.4 | Remember | | |
| C301.5 | Apply | Case study | 20 |
| C301.6 | Apply | | |

| Assessment based on Summative and End Semester Examination – Theory | | | |
|---|---|------------------|--|
| Bloom's Level | Summative Assessment (15%) [120 Marks] | | End Semester Examination (35%) [100 Marks] |
| | CIA1: (60 Marks) | CIA2: (60 Marks) | |
| Remember | 20 | 10 | 10 |
| Understand | 10 | 10 | 15 |
| Apply | 70 | 80 | 75 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |
| Assessment based on Continuous and End Semester Examination - Practical | | | |
| Bloom's Level | Continuous Assessment (25%) [100 Marks] | | End Semester Examination (15%) [100 Marks] |
| | FA: (75 Marks) | SA: (25 Marks) | |
| Remember | 10 | 10 | 10 |
| Understand | 20 | 10 | 10 |
| Apply | 70 | 80 | 80 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|------------------------|-------------------------|------------------|------------------------|-------------------------|----------------------------|--------------------------------|---|
| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
| CA 1 (100 Marks) | | | CA 2 (100 Marks) | | | Practical Exam (100 Marks) | | Theory Examination (35%) Practical Examination (15%) |
| SA 1 (60M) | FA 1 | | SA 2 (60M) | FA 2 | | FA (75M) | SA (25M) | |
| | Component-I (20 Marks) | Component-II (20 Marks) | | Component-I (20 Marks) | Component-II (20 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|------|
| C301.1 | 3 | 3 | 3 | 2 | 2 | | | | 2 | 2 | 2 | 2 | 3 | 3 | 2 |
| C301.2 | 3 | 3 | 3 | 2 | 2 | | | | 2 | 2 | 2 | 2 | 3 | 2 | 3 |
| C301.3 | 3 | 3 | 3 | 3 | 2 | | | | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| C301.4 | 3 | 3 | 3 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| C301.5 | 3 | 3 | 3 | 2 | 3 | | | | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| C301.6 | 3 | 3 | 3 | 2 | 3 | | | | 3 | 2 | 3 | 2 | 2 | 2 | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|------------------------|---------|
| 21CS302 | Java Programming | | 3/0/2/4 |
| Nature of Course | | F (Theory Programming) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To learn the object oriented concepts using java programming | | |
| 2 | To analyze the types of constructor, inheritance and polymorphism | | |
| 3 | To apply the concepts of package, abstract class and interface | | |
| 4 | To apply the concepts of exception handling mechanisms in real time problems | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C302.1 | Construct the Java programs using class, access modifiers, condition and looping statements | [AP] | |
| C302.2 | Implement the java programs using string class, files and serialization concepts | [AP] | |
| C302.3 | Develop the programs using object oriented concepts such as inheritance, abstraction, interface and packages | [AP] | |
| C302.4 | Classify the usage of different keywords based on its functionality and use the concepts of association, composition and aggregation for programming | [A] | |
| C302.5 | Construct the program using polymorphism and exception handling mechanisms to solve real time problems. | [AP] | |
| Course Contents: | | | |
| Course Contents: | | | |
| Module I15 Hrs | | | |
| Identifiers & JavaBeans, Legal Identifiers, Sun's Java Code Conventions, JavaBeans Standards, Declare Classes, Source File Declaration Rules, Class Declarations and Modifiers, Concrete Subclass, Declaring an Interface, Declaring Interface Constants, Declare Class Members, Access Modifiers, Nonaccess Member Modifiers, Constructor Declarations, Variable Declarations, Declaring Enums. An Overview of the Wrapper Classes, Creating Wrapper Objects, Using Wrapper Conversion Utilities ,Autoboxing. if and switch Statements, if-else Branching, switch Statements, Loops and Iterators, using while Loops, Using do Loops, Using for Loops, using break and continue, Unlabelled Statements, Labelled Statements. | | | |
| Module II15 Hrs | | | |
| String, StringBuilder, and StringBuffer, The String Class, Important Facts About Strings and Memory, Important Methods in the String Class, The StringBuffer and StringBuilder Classes, Important Methods in the StringBuffer and StringBuilder Classes, File Navigation and I/O, Types of Streams,The Byte-stream I/O hierarchy, Character Stream Hierarchy, Random Access File class, The java.io.Console Class, Serialization, Dates, Numbers, and Currency, Working with Dates, Numbers,and Currencies, Parsing, Tokenizing, and Formatting, Locating Data via Pattern Matching,Tokenizing.Class and Object, Encapsulation and Abstraction, Inheritance, Polymorphism, Message Passing, ClassSyntax, Access Modifiers, class, class Name, extends, implements keywords, Possible, syntaxes ofClasses, Procedure to use classes in Java, Internal flow in Class Utilization, More than one class inSingle Java Appl, Concrete Methods Vs Abstract Methods. Abstract Classes, Interfaces, MethodSyntax. | | | |
| Module III15 Hrs | | | |
| User defined Immutable Class, Object and Instance Constructors : Introduction, Default | | | |

Constructor, User Defined Constructors, Constructor Overloading, Instance Block and Instance Flow of Execution, 'this' keyword, 'static' keyword, Class.forName() method internal functionality, newInstance() method internal functionality, Utilizations of Class.forName() and newInstance() methods, Factory Methods, Singleton classes, final keyword, 'public static final' Convention for constant variables, enum keyword, main() method, Introduction To Relationships, Association, Composition and Aggregation. Inheritance: Introduction, Types of Inheritance, Static Context in Inheritance, Instance Context in Inheritance, Method Overloading, Rules and Regulations for Method Overriding, Abstract Methods and Abstract classes Introduction, Concrete Method and Abstract Method, Concrete class and Abstract Class, Abstract Class, Interfaces, Syntaxes between classes, abstract classes and Interfaces. Exception - Call Stack Mechanism the try catch block, The Finally Block, Exception Hierarchy, Multiple Exceptions In a Catch Block, Parameterized Try Block, Overriding Methods And Exception. Creating Your Own Exception, The Assert Keyword.

Lab Component

| S.No | List of Experiments | CO Mapping | BT |
|--------------------|--|------------|-----------|
| 1 | Write a Java program to demonstrate the Methods, Classes and Constructors. | C302.1 | [AP] |
| 2 | Write a Java program to demonstrate String concepts. | C302.1 | [AP] |
| 3 | Write a Java program to implement the Inheritance concepts. | C302.2 | [AP] |
| 4 | Write a Java program to implement the Polymorphism. | C302.2 | [AP] |
| 5 | Write a Java program to implement the abstract Class and interfaces. | C302.2 | [AP] |
| 6 | Write a Java program to demonstrate the concept of File handling. | C302.2 | [AP] |
| 7 | Write a Java program to demonstrate serialization. | C302.3 | [AP] |
| 8 | Write a Java program to demonstrate the Java Packages. | C302.3 | [AP] |
| 9 | Write a Java program to implement Exception Handling Mechanism. | C302.5 | [AP] |
| Total Hours | | | 75 |

Text Books:

| | |
|---|---|
| 1 | Herbert Schildt, "Java: The Complete Reference", 11th Edition, Oracle Press, 2021 |
| 2 | Paul Deitel, Harvey Deitel, "Java How to Program, Late Objects", 11th Edition, Pearson Education, 2018. |

Reference Books:

| | |
|---|--|
| 1 | Cay S. Horstmann, "Core Java Volume I—Fundamentals", 11th Edition, Pearson Education, 2020. |
| 2 | Y. Daniel Liang, "Introduction to Java Programming", 9th Edition, Prentice Hall Publications, 2015. |
| 3 | Robert W Sebesta, "Programming the World Wide Web", 7th Edition, Pearson Education Inc., 2014. |
| 4 | Steven Holzner, "Java 2 Black book", Dreamtech Press, 2011. |
| 5 | Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000. |

Web References:

| | |
|----|---|
| 1. | https://docs.oracle.com/javase/tutorial/ |
| 2. | https://onlinecourses.nptel.ac.in/noc20_cs58/preview |
| 3. | http://www.javatpoint.com |
| 4. | https://www.geeksforgeeks.org/functional-programming-in-java-with-examples/ |

| Online Resources: | |
|-------------------|---|
| 1. | https://www.coursera.org/learn/object-oriented-java |
| 2. | https://www.coursera.org/specializations/java-object-oriented |

| Continuous Assessment | | | | | | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------|----------------------|----------------------|-----------|-------------|-----------------------------|--------------------------|-------|
| Theory | | | | Practical | | | Total (A+B) | Total Continuous Assessment | | |
| Formative Assessment | Summative Assessment | Total | Total (A) | Formative Assessment | Summative Assessment | Total (B) | | | | |
| 80 | 120 | 200 | 100 | 75 | 25 | 100 | 200 | 50 | 50 | 100 |

| Formative Assessment based on Capstone Model - Theory | | | |
|---|---|--|--|
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (10%) [80 Marks] |
| C302.1 | Apply | Quiz | 20 |
| C302.2 | Apply | Assignment | 20 |
| C302.3 | Apply | Case study | 20 |
| C302.4 | Analyze | Group Assignment | 20 |
| C302.5 | Apply | | |
| Assessment based on Summative and End Semester Examination - Theory | | | |
| Bloom's Level | Summative Assessment (15%) [120 Marks] | | End Semester Examination (35%) [100 Marks] |
| | CIA1: (60 Marks) | CIA2: (60 Marks) | |
| Remember | 10 | 10 | 10 |
| Understand | 40 | 40 | 40 |
| Apply | 40 | 40 | 40 |
| Analyse | 10 | 10 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Assessment based on Continuous and End Semester Examination - Practical | | | |
| Bloom's Level | Continuous Assessment (25%) [100 Marks] | | End Semester Examination (15%) [100 Marks] |
| | FA: (75 Marks) | SA: (25 Marks) | |
| Remember | 10 | 10 | 10 |
| Understand | 30 | 30 | 30 |
| Apply | 40 | 40 | 40 |
| Analyse | 20 | 20 | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|---------------------------|----------------------------|---------------------|---------------------------|----------------------------|-------------------------------|--------------------------------|---|
| Continuous Assessment (50%) | | | | | | | End Semester Examination (50%) | |
| CA 1 (100 Marks) | | | CA 2 (100 Marks) | | | Practical Exam (100 Marks) | | Theory Examination (35%) Practical Examination (15%) |
| SA 1 (60M) | FA 1 | | SA 2 (60M) | FA 2 | | FA (75M) | SA (25M) | |
| | Component-I (20 Marks) | Component-II (20 Marks) | | Component-I (20 Marks) | Component-II (20 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C302.1 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 2 | 3 | 2 | 2 |
| C302.2 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 2 | 3 | 2 | 2 |
| C302.3 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 2 | 3 | 2 | 2 |
| C302.4 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 2 | 3 | 2 | 2 |
| C302.5 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 3 | 3 | 2 | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | | |
|---|---|------------------------------------|------------|---------|
| 21EE404 | Electrical Machines - II Laboratory | | | 0/0/2/1 |
| Nature of Course | | M (Practical Application) | | |
| Pre-requisites | | Electrical Machines - I Laboratory | | |
| Course Objectives: | | | | |
| 1 | To expose the operation of Synchronous and Induction Machines and give them experimental skills. | | | |
| Course Outcomes: | | | | |
| Upon completion of the course, students shall have ability to | | | | |
| C404.1 | Interpret the performance of Synchronous Generator by conducting various tests. | | | [AP] |
| C404.2 | Examine the characteristics of V and inverted V curves in Synchronous Motor. | | | [A] |
| C404.3 | Analyze the performance of Induction Machines. | | | [A] |
| C404.4 | Investigate the performance of Induction Machines. | | | [A] |
| C404.5 | Demonstrate the braking operation of an Induction Machine. | | | [AP] |
| Course Contents: | | | | |
| S.No | List of Experiments | | CO Mapping | BT |
| 1. | Performance characteristics of Three Phase Alternator by direct loading. | | C404.1 | [AP] |
| 2. | Regulation of Three Phase Alternator by EMF method. | | C404.1 | [AP] |
| 3. | Regulation of Three Phase Alternator by MMF method. | | C404.1 | [AP] |
| 4. | Regulation of Three Phase Alternator by ZPF method. | | C404.1 | [AP] |
| 5. | Regulation of Three Phase Salient Pole Alternator by Slip test. | | C404.1 | [A] |
| 6. | V and Inverted V curves of Three Phase Synchronous Motor. | | C404.2 | [A] |
| 7. | Load test on Single and Three Phase Induction Motor. | | C404.3 | [A] |
| 8. | No Load and Blocked Rotor tests on Single Phase and Three Phase Induction Motor (Determination of Equivalent Circuit parameters). | | C404.3 | [A] |
| 9. | Performance characteristics of Single Phase and Three Phase Induction Motors using Simulation. | | C404.4 | [AP] |
| 10. | Braking test of Three Phase Induction Motor. | | C404.5 | [AP] |
| Total Hours | | | 30 | |
| Text Books: | | | | |
| 1 | I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education 5 th Edition, 2017. | | | |
| 2 | A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013. | | | |
| 3 | P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011. | | | |
| Reference Books: | | | | |
| 1 | P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley and Sons, Third Edition, 2013. | | | |
| 2 | M.G. Say, "Alternating Current Machines", Pitman Publishing Ltd., 4 th edition, 2013. | | | |
| 3 | A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 2010. | | | |
| Web References: | | | | |
| 1 | http://nptel.ac.in/syllabus/syllabus.php?subjectId=108105018 | | | |
| 2 | http://freevideolectures.com/Course/2335/Basic-Electrical-Technology/23 | | | |
| 3 | https://www.electrical4u.com/deep-bar-double-cage-induction-motor/ | | | |
| 4 | https://www.youtube.com/watch?v=b24jORRoxEc | | | |
| 5 | http://www.engineeringmatters.com/EngineeringMatters_Project_Maglev.pdf | | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 75 | 25 | 100 | 60 | 40 | 100 |

| Assessment based on Continuous and End Semester Examination | | | |
|---|--|------------------|--|
| Bloom's Level | Continuous Assessment (60%) [100 Marks] | | End Semester Practical Examination (40%) [100 Marks] |
| | FA (75 Marks) | SA (25 Marks) | |
| Remember | 10 | 10 | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 40 | 40 | 40 |
| Evaluate | 0 | 0 | 0 |
| Create | 0 | 0 | 0 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C404.1 | 2 | 1 | | | | | | | 2 | | | 1 | 3 | | 3 |
| C404.2 | 2 | 1 | | | | | | | 2 | | | 1 | 3 | | 3 |
| C404.3 | 2 | 3 | 2 | 2 | | | | | 2 | | | 1 | 3 | | 3 |
| C404.4 | 2 | 1 | | | 3 | | | | 2 | | | 1 | 3 | | 3 |
| C404.5 | 3 | 2 | 1 | 1 | | | | | 2 | | | 1 | 3 | | 3 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | | |
|---|---|---------------------------|------------|---------|
| 21EE405 | Control Systems Laboratory | | | 0/0/2/1 |
| Nature of Course | | M (Practical application) | | |
| Pre-requisites | | Control Systems | | |
| Course Objectives: | | | | |
| 1 | To enable the students to strengthen their understanding of the design and analysis of control systems using modern software resources. | | | |
| Course Outcomes: | | | | |
| Upon completion of the course, students shall have ability to | | | | |
| C405.1 | Construct the transfer function a DC separately excited generator and obtain its characteristics | | | [AP] |
| C405.2 | Construct the transfer function of the given DC Motor for Armature controlled and Field controlled cases | | | [AP] |
| C405.3 | Demonstrate Servo and stepper motor System also to set up a closed loop position control system and study the system performance. | | | [U] |
| C405.4 | Analyze the time response and stability of first and second order Systems | | | [A] |
| C405.5 | Design a Controllers and lag compensator for uncompensated system using simulation software | | | [A] |
| Course Contents: | | | | |
| S.No | List of Experiments | | CO Mapping | BT |
| 1 | Determination of transfer function of separately excited DC Generator | | C405.1 | [AP] |
| 2 | Determination of transfer function of Armature Controlled DC Motor | | C405.2 | [AP] |
| 3 | Determination of transfer function of Field Controlled DC Motor | | C405.2 | [AP] |
| 4 | Servo motor position control systems | | C405.3 | [U] |
| 5 | Stepper motor position control systems | | C405.3 | [U] |
| 6 | Simulation of first and Second order system for different test inputs | | C405.4 | [A] |
| 7 | Time response analysis for a second order system using simulation software | | C405.4 | [A] |
| 8 | Stability analysis of linear systems using digital simulation software | | C405.4 | [A] |
| 9 | Design of P, PI, PD and PID controllers for type-0 and type-1 system using | | C405.5 | [A] |
| 10 | Design of lag, lead and lag-lead compensator for uncompensated system usingsimulation software. | | C405.5 | [A] |
| Total Hours | | | 30 | |
| Text Books: | | | | |
| 1 | I. J. Nagrath and M. Gopal, "Control Systems Engineering", 6 th Edition, New Age International Publishers, 2017 | | | |
| 2 | Katsuhiko Ogata, "Modern Control Engineering", 5 th edition, Pearson, New Delhi, 2015. | | | |
| 3 | Farid Golnaraghi and Benjamin C. Kuo, "Automatic Control systems", 9 th Edition, Wiley, 2014. | | | |
| Reference Books: | | | | |
| 1 | Norman S. Nise, "Control Systems Engineering", Wiley, New Delhi, 2018. | | | |
| 2 | Richard Poley, "Control Theory Fundamentals", 2 nd Edison, Createspace, 2014. | | | |
| 3 | Richard C. Dorf, Robert H.Bishop, "Modern Control Engineering", 13 th Edition, Pearson Education, New Delhi, 2016. | | | |
| 4 | A.Nagoorkani, "Control Systems Engineering", RBA Publications 2014. | | | |
| 5 | S.Palani, "Control Systems Engineering", 2 nd Edition, Tata McGraw-Hill Education, 2010. | | | |
| Web References: | | | | |
| 1 | http://www.nptel.ac.in/courses/108101037/ | | | |
| 2 | http://www.nptel.ac.in/courses/108102043/ | | | |
| 3 | https://nptel.ac.in/courses/108101037/14 | | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 75 | 25 | 100 | 60 | 40 | 100 |

| Assessment based on Continuous and End Semester Examination | | | |
|---|--|------------------|--|
| Bloom's Level | Continuous Assessment (60%) [100 Marks] | | End Semester Practical Examination (40%) [100 Marks] |
| | FA (75 Marks) | SA (25 Marks) | |
| Remember | 0 | 0 | 0 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | 0 | 0 | 0 |
| Create | 20 | 20 | 20 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C405.1 | 3 | 2 | 1 | 1 | | | | | | 2 | | | 3 | | |
| C405.2 | 3 | 2 | 1 | 1 | | | | | | 2 | | | 3 | 1 | |
| C405.3 | 2 | 1 | | | | | | | | | | | 2 | 1 | |
| C405.4 | 3 | 3 | 2 | 2 | 3 | | | 2 | 2 | 1 | | 2 | 2 | 1 | |
| C405.5 | 3 | 3 | 3 | 3 | 3 | | | 2 | | 1 | 1 | 2 | 2 | | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|---|---|-----------------------|---------|
| 21EE501 | Power Electronics | | 3/0/0/3 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | Analog Electronics | |
| Course Objectives: | | | |
| 1 | To understand the characteristics of Power Semiconductor devices. | | |
| 2 | To provide adequate knowledge of DC choppers. | | |
| 3 | To impart the concepts of PWM inverters. | | |
| 4 | To illustrate the operation of AC voltage regulators. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C501.1 | Examine the operation of DC-DC converter and resonant converters. | [A] | |
| C501.2 | Infer the operation of various types of controlled rectifiers. | [AP] | |
| C501.3 | Design the suitable filter for power converters and analyze the effect the source impedance. | [A] | |
| C501.4 | Examine the operation of inverters and AC-AC Converter. | [A] | |
| C501.5 | Determine various applications of power electronic circuits in Renewable energy and Electric vehicles. | [AP] | |
| Course Contents: | | | |
| Module 1: DC to DC Converter | | | 15 Hrs |
| Silicon carbide power devices, MOSFET and its characteristics, protection and gate drive circuits - Circuit Configuration and analysis - Buck, boost, buck - boost converter- Cuk and SEPIC converter - SMPS - Introduction to Resonant Converters- classification: ZVS and ZCS. | | | |
| Module 2: Rectifiers | | | 15 Hrs |
| SCR and its characteristics - Single phase half and full wave rectifiers with R, RL, RLE load -Three phase half and full wave rectifiers with R, RL, RLE load - Design of filters – Dual Converter - Power factor improvement - Effect of source impedance. | | | |
| Module 3: Inverters and AC Voltage Controllers | | | 15 Hrs |
| IGBT and its characteristics, gate drive circuits and heat sink - Single phase Half bridge and full bridge inverter - three phase inverters - constant voltage source and constant current source inverters - PWM control of inverters - single pulse, multi pulse, sinusoidal, space vector modulation techniques - AC to AC voltage controller - Introduction to Multilevel inverters - Role of power converters in Renewable energy and Electric vehicles. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics - Converters,Applications and Design", John Wiley andamp; Sons edition 2011. | | |
| 2 | M.H. Rashid, "Power Electronics Circuits, devices and applications", Pearson Education, Inc. Edition 2014. | | |
| 3 | P.S. Bhimbra, "Power Electronics", Khanna Publishers edition 2018. | | |
| Reference Books: | | | |
| 1 | Vedam Subramanian, "Power Electronics" New age international Second edition 2018. | | |
| 2 | M.D.Singh, "Power Electronics", Tata McGraw-Hill, 2 nd Edition 2014. | | |
| 3 | Bimal K. Bose, "Modern Power Electronics andamp; AC Drives", Pearson,2015. | | |
| Web References: | | | |
| 1 | https://nptel.ac.in/courses/108101038/ | | |
| 2 | https://www.tutorialspoint.com/power_electronics/index.htm | | |
| 3 | https://in.mathworks.com/videos/developing-dc-dc-converter-control-with- | | |
| 4 | https://in.mathworks.com/videos/developing-dc-dc-converter-control-with-simulinkautomatically-generating-controller-code-for-implementation-on-embedded- | | |

| | |
|---|---|
| | processor1535540362783.html |
| 5 | https://in.mathworks.com/videos/series/developing-dc-dc-converter-control-with-simulink.html |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
|----------------|---------------|--|---------------------|
| C501.1 | Analyze | Quiz | 20 |
| C501.2 | Apply | Class Presentation | 20 |
| C501.3 | Analyze | Assignment | 20 |
| C501.4 | Analyze | | |
| C501.5 | Apply | Simulation Exercise | 20 |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 10 | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 40 | 40 | 40 |
| Analyse | 30 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|---|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C501.1 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | 2 | |
| C501.2 | 3 | 2 | 1 | 1 | | | | | | | 1 | 2 | 3 | 3 | |
| C501.3 | 3 | 3 | 2 | 2 | | | | | | | 1 | 2 | 3 | 3 | |
| C501.4 | 3 | 3 | 2 | 2 | | | | | | | 1 | 2 | 3 | 2 | |
| C501.5 | 2 | 1 | | | | | | | | | | 2 | 3 | 2 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|---|---------|
| 21EE502 | Power System Analysis | | 3/0/0/3 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | Generation, Transmission and Distribution | |
| Course Objectives: | | | |
| 1 | To understand the concepts of power systems and its components. | | |
| 2 | To apply various numerical methods to analyze a power system in steady state and fault conditions. | | |
| 3 | To analyze the stability concepts of power systems. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C502.1 | Interpret the various power system components and calculate the per unit quantities. | | [AP] |
| C502.2 | Construct the bus admittance, impedance matrices and calculate various load flow conditions. | | [AP] |
| C502.3 | Analyze various short circuit conditions in generator and transmission lines. | | [A] |
| C502.4 | Classify the types of faults and analyze different fault conditions. | | [A] |
| C502.5 | Compute the stability of the power system. | | [AP] |
| Course Contents: | | | |
| Module 1: Modelling of Power System and Load Flow Analysis | | | 15 Hrs |
| Modelling of power system components - Single line diagram, per unit analysis, Formation of admittance matrix with and without mutual admittance, Z-bus building algorithm without mutual system components impedances. Load flow analysis: Classification of Buses - Formation of load flow equations. Load flow solution using Gauss-Seidel, Newton-Raphson and Fast decoupled method. | | | |
| Module 2: Short Circuit Analysis | | | 15 Hrs |
| Importance of Short circuit study - Types of faults in power system - Short circuit transients in generator and transmission line - Symmetrical fault analysis using Z-bus algorithm - Sequence components, sequence networks, Unsymmetrical fault analysis - Line to Ground, Line to Line, Double Line to Ground faults. | | | |
| Module 3: Power System Stability | | | 15 Hrs |
| Concepts of stability in power system - steady state, dynamic and transient stability. Single Machine Infinite Bus (SMIB) System - Swing equation, Power angle equation and power angle curve. Equal area criterion - Critical clearing angle and time. Solution of swing equation using Modified Euler's and Range-Kutta method. Multi Machine stability. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Hadi Saadat, "Power System Analysis", Tata McGraw Hill, 2015. | | |
| 2 | John J. Grainger and William. D. Stevenson, Jr, "Power System Analysis", McGraw-Hill International Edition, 2016. | | |
| 3 | Kothari D. P and Nagrath I. J, "Modern Power System Analysis", 3 rd Edition., Tata McGraw Hill Publishing Company Limited, 2011. | | |
| Reference Books: | | | |
| 1 | J. Duncan Glover, M.S Sarma and Thomas. J. Overbye, "Power System Analysis and Design" Cengage Learning, 5 th Edition, 2011. | | |
| 2 | Pai M. A., "Computer Techniques in Power System Analysis", 3 rd Edition, Tata McGraw-Hill Publishing Company Limited, 2014. | | |
| 3 | Prabha Kundur, "Power System Stability and Control" 5 th Edition, Tata McGraw-Hill Publishing Company Limited, 2008. | | |

| | |
|------------------------|---|
| 4 | Abhijit Chakrabarti and Sunita Halder, "Power System Analysis Operation and Control", 3 rd Edition, PHI Publications, 2010. |
| Web References: | |
| 1 | https://nptel.ac.in/courses/108105067/ |
| 2 | https://www.vlab.co.in/broad-area-electrical-engineering |
| 3 | https://youtu.be/TdAqh20DDhE |
| 4 | https://cosmolearning.org/courses/power-system-analysis-304/video-lectures/ |
| 5 | https://www.youtube.com/watch?v=biApXHVSRa8 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|--|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
| C502.1 | Apply | Quiz | 20 |
| C502.2 | Apply | Problem Solving Tutorials | 20 |
| C502.3 | Analyze | Case Study | 20 |
| C502.4 | Analyze | | |
| C502.5 | Apply | Simulation Exercises | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 10 | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 40 | 40 | 40 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|---------------------------|----------------------------|--------------------|---------------------------|----------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component-I (20 Marks) | Component-II (20 Marks) | | Component-I (20 Marks) | Component-II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C502.1 | 3 | 2 | 1 | 1 | 2 | | | | 1 | | | | 2 | | |
| C502.2 | 3 | 2 | 1 | 1 | 2 | | | | 1 | | | | 2 | | |
| C502.3 | 3 | 3 | 2 | 2 | 3 | | | | 1 | | | | 3 | | |
| C502.4 | 3 | 3 | 2 | 2 | 3 | 1 | | | 1 | 1 | | | 3 | | |
| C502.5 | 3 | 2 | 1 | 1 | 2 | 1 | | | 1 | 2 | | | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|------------------------|---------|
| 21EE503 | Microcontrollers | | 3/1/2/5 |
| Nature of Course | | F (Theory Programming) | |
| Course Pre-requisites | | Digital Circuits | |
| Course Objectives: | | | |
| 1 | Understand the architecture of Microcontrollers. | | |
| 2 | Analyze the working of various interfacing ICs. | | |
| 3 | To develop application-based Assembly Language programs. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C503.1 | Illustrate the architecture of 8051 Microcontroller | | [U] |
| C503.2 | Develop assembly language programs using 8051 for various applications. | | [AP] |
| C503.3 | Analyze the architecture of PIC Microcontroller and Construct the simple programs. | | [A] |
| C503.4 | Infer the architecture of ARM controller. | | [A] |
| C503.5 | Construct the simple programs using ARM. | | [C] |
| Course Contents: | | | |
| Module 1: 8051 Microcontroller | | | 20 Hrs |
| Overview of Microprocessors - 8051: Functional block diagram - Instruction set - addressing modes - Interrupt structure - Timer - I/O ports - Serial Communication, Simple programming - Key board and display interface - DC motor control - Stepper motor control. | | | |
| Module 2: PIC Microcontroller | | | 20 Hrs |
| PIC18FXXX: Architecture - Data and program memory organization - Addressing modes -Instruction set - Move / Copy instructions, Arithmetic instructions, Logic instructions, Branches instructions, Bit Manipulation instructions, Read/Write instructions, Machine Control instructions - Timers - Interrupt, ISR, priority - Speed Control of Induction Motor. | | | |
| Module 3: ARM Controller | | | 20 Hrs |
| ARM7TDMI: Features - Block diagram - Architecture - Addressing modes - Instruction set - Thumb instructions - Data processing instructions, Data transfer instructions, Branch and control instructions, Register load and store instructions, Multiple register load and store instructions, Status register access instructions, Coprocessor instructions - Seven Segment Display Interfacing with ARM Controller. | | | |
| Total Theory Hours | | | 60 |
| Course Contents: | | | |
| S.No | List of Experiments | CO Mapping | BT |
| 1. | Arithmetic operation using 8051 Microcontroller. | C503.1 | [A] |
| 2. | Minimum, maximum and sorting data using 8051 Microcontroller. | C503.1 | [A] |
| 3. | Code conversion using 8051 Microcontroller. | C503.2 | [A] |
| 4. | 8279 Keyboard and display interfacing with 8051 Microcontroller. | C503.2 | [AP] |
| 5. | Stepper motor control using 8051. | C503.3 | [AP] |
| 6. | DC motor speed measurement and control using 8051. | C503.4 | [AP] |
| 7. | Simple arithmetic operations: Addition/Subtraction/Multiplication/Divisionusing PIC Controller | C503.5 | [A] |

| | | | |
|------------------------|---|---------|-----------|
| 8. | Simulation based Speed control of Induction Motor using PIC controller. | C503.5 | [AP] |
| 9. | ARM Assembly program for Arithmetic and Logical Operations. | C503.5 | [A] |
| 10. | Simulation based Seven Segment Display Interfacing with ARM Controller. | C5063.5 | [AP] |
| Total Lab Hours | | | 30 |
| Total Hours | | | 90 |

Text Books:

| | |
|---|---|
| 1 | Kenneth Ayala, "The 8051 Microcontroller", Cengage Learning Publications, 2 nd Edition, 2017. |
| 2 | John. B.Peatman , " Design with PIC Microcontroller" , Prentice hall, 2012. |
| 3 | Subrata Ghoshal, 8051 Microcontroller Internals, Instructions, Programming and Interfacing, Second edition, Pearson Education Asia, 2014. |
| 4 | Myke Predko, "Programming and customizing the PIC microcontroller", Tata McGraw Hill Publishing Company Limited, Third Edition, 2008. |
| 5 | Steve Furber, " ARM System –On – Chip architecture ", Addison Wesley, 2009. |

Reference Books:

| | |
|---|--|
| 1 | Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", Prentice Hall Publications, 2nd Edition, 2008. |
| 2 | Krishna Kant, "Microprocessor and Microcontrollers" Eastern Company Edition, Prentice Hall of India, New Delhi, 2 nd edition, 2013. |
| 3 | Joseph Yiu, „The Definitive Guide to the ARM Cortex-M0" Newnes – Elsevier, 2011. |
| 4 | Muhammad Tahir and Kashif Javed, „ARM Microprocessor Systems - Cortex-M Architecture, Programming, and Interfacing", CRC Press, 2011. |

Web References:

| | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc18_ec03 |
| 2 | https://nptel.ac.in/courses/108107029/ |
| 3 | http://www.ti.com/microcontrollers/overview.html |
| 4 | https://swayam.gov.in/course/3490-digital-electronics-and-microprocessor |
| 5 | https://nptel.ac.in/courses/117104072/ |

| Continuous Assessment | | | | | | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------|----------------------|----------------------|-----------|-------------|-----------------------------|--------------------------|-------|
| Theory | | | | Practical | | | Total (A+B) | Total Continuous Assessment | | |
| Formative Assessment | Summative Assessment | Total | Total (A) | Formative Assessment | Summative Assessment | Total (B) | | | | |
| 80 | 120 | 200 | 100 | 75 | 25 | 100 | 200 | 50 | 50 | 100 |

Formative Assessment based on Capstone Model - Theory

| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (10%) [80 Marks] |
|----------------|---------------|--|---------------------|
| C503.1 | Understand | Quiz | 20 |
| C503.2 | Apply | Class Presentation | 20 |
| C503.3 | Analyze | Assignment | 20 |
| C503.4 | Analyze | Simulation Exercise | 20 |
| C503.5 | Create | | |

| Assessment based on Summative and End Semester Examination - Theory | | | |
|---|--|------------------|--|
| Bloom's Level | Summative Assessment (15%) [120 Marks] | | End Semester Examination (25%) [100 Marks] |
| | CIA1: (60 Marks) | CIA2: (60 Marks) | |
| Remember | 10 | 10 | 20 |
| Understand | 40 | 40 | 30 |
| Apply | 30 | 30 | 40 |
| Analyse | 20 | 20 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Assessment based on Continuous and End Semester Examination - Practical | | | |
| Bloom's Level | Continuous Assessment (25%) [100 Marks] | | End Semester Examination (25%) [100 Marks] |
| | FA: (75 Marks) | SA: (25 Marks) | |
| Remember | 0 | 0 | 0 |
| Understand | 0 | 0 | 0 |
| Apply | 60 | 60 | 60 |
| Analyse | 40 | 40 | 40 |
| Evaluate | 0 | 0 | 0 |
| Create | 0 | 0 | 0 |

| Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|------------------------|-------------------------|------------------|------------------------|-------------------------|----------------------------|----------|---|
| Continuous Assessment (50%) | | | | | | | | End Semester Examination (50%) |
| CA 1 (100 Marks) | | | CA 2 (100 Marks) | | | Practical Exam (100 Marks) | | Theory Examination (25%) Practical Examination (25%) |
| SA 1 (60M) | FA 1 | | SA 2 (60M) | FA 2 | | FA (75M) | SA (25M) | |
| | Component-I (20 Marks) | Component-II (20 Marks) | | Component-I (20 Marks) | Component-II (20 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C503.1 | 3 | 3 | 2 | 2 | 3 | | | | | | | | | 3 | |
| C503.2 | 3 | 2 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | | 2 | 1 | | 3 | 1 |
| C503.3 | 3 | 3 | 2 | 2 | 3 | | | | | | | | | 3 | |
| C503.4 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 2 | | 2 | 1 | | 3 | 1 |
| C503.5 | 3 | 2 | 1 | 1 | 3 | | | | | | | | | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|---|---|---|---------|
| 21EE504 | Virtual Instrumentation Programming | | 2/0/2/3 |
| Nature of Course | | E (Theory skill based) | |
| Course Pre-requisites | | Measuring Instruments and Smart sensors | |
| Course Objectives: | | | |
| 1 | To understand the architecture of VI and basic programming concepts in software tool. | | |
| 2 | To learn different Data Acquisition system concepts. | | |
| 3 | To develop real time applications using software tool. | | |
| 4 | To study various Instrument Interfacing protocols. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C504.1 | Explain the architecture and features of Virtual Instrument | | [U] |
| C504.2 | Create the graphical programming in LabVIEW software. | | [C] |
| C504.3 | Illustrate the basic concepts of PC based data acquisition | | [U] |
| C504.4 | Analyze the Control system design and PID Controller toolkits in LabVIEW | | [A] |
| C504.5 | Demonstrate the LabVIEW Toolkit usage in Image Processing and Machine vision applications | | [AP] |
| Course Contents: | | | |
| Module 1: VI Programming Techniques | | | 10 Hrs |
| Block diagram and Architecture of VI - Graphical System Design (GSD) model - Comparison with conventional programming - LabVIEW Software environment VI's and sub -VI's - Loops - Arrays - Clusters - Graphs and charts - Case and sequence structures - Formula nodes - Local and global variable - String and File I/O. | | | |
| Module 2: DAQ and Analysis Tools | | | 10 Hrs |
| Concept of PC based data acquisition - DAQ Software Architecture-DAQ Assistant - Analog Input and Analog Output - Digital Input and Digital Output - Timers-Counters - Grounding: Differential and Single Ended - Increasing Measurement Quality of DAQ - Temperature based data acquisition system | | | |
| Module 3: LabVIEW Tools and Applications of VI | | | 10 Hrs |
| Control Design and Simulation Tools – PID Control Toolkit- IMAQ: Image processing and analysis - Machine Vision- Motion Control- Web Publishing Tools -Simple programming with Arduino Uno- LabVIEW interface | | | |
| Total Theory Hours | | | 30 |
| Lab Component | | | |
| S.No | List of Experiments | CO Mapping | BT |
| 1 | Creating Virtual Instrumentation for simple applications | C504.1 | [U] |
| 2 | Programming exercises for loops | C504.2 | [C] |
| 3 | Programming exercises for arrays | C504.2 | [A] |
| 4 | Programming exercises for clusters | C504.2 | [A] |
| 5 | Build a VI using Graphs and Charts | C504.2 | [C] |
| 6 | Build a VI using Case and sequence structures | C504.3 | [C] |
| 7 | Programming exercises for Strings and File I/O | C504.3 | [A] |
| 8 | Real time temperature-based data acquisition system. | C504.4 | [A] |
| 9 | Programming exercises for Control Design Toolboxes | C504.4 | [A] |

| | | | |
|-------------------|--|--------|-----|
| 10 | Programming exercises for IMAQ Toolboxes. | C504.4 | [A] |
| 11 | Programming exercises for Arduino Uno. | C504.4 | [A] |
| Total Lab Hours | | | 30 |
| Total Hours | | | 60 |
| Text Books: | | | |
| 1 | Jovitha Jerome, “Virtual Instrumentation using LabVIEW”, Prentice Hall, 2010. | | |
| 2 | Gary W. Johnson, Richard Jennings, “Lab-view Graphical Programming”, Tata McGraw Hill Professional Publishing, IV Edition, 2011. | | |
| 3 | Steve Mackay, Edwin Wright, John Park, and Deon Reynders, “Industrial Data Networks”, Elsevier, 2010. | | |
| 4 | Marco Schwartz and Oliver Manickum “Programming Arduino with LabVIEW”, Kindle Edition, 2015. | | |
| Reference Books: | | | |
| 1 | P.Surekha, S.Sumathi, “LabVIEW based Advance Instrumentation”, Springer, 2007. | | |
| 2 | Sanjay Gupta and Joseph John, “Virtual Instrumentation using LabVIEW”, Tata McGraw-Hill Inc, 2017. | | |
| 3 | Behzad Ehsani, “Data Acquisition Using LabVIEW”, Kindle Edition, 2016. | | |
| 4 | Kevin James, “PC Interfacing and Data Acquisition: Techniques for Measurement Instrumentation and Control”, Newness, 2000. | | |
| Web References: | | | |
| 1 | http://www.ni.com/academic/students/learn-labview/ | | |
| 2 | http://www.ni.com/academic/students/learn-daq/ | | |
| 3 | https://www.electronicshub.org/labview-projects/ | | |
| 4 | https://learn.ni.com/teach/resources | | |
| Online Resources: | | | |
| 1 | http://www.ni.com/webcast/2898/en/ | | |

| Continuous Assessment | | | | | | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------|----------------------|----------------------|-----------|-------------|-----------------------------|--------------------------|-------|
| Theory | | | | Practical | | | Total (A+B) | Total Continuous Assessment | | |
| Formative Assessment | Summative Assessment | Total | Total (A) | Formative Assessment | Summative Assessment | Total (B) | | | | |
| 80 | 120 | 200 | 100 | 75 | 25 | 100 | 200 | 50 | 100 | |

| Formative Assessment based on Capstone Model - Theory | | | |
|--|----------------------|---|----------------------------|
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (10%) [80 Marks] |
| C504.1 | Understand | Quiz | 20 |
| C504.2 | Create | Simulation Exercise | 20 |
| C504.3 | Understand | Assignment | 20 |
| C504.4 | Analyze | Class Presentation | 20 |
| C504.5 | Apply | | |

| Assessment based on Summative and End Semester Examination - Theory | | | |
|---|--|------------------|--|
| Bloom's Level | Summative Assessment (15%) [120 Marks] | | End Semester Examination (25%) [100 Marks] |
| | CIA1: (60 Marks) | CIA2: (60 Marks) | |
| Remember | 10 | 10 | 20 |
| Understand | 40 | 40 | 30 |
| Apply | 30 | 30 | 40 |
| Analyse | 20 | 20 | 10 |
| Evaluate | - | - | - |
| Create | - | - | - |
| Assessment based on Continuous and End Semester Examination - Practical | | | |
| Bloom's Level | Continuous Assessment (25%) [100 Marks] | | End Semester Examination (25%) [100 Marks] |
| | FA: (75 Marks) | SA: (25 Marks) | |
| Remember | 20 | 10 | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 40 | 40 | 40 |
| Analyse | 20 | 30 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | | |
|---|------------------------|-------------------------|------------------|------------------------|-------------------------|----------------------------|----------|---|
| Continuous Assessment (50%) | | | | | | | | End Semester Examination (50%) |
| CA 1 (100 Marks) | | | CA 2 (100 Marks) | | | Practical Exam (100 Marks) | | Theory Examination (25%) Practical Examination (25%) |
| SA 1 (60M) | FA 1 | | SA 2 (60M) | FA 2 | | FA (75M) | SA (25M) | |
| | Component-I (20 Marks) | Component-II (20 Marks) | | Component-I (20 Marks) | Component-II (20 Marks) | | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C504.1 | 2 | 1 | | | | | | | | | | | | | |
| C504.2 | 3 | 3 | 3 | 3 | 3 | | | 2 | 2 | 2 | | 3 | 2 | | 2 |
| C504.3 | 2 | 1 | | | | | | 2 | 2 | 2 | | 2 | 2 | 2 | |
| C504.4 | 3 | 2 | 1 | 1 | | | | | | 2 | | 2 | 2 | 2 | |
| C504.5 | 3 | 3 | 2 | 2 | 3 | | | 2 | 2 | 2 | | 3 | 3 | | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | | |
|---|---|---------------------------|------------|---------|
| 21EE505 | Power Electronics Laboratory | | | 0/0/2/1 |
| Nature of Course | | M (Practical application) | | |
| Pre-requisites | | Analog Electronics | | |
| Course Objectives: | | | | |
| 1 | To provide an opportunity to understand the operation, function and interaction between various components | | | |
| 2 | To impart the knowledge in design, modelling and simulation of Power electronic converter based systems | | | |
| Course Outcomes: | | | | |
| Upon completion of the course, students shall have ability to | | | | |
| C505.1 | Examine the operation and characteristics of various power electronic components. | | | [AP] |
| C505.2 | Analyze the working of single - phase converter. | | | [A] |
| C505.3 | Analyze the characteristics of DC to DC chopper. | | | [A] |
| C505.4 | Illustrate the working operation of Three phase rectifier, inverter and AC voltage controller. | | | [A] |
| C505.5 | Select the suitable converter for DC and AC motor speed control | | | [AP] |
| Course Contents: | | | | |
| S.No | List of Experiments | | CO Mapping | RBT |
| 1. | V-I characteristics of SCR and TRIAC. | | C505.1 | [AP] |
| 2. | V-I characteristics of MOSFET and IGBT. | | C505.1 | [AP] |
| 3. | Switching characteristics of SCR and IGBT. | | C505.1 | [AP] |
| 4. | Single-phase half and fully controlled Rectifiers. | | C505.2 | [A] |
| 5. | Single phase IGBT based Inverter performance verification. | | C505.2 | [A] |
| 6. | Design a buck converter and boost converter circuit using power MOSFET. | | C505.3 | [A] |
| 7. | Analyze the performance of ZVS and ZCS converter. | | C505.3 | [A] |
| 8. | Analyze the performance of AC-AC Voltage controller. | | C505.4 | [A] |
| 9. | (a) Analyze the performance of Three phase fully Controlled rectifier. | | C505.4 | [A] |
| | (b) Analyze the performance of Three phase bridge inverter. | | | |
| 10. | Speed control of DC and AC motors using power converter circuits | | C505.5 | [AP] |
| Total Hours | | | 30 | |
| Text Books: | | | | |
| 1 | Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics – Converters, Applications and Design", John Wiley and Sons edition 2011. | | | |
| 2 | M.D.Singh, "Power Electronics", Tata McGraw-Hill, 2 nd edition 2014 | | | |
| 3 | P.S. Bhimbra, "Power Electronics", Khanna Publishers edition 2018. | | | |
| Reference Books: | | | | |
| 1 | Vedam Subramanian, "Power Electronics" New age international Second edition 2018. | | | |
| 2 | P.C. Sen, "Modern Power Electronics", Tata McGraw-Hill, edition 2018. | | | |
| 3 | Bimal K. Bose, "Modern Power Electronics and AC Drives", Pearson,2015 | | | |
| Web References: | | | | |
| 1 | https://nptel.ac.in/courses/108101038/ | | | |
| 2 | https://www.tutorialspoint.com/power_electronics/index.htm | | | |
| 3 | https://in.mathworks.com/videos/developing-dc-dc-converter-control-with-simulinkautomatically-generating-controller-code-for-implementation-on-embedded- | | | |

| | |
|---|---|
| | processor1535540362783.html |
| 4 | https://in.mathworks.com/videos/series/developing-dc-dc-converter-control-withsimulink.html |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 75 | 25 | 100 | 60 | 40 | 100 |

| Assessment based on Continuous and End Semester Examination | | | |
|---|--|------------------|--|
| Bloom's Level | Continuous Assessment (60%) [100 Marks] | | End Semester Practical Examination (40%) [100 Marks] |
| | FA (75 Marks) | SA (25 Marks) | |
| Remember | 0 | 0 | 0 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | 0 | 0 | 0 |
| Create | 20 | 20 | 20 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C505.1 | 2 | 1 | | | 3 | | | | | | | | 3 | 2 | |
| C505.2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | 2 | 3 | 3 | |
| C505.3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | 1 | 3 | 3 | |
| C505.4 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | 2 | 3 | 3 | |
| C505.5 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | | | | 2 | 3 | 2 | 2 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | | |
|---|--|-------------------------------|------------|---------|
| 21EE506 | Power System Simulation Laboratory | | | 0/0/2/1 |
| Nature of Course | | M (Practical application) | | |
| Pre-requisites | | Transmission and Distribution | | |
| Course Objectives: | | | | |
| 1 | To know and study about the transmission line parameters. | | | |
| 2 | To apply iterative techniques for power flow analysis. | | | |
| 3 | To Impart Knowledge on stability | | | |
| Course Outcomes: | | | | |
| Upon completion of the course, students shall have ability to | | | | |
| C506.1 | Construct the bus admittance and impedance matrices. | | | [AP] |
| C506.2 | Examine the Load flow problems and calculate the load flow results. | | | [A] |
| C506.3 | Classify the types of faults and analyze the power system on different faulted conditions. | | | [AP] |
| C506.4 | Illustrate the concepts of transient and steady state stability in power systems. | | | [A] |
| C506.5 | Analyze the multi machine stability | | | [A] |
| Course Contents: | | | | |
| S.No | List of Experiments | | CO Mapping | RBT |
| 1. | Computation and Modelling of Transmission Line Parameters. | | C506.1 | [AP] |
| 2. | Formation of Bus Admittance Matrix with and without mutual element. | | C506.1 | [AP] |
| 3. | Formation of Bus Impedance Matrix. | | C506.1 | [AP] |
| 4. | Load Flow Analysis by Gauss - Seidel Iterative Technique. | | C506.2 | [A] |
| 5. | Load Flow Analysis by Newton Raphson Technique. | | C506.2 | [A] |
| 6. | Symmetrical Fault Analysis. | | C506.3 | [AP] |
| 7. | Unsymmetrical Fault Analysis. | | C506.3 | [AP] |
| 8. | Steady State Stability Analysis. | | C506.4 | [A] |
| 9. | Transient Stability by point by point method. | | C506.4 | [A] |
| 10. | Stability analysis of Multi-Machine Infinite Bus System. | | C506.5 | [A] |
| 11 | State Estimation of Weighted-Least-Square State Estimation | | C506.5 | [A] |
| Total Hours | | | 30 | |
| Text Books: | | | | |
| 1 | Tharangika Bambaravanage, Asanka Rodrigo, Sisil Kumarawadu, "Modeling, Simulation, and Control of a Medium-Scale Power System", Springer Nature Singapore Pte Ltd, 2018. | | | |
| 2 | Hadi Saadat, " Power System Analysis", Tata McGraw Hill, 2015. | | | |
| 3 | John J. Grainger and Stevenson Jr. W. D, "Power System Analysis", McGraw Hill International edition, 2016.. | | | |
| 4 | Kothari D. P and Nagrath I. J., "Modern Power System Analysis", 3rd Ed., Tata McGraw-Hill Publishing Company Limited, 2011. | | | |
| Reference Books: | | | | |
| 1 | J.Duncan Glover, M.S Sarma and Thomas J Overbye, "Power System Analysis and design" Cengage Learning , 5 th edition 2011. | | | |
| 2 | Pai M. A., "Computer Techniques in Power System Analysis", 3 rd Ed., Tata McGraw-Hill Publishing Company Limited. 2014. | | | |

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|------------------------|---|
| 3 | Prabha Kundur., "Power System Stability and Control" 5 th Ed., Tata McGraw -Hill Publishing Company Limited 2008, |
| Web References: | |
| 1 | https://nptel.ac.in/courses/108105067/ |
| 2 | https://www.vlab.co.in/broad-area-electrical-engineering |
| 3 | https://youtu.be/TdAqh20DDhE |
| 4 | https://www.youtube.com/watch?v=BaKC7v8bRsg&dt=3099s |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 75 | 25 | 100 | 60 | 40 | 100 |

| Assessment based on Continuous and End Semester Examination | | | |
|---|--|------------------|--|
| Bloom's Level | Continuous Assessment (60%) [100 Marks] | | End Semester Practical Examination (40%) [100 Marks] |
| | FA (75 Marks) | SA (25 Marks) | |
| Remember | 0 | 0 | 0 |
| Understand | 20 | 20 | 20 |
| Apply | 40 | 40 | 40 |
| Analyse | 40 | 40 | 40 |
| Evaluate | 0 | 0 | 0 |
| Create | 0 | 0 | 0 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C506.1 | 3 | 2 | | | 3 | | | | 1 | | | | 3 | | |
| C506.2 | 3 | 3 | 2 | 2 | 3 | | | 2 | 1 | | | | 3 | | 2 |
| C506.3 | 3 | 2 | 1 | 1 | 3 | | | | 1 | | | | 3 | | |
| C506.4 | 3 | 3 | 2 | 2 | 2 | | | 2 | 1 | | | | 3 | | 2 |
| C506.5 | 3 | 3 | 3 | 3 | 3 | | | 2 | 1 | | | | 3 | | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|----------------------------------|---------|
| 21EC611 | Principles of Digital Signal Processing | | 2/1/0/3 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | Transforms and Numerical Methods | |
| Course Objectives: | | | |
| 1 | To study and analyse various signals and systems and their mathematical operations. | | |
| 2 | To study various transformation techniques in signal processing. | | |
| 3 | To design analog and digital filters for signal processing applications. | | |
| 4 | To learn about programmable digital signal processor and multi-rate signal processing | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C611.1 | Explain various types of signals and systems. | | [U] |
| C611.2 | Analyse the mathematical operations on signals and systems. | | [A] |
| C611.3 | Analyse various transformation techniques. | | [A] |
| C611.4 | Illustrate various types of digital filters using IIR and FIR filter design. | | [AP] |
| C611.5 | Interpret the programmable digital signal processor. | | [U] |
| Course Contents: | | | |
| Module 1: Signals and Systems | | | 15 Hrs |
| Introduction to DSP - Signals and systems - Standard signals - Classification of signals - Discrete Time (DT) signals: Deterministic and Random signals, Periodic and Aperiodic signals, Energy and Power signals, Odd and Even signals - Classification of systems - Discrete Time systems: Static and Dynamic, Causal and Non-causal, Linear and Nonlinear, Time - variant and Time - invariant, Stable and Unstable. LTI System - Convolution and Correlation. | | | |
| Module 2: Transformation Techniques | | | 15 Hrs |
| Z Transform: properties, ROC - Inverse Z transforms - Stability analysis - Discrete Fourier Transforms - Properties - Circular Convolution - Fast Fourier Transform algorithms - Decimation in Time Algorithm and Decimation in Frequency Algorithm. Discrete time Fourier Transform - Relation between DFT and DTFT. | | | |
| Module 3: Design of Digital Filters and Architecture of DSP | | | 15 Hrs |
| FIR filter: design of linear phase FIR filters - design of FIR filters using windowing technique - Rectangular, Hamming, Hanning windows. IIR filter: Analog low pass filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation. Architecture of DSP - Von Neumann and Harvard architecture - Architecture and features of TMS 320C55xx DSP processor. Architecture of one DSP processor for motor control. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | J.G. Proakis and D.G. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, New Delhi, 5th edition, 2022. | | |
| 2 | A.Nagoorkani, "Digital Signal Processing", Tata McGraw Hill, New Delhi, 2012. | | |
| 3 | S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011. | | |
| Reference Books: | | | |
| 1 | A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 2011 | | |
| 2 | Salivahanan, A. Vallavaraj, C. Gnanapriya, "Digital Signal Processing", Tata McGraw Hill, New Delhi, 2011. | | |
| 3 | Vinay K. Ingle and J.G. Proakis, "Digital Signal Processing Using MATLAB", 3rd Edition', Pearson Education, 2010. | | |
| Web References: | | | |

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|---|---|
| 1 | http://nptel.ac.in/courses/117102060/ |
| 2 | https://www.tutorialspoint.com/digital_signal_processing/ |
| 3 | https://www.allaboutcircuits.com/projects/category/embedded/digital-signal-processing/ |
| 4 | https://www.dspguide.com/ch28/3.htm |
| 5 | https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-341-discrete-time-signal-processing-fall-2005/ |
| 6 | http://www.ictacademy.in/Pages/Digital-Signal-Processing.aspx |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C611.1 | Understand | Online Quiz | 20 |
| C611.2 | Analyze | Technical Presentation | 20 |
| C611.3 | Analyze | Assignment | 20 |
| C611.4 | Apply | | |
| C611.5 | Understand | Simulation exercises | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 30 | 30 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 20 | 20 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C611.1 | 2 | 1 | | | 2 | | | | | | 2 | 3 | 1 | 1 | |
| C611.2 | 3 | 3 | 2 | 2 | 3 | | | | | | | 2 | 2 | 2 | |
| C611.3 | 3 | 3 | 2 | 2 | 3 | | | | | | | | 2 | 2 | |
| C611.4 | 3 | 2 | 1 | 1 | 3 | | | | 2 | | 2 | | 1 | 2 | |
| C611.5 | 2 | 1 | | | 2 | | | | | | 2 | 2 | | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|------------------------|---------|
| 21EC612 | Embedded System Programming | | 3/0/2/4 |
| Nature of Course | | E (Theory Skill Based) | |
| Course Pre-requisites | | Microcontrollers | |
| Course Objectives: | | | |
| 1 | To introduce the functional building blocks of embedded systems. | | |
| 2 | To provide sufficient knowledge to understand the embedded systems design and interfacing between processors and peripheral device. | | |
| 3 | To enable coding of effective Embedded C programs on any dedicated processor. | | |
| 4 | To familiarize with the concepts of Real time operating systems and choice for specific application. | | |
| 5 | To understand the real-world embedded devices. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C612.1 | Describe the functional building blocks embedded system, Processor and memory Organization. | | [U] |
| C612.2 | Examine the different types of Processors and Memory to be selected for different case studies. | | [A] |
| C612.3 | Interpret the architecture and functioning of network devices, I/O Programming and Schedule Mechanism. | | [A] |
| C612.4 | Apply suitable RTOS concepts with suitable real time applications. | | [AP] |
| C612.5 | Develop the embedded C programs for different peripheral interface experiments. | | [AP] |
| Course Contents: | | | |
| Module 1: Processor and Memory Organization 15 Hrs | | | |
| Functional building blocks of embedded systems, Structural units in a processor; selection of processor and memory devices, memory management, DMA, Cache mapping techniques, dynamic allocation, Fragmentation, Interrupts, I/O devices, Embedded Product Design Life Cycle. Case study: Required Memory devices for an Automatic chocolate vending machine, Digital Camera and Voice recorder. | | | |
| Module 2: Devices and Buses for Network 15 Hrs | | | |
| I/O devices; timer and counting devices serial communication using I2C, SPI, USB buses, ARM bus; interfacing with devices/ports, device drivers in a system - Introduction Controller Area Network (CAN), Wireless Communication using Bluetooth, Zigbee, IEEE 802.15.4 standard. Introduction to Raspberry pi and Jetson Nano. Case study: IOT based Embedded Applications. | | | |
| Module 3: RTOS 15 Hrs | | | |
| Introduction to Basic concepts of OS and RTOS - Task, Process and Threads, Interrupt Routines in RTOS, Multiprocessing and Multitasking, Pre-emptive and Non-Pre-emptive Scheduling, Task Communication, shared Memory, Message Passing-, Inter Process Communication - Synchronization Between Processes - Mailbox, Pipes, Priority Inversion, Priority Inheritance, Scheduling Algorithms - Rate monotonic algorithm, Earliest Deadline algorithm, Round Robin algorithm, Embedded multitasking, semaphores, Deadlock. Software aspects of embedded systems, Real time programming languages and operating systems for embedded systems. Selection of operating systems for commercial applications. | | | |
| Total Theory Hours | | | 45 |
| Lab Component | | | |
| S.No | List of Experiments | CO Mapping | RBT |
| 1. | Study of KEIL using 8051 | C612.1 | [U] |
| 2. | LED Blinking using 8051 | C611.2 | [A] |

| | | | |
|------------------|---|--------|-----|
| 3. | Interfacing LCD with 8051 | C612.2 | [A] |
| 4. | Seven Segment Display using 8051 | C612.2 | [A] |
| 5. | Interfacing ADC with 8051 | C612.3 | [A] |
| 6. | Interfacing Matrix Keyboard using 8051 | C612.3 | [A] |
| 7. | Interfacing DC Motor with 8051 | C612.4 | [A] |
| 8. | Real Time people tracking system using Jetson Nano | C612.4 | [A] |
| 9. | Design of embedded based Irrigation system using Jetson Nano | C612.5 | [A] |
| 10. | Design of embedded based Abnormal Health Alert System using Raspberry pi. | C612.5 | [A] |
| Total Lab Hours | | 30 | |
| Total Hours | | 75 | |
| Text Books: | | | |
| 1 | P.Raj Kamal, Embedded System- Architecture, Programming, and Design. (2/e), Tata McGraw Hill, 2014. | | |
| 2 | K.V. Shibu, Introduction to Embedded Systems, Tata McGraw, 2009. | | |
| 3 | David E-Simon: An Embedded software Primer, Pearson Education, 2012. | | |
| 4 | Jeff Cicolani Beginning Robotics with Raspberry Pi and Arduino Using Python and OpenCV, Apress Publications, First Edition, 2020 | | |
| Reference Books: | | | |
| 1 | G.H. Miller, Microcomputer Engineering, 3d edition, Pearson Education, 2013. | | |
| 2 | W. Wolf. Computers as components: principles of embedded computing system design. Morgan Kaufmann, 2012. | | |
| 3 | Jonathan. W. Valvano, Embedded Microcomputer Systems, Real Time Interfacing, Published by Thomson Brooks/Col, 2012. | | |
| Web References: | | | |
| 1 | http://www.infocobuild.com/education/audio-video-courses/computer-science/EmbeddedSystemsDesign-IIT-Kharagpur/lecture-10.html | | |
| 2 | https://nptel.ac.in/courses/106105159/ | | |
| 3 | https://www.youtube.com/watch?v=y9RAhEfLfJs | | |
| 4 | https://www.coursera.org/learn/introduction-embedded-systems/lecture/SNbQd/0-introduction-to-the-course | | |
| 5 | https://www.youtube.com/watch?v=V3zBMnCa8Hw | | |

| Continuous Assessment | | | | | | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------|----------------------|----------------------|-----------|-------------|-----------------------------|--------------------------|-------|
| Theory | | | | Practical | | | Total (A+B) | Total Continuous Assessment | | |
| Formative Assessment | Summative Assessment | Total | Total (A) | Formative Assessment | Summative Assessment | Total (B) | | | | |
| 80 | 120 | 200 | 100 | 75 | 25 | 100 | 200 | 50 | 50 | 100 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C612.1 | 3 | 2 | 2 | 2 | | | | | | | | | 3 | | |
| C612.2 | 3 | 2 | 2 | 2 | | | | | | | | | 3 | | |
| C612.3 | 3 | 2 | 2 | 2 | | | | | | | | | 3 | | |
| C612.4 | 3 | 2 | 2 | 2 | | | | | | | | | 3 | | |
| C612.5 | 2 | 2 | 2 | 2 | 3 | | | | 1 | 2 | | 2 | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | | |
|---|---|----------------------------------|------|---------|
| 21EC613 | Principles of Digital Signal Processing Laboratory | | | 0/0/2/1 |
| Nature of Course | | M (Practical application) | | |
| Pre-requisites | | Transforms and Numerical Methods | | |
| Course Objectives: | | | | |
| 1 | To provide an opportunity to understand the operation and function of various signals. | | | |
| 2 | To impart the knowledge in design, modelling and simulation of digital based systems. | | | |
| Course Outcomes: | | | | |
| Upon completion of the course, students shall have ability to | | | | |
| C613.1 | Analyze elementary Discrete-Time sequences. | | | [A] |
| C613.2 | Analyze the basic signal processing operations. | | | [A] |
| C613.3 | Realize the FIR digital filters using a simulation tool and analyze the response of the filter. | | | [AP] |
| C613.4 | Realize the IIR digital filters using a simulation tool and analyze the response of the filter. | | | [AP] |
| C613.5 | Analyze signal processing using DSP processors. | | | [A] |
| Course Contents: | | | | |
| S.No | List of Experiments | CO Mapping | RBT | |
| 1 | Representation of basic signals. | C613.1 | [A] | |
| 2 | Verification of sampling theorem. | C613.2 | [A] | |
| 3 | Computation of linear convolution. | C613.2 | [A] | |
| 4 | Computation of circular convolution | C613.2 | [A] | |
| 5 | Frequency response of LTI system. | C613.2 | [A] | |
| 6 | Design and analysis of FIR filter using windowing technique | C613.3 | [AP] | |
| 7 | Design of Butterworth filter | C613.4 | [AP] | |
| 8 | Chebyshev filter | C613.4 | [AP] | |
| 9 | Generation of Signals using DSP processor | C613.5 | [A] | |
| 10 | Convolution using DSP processor | C613.5 | [A] | |
| Total Hours | | 30 | | |
| Text Books: | | | | |
| 1 | J.G. Proakis and D.G. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, New Delhi, 5th edition, 2022. | | | |
| 2 | A.Nagoorkani, "Digital Signal Processing", Tata McGraw Hill, New Delhi, 2012 | | | |
| 3 | S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011. | | | |
| Reference Books: | | | | |
| 1 | A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 2011 | | | |
| 2 | Salivahanan, A. Vallavaraj, C. Gnanapriya, "Digital Signal Processing", Tata McGraw Hill, New Delhi, 2011. | | | |
| 3 | Vinay K. Ingle and J.G. Proakis, "Digital Signal Processing Using MATLAB", 3rd Edition', Pearson Education, 2010. | | | |
| Web References: | | | | |
| 1 | http://nptel.ac.in/courses/117102060/ | | | |
| 2 | https://www.tutorialspoint.com/digital_signal_processing/ | | | |
| 3 | https://www.allaboutcircuits.com/projects/category/embedded/digital-signal-processing/ | | | |
| 4 | https://www.dspguide.com/ch28/3.htm | | | |
| 5 | https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-341-discrete- | | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 75 | 25 | 100 | 60 | 40 | 100 |

Assessment based on Continuous and End Semester Examination

| Bloom's Level | Continuous Assessment (60%) [100 Marks] | | End Semester Practical Examination (40%) [100 Marks] |
|---------------|--|------------------|--|
| | FA (75 Marks) | SA (25 Marks) | |
| Remember | 0 | 0 | 0 |
| Understand | 20 | 20 | 20 |
| Apply | 20 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | 0 | 0 | 0 |
| Create | 20 | 20 | 20 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C613.1 | 3 | 2 | 1 | 1 | 3 | | | | 2 | | | | 1 | 3 | |
| C613.2 | 3 | 3 | 2 | 2 | 3 | | | | 1 | | | | 2 | 3 | |
| C613.3 | 3 | 3 | 2 | 2 | 3 | | | | 2 | | | | 2 | 3 | |
| C613.4 | 3 | 3 | 3 | 3 | 3 | | | | 2 | | | | 2 | 3 | |
| C613.5 | 3 | 3 | 3 | 3 | 3 | | | | 2 | | | | 2 | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|--|--|--|---------|
| 21EE701 | Power System Protection and Switchgear | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Transmission and Distribution, Power System Analysis | |
| Course Objectives: | | | |
| 1 | To learn the fundamentals of protective equipment's used in power systems | | |
| 2 | To give a broad coverage on types of protective relays and circuit breakers. | | |
| 3 | To study about the theory of arcing and protection against over voltage. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C701.1 | Interpret the importance of protective devices in power systems. | | [U] |
| C701.2 | Examine the working of various protective relays. | | [A] |
| C701.3 | Apply suitable protection schemes for different apparatus, feeders and bus bar faults. | | [AP] |
| C701.4 | Illustrate the causes of overvoltage and protection against overvoltage. | | [U] |
| C701.5 | Examine the operation of various circuit breakers with arcing concepts. | | [A] |
| Course Contents: | | | |
| Module 1: Protective Relays | | | 15 Hrs |
| Fundamentals of protection and switchgear in Power systems - Causes, need of protection and types of protection, Relays - Classification of Electromechanical and induction relays, its operating principle, types and applications, Types of Overcurrent Relay - Definite Time, Inverse Time & IDMT Relays, Static relays and Numerical relays - Introduction, Block diagram, operating principle and application, Recent developments of relays and switchgear for Smart grid operations, Case study - relay coordination and importance of relay selection. | | | |
| Module 2: Apparatus Protection | | | 15 Hrs |
| Generator protection - stator and rotor protection. Transformer Protection - Differential protection. Line Protection - Distance, Differential protection and Carrier current protection, Feeder and Bus bar protection. Causes of over voltage - Ground wires, Surge diverters or Lighting Arresters, Surge absorbers, Applications of artificial intelligence in Power System Protection. | | | |
| Module 3: Circuit Breakers | | | 15 Hrs |
| Fault clearing process - Theory of arcing and arc quenching - Circuit breakers and its classification - Minimum oil, Air blast,SF6 and Vacuum circuit breakers - Case studies on SF6 and Vacuum circuit breaker - RRRV, current chopping, interruption of capacitive current, Resistor switching - Introduction of miniature circuit breakers, Molded case circuit breakers, Solid state and Hybrid circuit breakers. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Paul M. Anderson, Charles Henville, Rasheek Rifaat, Brian Johnson and Sakis Meliopoulos, "Power System Protection", IEEE Press, Wiley, Second Edition, 2022. | | |
| 2 | Badri Ram, Vishwakarma "Power System Protection and Switchgear" Tata McGraw Hill, 2011. | | |
| 3 | B. Ravindranath and N. Chander, "Power System Protection & Switchgear", New Age Publishers, 2010. | | |
| 4 | Y.G Paithangar, "Fundamentals of Power System Protection" PHI learning Pvt Ltd, Second Edition, 2010. | | |
| Reference Books: | | | |
| 1 | Omar Salah Elsayed Atwa, Practical Power System and Protective Relays Commissioning. Academic Press. Elsevier. 2019. | | |

| | |
|------------------------|--|
| 2 | Ramesh Bansal, "Power System Protection in Smart Grid Environment", Taylor and Francis, CRC Press, 2019. |
| 3 | C.L. Wadhwa, "Electrical Power Systems", New Age International (P) Ltd., 2017. |
| 4 | V.K Mehta and Rohit Mehta, "Principle of Power System", S Chand, reprint 2010. |
| Web References: | |
| 1 | https://www.youtube.com/watch?v=khgdMht9X8A |
| 2 | https://www.youtube.com/watch?v=id72r7QuGaM |
| 3 | https://www.youtube.com/watch?v=iL9m354sHWs |
| 4 | https://www.youtube.com/watch?v=8OVyLscA4fs |
| 5 | https://www.youtube.com/watch?v=oj1NwZL01io |

| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | End Semester Examination | Total |
|----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C701.1 | Understand | Online Quiz | 20 |
| C701.2 | Analyse | Assignment | 20 |
| C701.3 | Apply | Technical Presentation | 20 |
| C701.4 | Understand | Case Study | 20 |
| C701.5 | Analyse | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 20 | 30 |
| Apply | 10 | 20 | 30 |
| Analyse | 40 | 60 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|------------------|--------------------------|---------|---------|---------|----------|--------------------------|---------|---------|---------|----------|----------|------------------------|----------|----------|----------|
| C701.1 | 2 | 1 | | | | | 1 | | | | | | 3 | | |
| C701.2 | 2 | 1 | | | | | 1 | | | | | | 3 | | |
| C701.3 | 3 | 2 | 1 | 1 | | | 1 | | | | | | 3 | | |
| C701.4 | 2 | 1 | | | | | | | | 2 | | | 3 | | |
| C701.5 | 2 | 1 | | | | | 1 | | | 2 | | | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|------------------------|---------|
| 21MG701 | Engineering Economics | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To make the students understand the role of macro and micro Economics for business applications. | | |
| 2 | To familiarize the students about the cost behaviour in short and long run. | | |
| 3 | To expose the students to the methods of investment analysis. | | |
| 4 | To provide the students with an insight in to Indian and International Economics. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C701.1 | Understand the needs, roles, scope of Engineering Economics. | | [U] |
| C701.2 | Analyse costs and their role in pricing. | | [A] |
| C701.3 | Understand the cost behaviour and cost calculations. | | [U] |
| C701.4 | Have working knowledge of investment analysis. | | [A] |
| C701.5 | Understand the external environment for industries in India and the basics of international business. | | [U] |
| Course Contents: | | | |
| Module 1: Introduction to Economics | | | 15 Hrs |
| Economics - Definition, Scope; Micro Economics; Macro Economics; Law of Demand; Law of supply; Types of efficiency- Technical efficiency, Economic efficiency; Types of costs fixed cost vs variable cost, Total cost, Average cost, Marginal cost, opportunity cost, Short run cost, Long run cost, Sunk cost Break - Even analysis. | | | |
| Module 2: Investment Analysis | | | 15 Hrs |
| Investment aim, purpose, considerations; Time value of money, Capital budgeting - meaning, purpose; Capital expenditure vs Revenue expenditure; Discount rate; Methods of evaluating project feasibility payback period method, Net present value method, Internal rate of return method, Profitability Index Method. Replacement and Maintenance Analysis Types of replacements, Types of maintenance, Determination of Economic life of an asset. | | | |
| Module 3: Indian and International Economics | | | 15 Hrs |
| Indian Economy Salient features, Planning for Economic - Development of India Five Year Plans, Objectives and achievements; Role of small scale industry, Liberalization, Privatization and Globalization (LPG), International Economics - International trade Purchasing Power Parity Theory; Free Trade Vs Protection; Terms of trade, Balance of Trade, Balance of payment, Exchange Rate Meaning, Factors affecting exchange rates. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Pannerselvam, R., "Engineering Economics, Prentice-Hall of India Pvt. Ltd, New Delhi, 2nd Edition, 2013. | | |
| 2 | Seema Singh, Economics for Engineering Students, I.K. International Publishing House, 2nd edition, 2014. | | |
| 3 | James L. Riggs, David D. Bedworth and Sabah. U. Randhawa, Engineering Economics, TMH Publication, 4th edition, reprint 2004. | | |
| Reference Books: | | | |
| 1 | Ruddar daff and K.P.M Sundharam, Indian Economy , S. Chand and Company Ltd, 66 th revised edition, 2015. | | |

| | |
|------------------------|---|
| 2 | Henry Thompson, International Economics , Cambridge University Press India Pvt Ltd, 3rd edition, 2011. |
| 3 | Ian Fraser, John Gionea and Simon Fraser, Economics for Business , Tata McGraw Hill Publication, 4th edition, 2011. |
| Web References: | |
| 1 | https://icmai.in/upload/Students/Syllabus2012/Study_Material_New/FoundationPaper1.pdf |
| 2 | http://fzp.ujep.cz/~vosatka/ERASMUS/Principles_of_Economics/Principles-of-Economics--Mankiw-(5th).pdf |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C701.1 | Understand | Online Quiz | 20 |
| C701.2 | Analyze | Case study | 20 |
| C701.3 | Understand | Technical Presentation | 20 |
| C701.4 | Analyze | Assignment | 20 |
| C701.5 | Understand | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 20 | 30 |
| Apply | 10 | 20 | 30 |
| Analyse | 40 | 60 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|------------------|-------------------|---------|---------|---------|---------|-------------------|---------|---------|---------|----------|----------|-----------------|----------|----------|----------|
| C701.1 | | | | | | 2 | | 2 | | 2 | 2 | 1 | | | |
| C701.2 | | | | | | 2 | | 2 | | 2 | 3 | 1 | | | |
| C701.3 | | | | | | 2 | | 2 | | 2 | 2 | 2 | | | |
| C701.4 | | | | | | 2 | | 2 | | 2 | 3 | 1 | | | |
| C701.5 | | | | | | 2 | | 2 | | 2 | 2 | 1 | | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|--|---------|
| 21EE702 | Digital Simulation for Electrical Systems Laboratory | | 0/0/2/1 |
| Nature of Course | | M (Practical Application) | |
| Course Pre-requisites | | Design of Electrical Machines, Power Electronics | |
| Course Objectives: | | | |
| 1 | To provide an opportunity to understand and analyze the operation and function of electrical components in the power system. | | |
| 2 | To impart the knowledge in design, modelling and simulation of Power Electronic Converter based systems used in renewable energy generation system. | | |
| 3 | To impart the knowledge in intelligent controllers used in hybrid power generation systems. | | |
| Course Outcomes Upon completion of the course, students shall have ability to | | | |
| C702.1 | Examine the performance and characteristics of transformer and DC motor. | [AP] | |
| C702.2 | Analyze the working of wind energy conversion system | [A] | |
| C702.3 | Analyze the performance characteristics of solar and fuel cell power generation system. | [A] | |
| C702.4 | Illustrate the working operation of standalone connected solar power system. | [A] | |
| C702.5 | Select the suitable simulation tool for analyzing the operation of power converters suitable for Hybrid (Solar-Wind) power system with the various intelligent controllers. | [AP] | |
| Course Contents | | | |
| S.No | List of Experiments | CO Mapping | BT |
| 1 | Performance analysis of Transformer and DC Motor using Motor solve software. | C702.1 | [AP] |
| 2 | Wind turbine emulation using DC motor. | C702.2 | [AP] |
| 3 | Maximum power point tracking of wind energy conversion systems. | C702.2 | [A] |
| 4 | Study of getting Solar radiation data and making record for particular location with Homer software. | C702.3 | [A] |
| 5 | Testing of inverter with Solar Photovoltaic Emulator input. | C702.3 | [A] |
| 6 | Performance assessment of 100W Fuel Cell. | C702.3 | [A] |
| 7 | VI-Characteristics and Efficiency of 1kWp Solar Photovoltaic System. | C702.4 | [A] |
| 8 | Performance assessment of Grid connected and Standalone 1kWp Solar Power System. | C702.4 | [A] |
| 9 | Simulation study on Hybrid (Solar-Wind) Power System. | C702.5 | [A] |
| 10 | Simulation study on Intelligent Controllers for Hybrid Systems. | C702.5 | [AP] |
| Total Hours | | | 30 |

| | |
|-------------------------|--|
| Text Books: | |
| 1. | Ned Mohan, Tore M. Undeland & William P. Robbins, "Power Electronics – Converters, Applications and Design", John Wiley & Sons edition 2011. |
| 2. | Weidong Xiao , Power Electronics Step –by Step: design, Modeling, Simulation and control, McGraw Hill, 2021. |
| 3. | P.S. Bhimbra, "Power Electronics", Khanna Publishers edition 2018. |
| Reference Books: | |
| 1. | Hedaya Mamood Alasooly, Some power Electronics Case Studies using Matlab Simpower system Blockset, BookRix, 2020. |
| 2. | Bimal K. Bose, "Modern Power Electronics & AC Drives", Pearson, 2015. |
| Web References: | |

| | |
|----|---|
| 1. | https://onlinecourses.nptel.ac.in/noc20_ee28/preview |
| 2. | https://nptel.ac.in/courses/121106014 |
| 3. | https://in.mathworks.com/videos/developing-dc-dc-converter-control-with-simulink-automatically-generating-controller-code-for-implementation-on-embedded-processor1535540362783.html |
| 4. | https://nptel.ac.in/courses/103107157 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 75 | 25 | 100 | 60 | 40 | 100 |

| Assessment based on Continuous and End Semester Examination | | | |
|---|--|------------------|--|
| Bloom's Level | Continuous Assessment (60%) [100 Marks] | | End Semester Practical Examination (40%) [100 Marks] |
| | FA (75 Marks) | SA (25 Marks) | |
| Remember | 0 | 0 | 0 |
| Understand | 20 | 20 | 20 |
| Apply | 20 | 30 | 30 |
| Analyse | 30 | 30 | 30 |
| Evaluate | 0 | 0 | 0 |
| Create | 20 | 20 | 20 |

| Course Articulation Matrix (Laboratory) | | | | | | | | | | | | | | | |
|---|-------------------|------|------|------|------|------|-------------------|------|------|-------|-------|-----------------|-------|-------|-------|
| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
| C702.1 | 2 | 1 | | | 3 | | | | | | | | 3 | 2 | |
| C702.2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | 2 | 3 | 3 | |
| C702.3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | 1 | 3 | 3 | |
| C702.4 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | | 2 | | 2 | 2 | 3 | 3 | |
| C702.5 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | | | | 2 | 3 | 2 | 2 | |
| 1 | Reasonably agreed | | | | | 2 | Moderately agreed | | | | 3 | Strongly agreed | | | |



PROFESSIONAL ELECTIVES

| | | | |
|---|--|--|-------------|
| 21EE901 | Smart Grid Technology | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Generation, Transmission and Distribution, Power System Analysis | |
| Course Objectives: | | | |
| 1 | To study the concept, benefit and function of smart grid and its international view on smart grid. | | |
| 2 | To learn smart grid technologies, smart meters and advanced metering infrastructure. | | |
| 3 | To know the power quality management issues in smart grid. | | |
| 4 | To realize the high performance computing for smart grid applications. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C901.1 | Interpret the functions, policies and challenges of smart grid | | [U] |
| C901.2 | Examine the role of automation in transmission and distribution systems. | | [A] |
| C901.3 | Infer the impacts of PHEV, big data and cyber security in smart grid. | | [AP] |
| C901.4 | Analyze the power quality management issues using smart meters. | | [A] |
| C901.5 | Illustrate the operation and importance of PMUs, IED and AMI in Micro Grids. | | [AP] |
| Course Contents: | | | |
| Module 1: Introduction | | 12 Hrs | |
| Introduction to smart grid- Difference between conventional grid and smart grid, Concept of resilient and self-Healing grid, need, benefits and functions of Smart grid and micro grid, opportunities and challenges of smart grid Electricity. Present development and international policies of smart grid. National and International Standards of Smart grid. | | | |
| Module 2: Smart Grid Technologies | | 15 Hrs | |
| Smart energy resources, Smart substations, Substation Automation, Feeder Automation, eStorage. Transmission systems: EMS, FACTS and HVDC, Wide area monitoring Protection and control - DMS, Volt/VAR control, Fault Detection, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers. Plugin Hybrid Electric Vehicles (PHEV): Role of big data and IoT, Cyber Security for Smart Grid. Impacts of Smart Grid. | | | |
| Module 3: Smart Grid components and Power quality management | | 18 Hrs | |
| Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, Phasor Measurement Unit (PMU), Intelligent Electronic Devices (IED) and their applications for monitoring and protection. Power Quality and EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources; Power Quality Conditioners for Smart Grid, Web based Power Quality Monitoring- Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Basics of Web Service and CLOUD Computing for Smart Grids. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | Janaka Ekanayake, Kithsiri Liyanage, Jianzhong.Wu, AkihikoYokoyama, Nick Jenkins, "Smart Grid: Technology and Applications", Wiley Publications, 2013. | | |
| 2 | James Momoh, "Smart Grid: Fundamentals of Design and Analysis",Wiley Publications, 2012. | | |
| 3 | Nouredine Hadjsaïd, Jean-Claude Sabonnadière, "Smart Grids", Wiley-ISTE, May 2012. | | |
| Reference Books: | | | |
| 1 | Lars T. Berger, Krzysztof Iniewski,"Smart Grid Applications, Communications, and Security", Wiley Publications,2015. | | |
| 2 | Chen-chingg Liu,Stephen McArthur and Seung-Jae Lee, "Smart Grid Handbook", 3 volume Set, Wiley-Blackwell publications, 2016. | | |
| 3 | Salman K. Salman "Introduction to the Smart Grid: Concepts, Technologies and Evolution",Institute of Engineering and Technology publications, 2017. | | |

| Web References: | |
|-----------------|---|
| 1 | http://whatis.techtarget.com/reference/Smart-Grid-Technology-Overview |
| 2 | https://nptel.ac.in/courses/108107113/ |
| 3 | https://www.youtube.com/watchv=dD1vybH-uFI |
| 4 | https://www.youtube.com/watchv=rHZ557mu7D0 |
| 5 | https://www.youtube.com/watchv=1OWRsAUmDo8 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C901.1 | Understand | Online Quiz | 20 |
| C901.2 | Analyse | Technical Presentation | 20 |
| C901.3 | Apply | Assignment | 20 |
| C901.4 | Analyse | Case Study | 20 |
| C901.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 20 |
| Understand | 20 | 20 | 20 |
| Apply | 10 | 40 | 40 |
| Analyse | 60 | 40 | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C901.1 | 2 | 1 | 1 | | | | | | | | | | 2 | | |
| C901.2 | 3 | 3 | 2 | 2 | | | | 1 | 2 | 2 | 2 | | 3 | | |
| C901.3 | 3 | 2 | 2 | 2 | | | | | | 2 | | | 3 | | |
| C901.4 | 3 | 2 | 1 | 2 | 2 | | 2 | | | 1 | | 1 | 3 | 2 | 2 |
| C901.5 | 3 | 2 | 1 | 1 | 3 | | | | | 1 | | 2 | 3 | 2 | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|--|-------------|
| 21EE902 | Power System Restructuring | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Generation, Transmission and Distribution, Power System Analysis | |
| Course Objectives: | | | |
| 1 | To provide in-depth understanding of operation of deregulated electricity market systems. | | |
| 2 | To examine typical issues in electricity markets worldwide. | | |
| 3 | To analyze various types of electricity market operational and control issues using new mathematical models. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C902.1 | Interpret the various types of deregulated electricity market operational and control issues. | | [U] |
| C902.2 | Infer the various role of ISO in deregulated environment energy market. | | [AP] |
| C902.3 | Analyze the operation of security, congestion and power management in deregulated energy system. | | [A] |
| C902.4 | Apply the reactive power management with deregulated electricity market Systems | | [AP] |
| C902.5 | Analyze the interruption values and reliability analysis for implementation in power system network. | | [A] |
| Course Contents: | | | |
| Module 1: Overview of Deregulation | | | 18 Hrs |
| Deregulation, Reconfiguring Power systems, unbundling of electric utilities, Background to deregulation and the current situation around the world, benefits from a competitive electricity market after effects of deregulation. Role of the independent system operator, Operational planning activities of ISO: ISO in Pool markets, ISO in Bilateral markets, Operational planning activities of a GENCO: Genco in Pool and Bilateral markets, market participation issues, competitive bidding. Power wheeling- Types of wheeling transactions- Transmission open access and types-Cost components in transmission- pricing of power transactions- Ideal Wheeling Rate. | | | |
| Module 2: Deregulation Management | | | 15 Hrs |
| Power wheeling, Transmission open access, pricing of power transactions, security management in deregulated environment, and congestion management in deregulation. General description of some ancillary services, ancillary services management in various countries, and reactive power management in some deregulated electricity markets. | | | |
| Module 3: Interruption and Reliability Analysis | | | 12 Hrs |
| Interruption criterion, stochastic components, component models, Calculation methods, Network model: stochastic networks, series and parallel connections, minimum cut sets, reliability cost. Generation, transmission and distribution reliability, Reliability and deregulation: conflict, reliability analysis, effects on the actual reliability, regulation of the market. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | K. Bhattacharya, MHT Bollen and J.C Doolder, "Operation of Restructured Power Systems", Kluwer Academic Publishers, USA, 2010. | | |
| 2 | Lei Lee Lai, "Power System restructuring and deregulation", John Wiley and Sons, UK. 2013. | | |
| 3 | Electrical Power Systems: Analysis, Security and Deregulation Second Edition P. Venkatesh, B.V. Manikandan, S. Charles Raja , A. Srinivasan, 2017. | | |
| Reference Books: | | | |
| 1 | Mohammad Shahidehpour and Muwaffaq Alomoush, "Restructured electrical power systems: operation, trading and volatility", Marcel Dekker Pub, 2013. | | |
| 2 | Abhijit Chakrabarti and Sunita Halder, "Power System Analysis Operation and Control", 3rdEd., PHI Publications.2010 | | |

| | |
|------------------------|--|
| 3 | Steven Stoft, "Power system economics: designing markets for electricity", John Wiley and Sons, 2011. |
| 4 | Fred I Denny and David E. Dismukes, "Power System Operations and Electricity Markets", CRC Press, LLC, 2012. |
| Web References: | |
| 1 | http://www.iexindia.com/ |
| 2 | http://www.powerexindia.com/ |
| 3 | http://www.cercind.gov.in/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C902.1 | Understand | Online Quiz | 20 |
| C902.2 | Apply | Technical Presentation | 20 |
| C902.3 | Analyse | Assignment | 20 |
| C902.4 | Apply | Case Study | 20 |
| C902.5 | Analyse | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 20 |
| Understand | 40 | 20 | 20 |
| Apply | 10 | 20 | 30 |
| Analyse | 40 | 60 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C902.1 | 2 | 1 | | | | | | 2 | | | | | 3 | 2 | 2 |
| C902.2 | 3 | 3 | 2 | 2 | | | | 2 | | | | | 3 | 2 | 2 |
| C902.3 | 3 | 3 | 2 | 2 | | | | 2 | | | | | 3 | 2 | 2 |
| C902.4 | 3 | 3 | 2 | 2 | | | | 2 | | | | | 3 | 2 | 2 |
| C902.5 | 3 | 2 | 1 | 1 | | | | 2 | | | | | 3 | 2 | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|------|---------|
| 21EE903 | Energy Auditing, Conservation and Management | | 3/0/0/3 |
| Nature of Course | G (Theory Analytical) | | |
| Pre-requisites | Power System, Transmission and Distribution | | |
| Course Objectives: | | | |
| 1 | To introduce the outline of Energy Management Systems (EMS). | | |
| 2 | To understand the scope of energy savings in residential sector, industries and commercial establishments. | | |
| 3 | To analyze the concept of New energy saving technologies and products in the market. | | |
| 4 | To apply the knowledge of thermodynamic principles, usage of thermal insulation in buildings, lighting devices and electric motors. | | |
| 5 | To accomplish the energy conservation is better to meet demand than constructing new power plant. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C903.1 | Demonstrate the energy consumption, energy saving potentials and perceive knowledge about Climate change risk, building codes, renewable and Net zero concepts. | [U] | |
| C903.2 | Comprehend the role of energy managers in industries, energy management motivation. | [E] | |
| C903.3 | Evaluate total Energy systems in energy audit. | [A] | |
| C903.4 | Analyze the concepts of energy conservation in Centrifugal Pumps, Fans & Blowers, Air Compressor and Distribution System. | [AP] | |
| C903.5 | Articulate the function of Bureau of energy efficiency and the importance of energy efficient appliances. | [AP] | |
| Course Contents: | | | |
| Module 1: Energy Scenario and Conservation | | | 12 Hrs |
| Energy Scenario - Energy conservation and its importance- Energy Conservation Act-2001 and its features. Climate Change Risks - Economics of various Energy Conservation schemes -ECBC 2017 (Energy Conservation Building Code)-Renewable Energy and Net Zero Buildings. | | | |
| Module 2: Energy Systems, Management and Auditing | | | 18 Hrs |
| Energy monitoring, auditing & targeting - Role of Energy Managers in Industries - Energy auditing - needs & types - energy audit instruments - Energy management approach understanding energy costs, bench marking, energy performance-maximizing system efficiencies - Simple Payback calculation. | | | |
| Module 3: Energy Efficiency and Case studies | | | 15 Hrs |
| Bureau of Energy Efficiency- Efficiency and its role - Energy efficient motors, Centrifugal pumps, Fans & Blowers, Air compressor - energy efficient transformers - energy efficiency in lighting Efficiency improvement in distribution system - Soft starters with energy saver - Case studies. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, 'Guide to Energy Management', 8th Edition, The Fairmont Press, Inc., 2016. | | |
| 2 | Energy Audit Manual-The Practitioner's Guide by NPC and EMC, Kerala (2017) | | |
| 3 | General aspect of energy management and energy audit, Fourth Edition 2015, by Bureau of Energy Efficiency, Ministry of Power, India. | | |
| Reference Books: | | | |
| 1 | Hossam A. Gabbar, "Energy Conservation in Residential, Commercial, and Industrial Facilities", Wiley-IEEE Press, 1st edition, 2018 | | |
| 2 | Turner .W.C, "Energy Management Handbook", 8th Edition, 2012. | | |
| 3 | John D Mc Donald, "Electric Power Substation Engineering" CRC Press, 3rd edition, 2012. | | |

| Web References: | |
|-----------------|---|
| 1 | http://nptel.ac.in/video.php subject Id=108102047 . |
| 2 | http://textofvideo.nptel.iitm.ac.in/108102047/lec20.pdf . |
| 3 | https://www.edx.org/course/Energy management system . |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|----------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C903.1 | Understand | Assignment | 20 |
| C903.2 | Evaluate | Class Presentation | 20 |
| C903.3 | Analyze | Case Study | 20 |
| C903.4 | Apply | Online Quiz | 20 |
| C903.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | | Component - II (20 Marks) |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|--------------------------|-----|-----|-----|----------|--------------------------|-----|-----|-----|------|----------|------------------------|------|------|------|
| C903.1 | 2 | 1 | 1 | | | | | | | | | | 2 | | |
| C903.2 | 3 | 3 | 2 | 2 | | | | 1 | 2 | 2 | 2 | | 3 | | |
| C903.3 | 3 | 2 | 2 | 2 | | | | | | 2 | | | 3 | | |
| C903.4 | 3 | 2 | 1 | 2 | 2 | | 2 | | | 1 | | 1 | 3 | 2 | 2 |
| C903.5 | 3 | 2 | 1 | 1 | 3 | | | | | 1 | | 2 | 3 | 2 | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|--|-------------|
| 21EE904 | Power System Operation and Control | | 3/0/0/3 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | Generation, Transmission and Distribution, Power System Analysis | |
| Course Objectives: | | | |
| 1 | To understand the economics of power system operation and planning. | | |
| 2 | To realize the requirements and methods of real and reactive power control in power system. | | |
| 3 | To recognize the recent advancements in power system operation | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C904.1 | Infer the types of Electrical Tariff and Pricing Structure | | [U] |
| C904.2 | Develop generation dispatching schemes for conventional power systems. | | [AP] |
| C904.3 | Appraise frequency, voltage and reactive power control schemes on power system. | | [A] |
| C904.4 | Illustrate the computer control concepts of power systems using SCADA, EMS and PMU functions. | | [A] |
| C904.5 | Interpret smart grid integration in power systems. | | [U] |
| Course Contents: | | | |
| Module 1: Power System Operation and Control | | | 18 Hrs |
| Load curves and forecasting - load factor, demand factor, diversity factor, capacity factor, Utilization factor - Types of Electrical Tariff - Economic decision making in power system planning - Economic Dispatch and Unit Commitment - General problem formulation and constraints, Offer and locational marginal pricing based dispatch, Solution methods - Economic Scheduling using MATLAB. | | | |
| Module 2: Real Power, Reactive Power, Voltage and Frequency Control | | | 18 Hrs |
| Load frequency control of single area and two area systems - Tie line bias control - Automatic Voltage Regulator and its dynamics - Mathematical model of speed-governing system - Turbine models, division of power system into control areas, P-f control of single control area (the uncontrolled and controlled cases) - P-F control of two area systems (the uncontrolled cases and controlled cases) - General concepts of series and shunt compensation – Introduction to FACTS. | | | |
| Module 3: Computer Control of Power Systems | | | 9 Hrs |
| Need of computer control of power systems. Overview of Protocols - Modbus, Distributed Network Protocol (DNP), IEC 870-5 and 60870 series, Benefits from the IEC (International Electro technical Commission) communication Standards. Concept of energy control centre (or) load dispatch centre and the functions, SCADA, EMS and PMU functions. Network topology determination, state estimation, security analysis and control. Various operating states: State transition diagram showing various state transitions and control strategies. Smart grid integration. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | Allen J. Wood, Bruce F. Wollenberg and Gerald B Sheble, 'Power Generation, Operation, and Control', John Wiley and Sons, 3rd Edition, 2014. | | |
| 2 | Steven Stoft, 'Power system economics', Wiley India, 2002. | | |
| 3 | Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis- Operation and Control', PHI New Delhi, 3rd Edition, 2010. | | |
| Reference Books: | | | |
| 1 | Robert H. Miller, James H. Malinowski, 'Power System Operation', Tata McGraw Hill, 2nd Edition, 2009. | | |
| 2 | Daniel Kirschen and Goran Strbac, 'Fundamentals of Power System Economics', John Wiley, 2004. | | |
| 3 | Nikos Hatziaargyrio, 'Microgrids – Architectures and Control', Wiley-IEEE Press, 2014. | | |
| Web References: | | | |
| 1 | https://nptel.ac.in/courses/108/104/108104052/ | | |
| 2 | https://www.youtube.com/watch?v=JRbk0_Klhr4 | | |

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|---|---|
| 3 | https://www.youtube.com/watch?v=3l_UN9TQ1Qg |
| 4 | https://www.youtube.com/watch?v=qqdQqtUp2vw |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C904.1 | Understand | Online Quiz | 20 |
| C904.2 | Apply | Technical Presentation | 20 |
| C904.3 | Analyze | Assignment | 20 |
| C904.4 | Analyze | Simulation Exercises | 20 |
| C904.5 | Understand | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 20 | 30 |
| Apply | 30 | 20 | 30 |
| Analyse | 20 | 60 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|------------------|--------------------------|---------|---------|---------|----------|--------------------------|---------|---------|---------|----------|----------|------------------------|----------|----------|----------|
| C904.1 | 2 | 1 | | | | | | | | | | | 3 | | |
| C904.2 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | | |
| C904.3 | 3 | 3 | 2 | 2 | | | | | | 2 | | | 3 | | |
| C904.4 | 2 | 1 | | | | | | | | | | | 3 | | |
| C904.5 | 2 | 1 | | | | | | | | | | | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | |
|---|---|---------|
| 21EE905 | Power Quality | 3/0/0/3 |
| Nature of Course | G (Theory Analytical) | |
| Pre-requisites | Power System Analysis | |
| Course Objectives: | | |
| 1 | To introduce the power quality problem and educate on production of voltages sags, over voltages, harmonics and methods of control. | |
| 2 | To study overvoltage problems, sources and effect of harmonics in power system. | |
| 3 | To impart knowledge on various methods of power quality monitoring. | |
| Course Outcomes: | | |
| Upon completion of the course, students shall have ability to | | |
| C905.1 | Describe the importance of power quality. | [U] |
| C905.2 | Analyze the impact of voltage sags and interruptions in power system. | [A] |
| C905.3 | Analyze the problems on over voltages in power system. | [A] |
| C905.4 | Analyze the effect of harmonics in power system. | [A] |
| C905.5 | Apply the various methods of power quality monitoring and techniques. | [AP] |
| Course Contents: | | |
| Module 1: Introduction to Power Quality 12 Hrs | | |
| Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients. Long and short duration interruption Sags and swells - voltage sag - voltage swell - voltage imbalance -voltage fluctuation - power frequency variations. International standards of power quality: Limits and regulations. Computer Business Equipment Manufacturers Associations (CBEMA) curve - ITI curve. | | |
| Module 2: Voltage Sags, Interruptions and Over Voltages 15 Hrs | | |
| Sources of sags and interruptions - estimating voltage sag performance. Analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Analysis of voltage sag estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches. Sources of over voltages - Capacitor switching – lightning – Ferro resonance. Mitigation of voltage swells - surge arresters -low pass filters - power conditioners. Lightning protection – shielding – line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients - ETAP, Dig silent Power Factory and EMTP. | | |
| Module 3: Harmonics and Power Quality Monitoring 18 Hrs | | |
| Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion – voltage and current distortion - harmonic indices - inter harmonics – Infraction harmonics. Harmonics with distortion factor and true power factor. IEEE 519-2014 and IEEE 3002.8-2018 standards. Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - Solution for power quality problems using simulation tools -power line disturbance analyzer - quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring. | | |
| Total Hours | | 45 |
| Text Books: | | |
| 1 | Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.WayneBeaty, “Electrical Power Systems Quality” McGraw Hill,2017. | |
| 2 | Eswald.F.Fudis and M.A.S.Masoum, “Power Quality in Power System and Electrical Machines,” Elseviar Academic Press, 2015. | |
| 3 | P J. Arrillaga, N.R. Watson, S. Chen, “Power System Quality Assessment”, Wiley, 2011. | |
| Reference Books: | | |
| 1 | G.T. Heydt, “Electric Power Quality”, 2nd Edition. West Lafayette, IN, Starsin a Circle Publications , 2009. | |

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|------------------------|---|
| 2 | M.H.J Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", New York: IEEE Press, 2013. |
| 3 | Bhim Singh, Ambrish Chandra and Kamal Al-Haddad, "Power Quality: Problems and mitigation Techniques", Wiley 2015. |
| 4 | G.J.Wakileh, "Power Systems Harmonics – Fundamentals, Analysis and Filter Design," Springer 2007. |
| Web References: | |
| 1 | https://nptel.ac.in/courses/108102179 |
| 2 | https://nptel.ac.in/courses/108107157 |
| 3 | http://nptel.ac.in/courses/108106025/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C905.1 | Understand | Online Quiz | 20 |
| C905.2 | Analyze | Technical Presentation | 20 |
| C905.3 | Analyze | Case Study | 20 |
| C905.4 | Analyze | Assignment | 20 |
| C905.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|-------------------|-----|-----|-----|-----|-------------------|-----|-----|-----|------|------|-----------------|------|------|------|
| C905.1 | 2 | | | | | | | | | | | 1 | 1 | | |
| C905.2 | 3 | 3 | 2 | 2 | | 1 | 2 | | | | | | 1 | | |
| C905.3 | 3 | 3 | 2 | 2 | | 2 | 2 | 1 | 1 | | | 1 | 2 | | 1 |
| C905.4 | 3 | 3 | 2 | 2 | | 2 | 2 | 1 | 1 | | | 1 | 3 | | 1 |
| C905.5 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | | | 1 | 2 | | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|---|---------|
| 21EE906 | High Voltage Engineering | | 3/0/0/3 |
| Nature of Course | | G (Theory analytical) | |
| Pre-requisites | | Generation, Transmission and Distribution | |
| Course Objectives: | | | |
| 1 | To expose the students to the basic causes of over voltages in power systems. | | |
| 2 | To describe the fundamentals of breakdown and partial discharge in insulating solid and gas at high voltages. | | |
| 3 | To understand the generation and measurement of high voltages and currents. | | |
| 4 | To understand the concepts of high voltage testing. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C906.1 | Identify the causes and types of overvoltage. | [U] | |
| C906.2 | Examine international standards of designing and testing. | [A] | |
| C906.3 | Infer various breakdown phenomena occurring in gaseous, liquid and solid dielectrics. | [U] | |
| C906.4 | Examine the different methods of generating various high voltages and currents. | [A] | |
| C906.5 | Infer the different methods of measuring various high voltages and currents with digital techniques. | [AP] | |
| Course Contents: | | | |
| Module 1: Causes of Over Voltages and High Voltage Testing 15 Hrs Causes of Over Voltages and its effect on Power System – Lightning, Switching Surges and Temporary Over Voltages – Insulation Co-ordination. High voltage testing of Electrical Power apparatus – Power Frequency, Impulse Voltage and DC testing – International and Indian standards – Design, Planning and Layout of High Voltage Laboratory. | | | |
| Module 2: Electrical Breakdown in Gases, Solids and Liquids 10 Hrs Basic Gaseous breakdown in Uniform and Non-Uniform Fields – Corona Discharges – Vacuum breakdown - Conduction and Breakdown in Pure and Commercial Liquids – breakdown mechanisms in Solid and Composite dielectrics. Modern Power Systems protection devices, MOA – Metal Oxide Arresters | | | |
| Module 3: Generation and Measurement of High Voltages 20 Hrs Generation of High DC, AC, Impulse Voltages and Currents. Tripping and control of Impulse Generators. High Voltage DC: Rectifier circuits, Voltage Multipliers, Van-de-graph and Electrostatic Generators. High Voltage AC: Cascaded transformers and Tesla coils. Measurement of High voltages and High Currents and Impulse Current using Sphere Gaps, Peak Voltmeters, Potential Dividers, high speed CRO – Digital techniques in High Voltage Measurement. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | C.L.Wadhwa, “High Voltage Engineering”, III Edition New Age International, 2012. | | |
| 2 | Subir Ray, “An Introduction to High Voltage Engineering”, PHI Learning Private Limited, New Delhi, Second Edition, 2013 | | |
| 3 | L.L. Alston, “High Voltage Technology”, Oxford University Press, First Indian Edition, 2011. | | |
| Reference Books: | | | |
| 1 | Rakosh Das Begamudre, “High Voltage engineering, Problems and Solutions”, New Age International Publications, 2010. | | |
| 2 | Naidu, M.S. and Kamaraju,V., 'High Voltage Engineering', 4th Edition, Tata McGraw- Hill Publishing Company, New Delhi,6th Edition, 2020. | | |
| Web References: | | | |
| 1 | http://nptel.ac.in/courses/108104048/ui/Course_home1_1.html | | |

| | |
|---|---|
| 2 | http://www.electrical-engineering-portal.com |
| 3 | https://www.youtube.com/watch?v=qqdQqtUp2vw |
| 4 | https://www.youtube.com/watch?v=JRbk0_Klhr4 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
|----------------|---------------|------------------------|---------------------|
| C906.1 | Understand | Online Quiz | 20 |
| C906.2 | Analyze | Case Study | 20 |
| C906.3 | Understand | Assignment | 20 |
| C906.4 | Analyze | | |
| C906.5 | Apply | Technical Presentation | 20 |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | - | - | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 50 | 50 | 40 |
| Evaluate | - | - | - |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C906.1 | 3 | 2 | | | | | | | | | | 1 | 1 | | 1 |
| C906.2 | 3 | 2 | 2 | 2 | 2 | | | | | | | | 2 | | 3 |
| C906.3 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | | 2 |
| C906.4 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | | 3 |
| C906.5 | 3 | 2 | 3 | 2 | | | | | | | | | 3 | | 3 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|------------------------|---------|
| 21EE907 | Renewable Energy and Storage Systems | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Power System | |
| Course Objectives: | | | |
| 1 | To study different non-conventional energy systems and its applications. | | |
| 2 | To enhance student's knowledge and assimilate new technologies. | | |
| 3 | To learn techno-economical storage methods of renewable energy systems. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C907.1 | Enumerate the need of renewable energy and analyze the energy scenario in India and Integrated Resource Plan. | | [U] |
| C907.2 | Assess the role of Solar and wind energy in power plants. | | [A] |
| C907.3 | Apply the ideas of renewable energy sources to perform case studies. | | [AP] |
| C907.4 | Assess the role of biomass, tidal and geothermal in power plants. | | [A] |
| C907.5 | Illustrate the operation and importance of different energy storage methods. | | [U] |
| C907.6 | Investigate the integration of renewable energy systems in Power plants. | | [AP] |
| Course Contents: | | | |
| Module 1: Introduction | | 15 Hrs | |
| Over View of Conventional Power Plants - Importance of Sustainable energy source - Types of Sustainable Energy sources - Limitations of Sustainable Energy sources - Present Indian and international energy scenario of conventional and sustainable energy sources - Kyoto protocol - Concept of clean development mechanism and proto type carbon funds - Integrated resource plan. | | | |
| Module 2: Wind Energy and Solar Energy | | 15 Hrs | |
| Power in the Wind - Types of Wind Power Plants (WPPs) - Components of WPPs - Working of WPPs - Site selection of WPPs - Grid integration issues of WPPs. Solar Power, Radiation Measurement, Solar thermal, solar photovoltaic, Cells, Module and array types - series and parallel connections - Maximum power point tracking, grid interactive solar PV systems - Applications. Case studies on solar PV system, wind energy system. | | | |
| Module 3: Other Energy Sources and Storage Methods | | 15 Hrs | |
| Methods to generate - Biomass energy, tidal energy, geothermal energy, fuel cells and Ocean thermal energy conversion its applications - Storage methods of mechanical, chemical, electromagnetic, electrostatic and thermal energy - Selection and significance of Batteries - Hybrid energy systems and hybrid electric vehicles. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | John T widwell and Tony Weir, "Renewable Energy Resources",4 th Edition, Routledge, 2021. | | |
| 2 | B.H.Khan, "Non-Conventional Energy Resources",3 rd Edition, Tata McGraw Hill New Delhi, 2017. | | |
| 3 | G D Rai, „Non-conventional Energy sources“, Khanna Publishers, 5th Edition, 2014. | | |
| Reference Books: | | | |
| 1 | Sukhatme, "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017. | | |

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|------------------------|---|
| 2 | Aldo Vieira Da Rosa , “ Fundamentals of Renewable Energy Processes”, Academia Press ,2013 |
| 3 | G.Masters, “Renewable and Efficient Electric Power Systems”, IEEE-Wiley Publishers, 2013. |
| Web References: | |
| 1 | http://unfccc.int/kyoto_protocol/items/2830.php |
| 2 | https://www.coursera.org/learn/wind-energy |
| 3 | https://www.edx.org/course/solar-energy-delftx-et3034x-0 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms’ Taxonomy) | | | |
|---|---------------|----------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom’s Level | Assessment Component | FA (16%) [80 Marks] |
| C907.1 | Understand | Online Quiz | 20 |
| C907.2 | Analyze | Case Study | 20 |
| C907.3 | Apply | Assignment | 20 |
| C907.4 | Analyze | | |
| C907.5 | Understand | Simulation Exercises | 20 |
| C907.6 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom’s Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | - | - | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 50 | 50 | 40 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C907.1 | 2 | 1 | | | | 2 | 2 | 2 | | | | 1 | | | 1 |
| C907.2 | 3 | 3 | 2 | | | 2 | 3 | 1 | | | | 3 | 1 | 2 | 2 |
| C907.3 | 3 | 3 | 2 | 1 | | 2 | 3 | 1 | | 1 | | 3 | 1 | 2 | 1 |
| C907.4 | 3 | 3 | 2 | | | 2 | 3 | 1 | | | | 3 | 1 | 2 | 1 |
| C907.5 | 2 | 1 | | | | 2 | 3 | 1 | | | | 3 | 1 | 1 | 1 |
| C907.6 | 3 | 3 | 2 | 1 | | 2 | 3 | 1 | | 1 | | 3 | 1 | 2 | 1 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|------------------------|-------------|
| 21EE908 | Distribution Automation Systems | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Power System Analysis | |
| Course Objectives: | | | |
| 1 | To study the concept and basic control techniques involved in distribution automation. | | |
| 2 | To learn about the hardware used in DAS infrastructure. | | |
| 3 | To know the advanced distribution automation. | | |
| 4 | To realize the various communication systems involved in distribution automation. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C908.1 | Interpret the control techniques involved in distributed automation systems. | | [U] |
| C908.2 | Analyze the layouts of substations and feeders. | | [A] |
| C908.3 | Examine the load management and voltage management. | | [A] |
| C908.4 | Illustrate an appropriate method of communication for the distribution system automation. | | [AP] |
| C908.5 | Investigate the economic aspects of distribution system with automation. | | [U] |
| Course Contents: | | | |
| Module 1: Introduction to Distribution Automation | | | 15 Hrs |
| Introduction to Distribution Automation, Control System Interfaces, Control and Data requirements, Centralized (Vs) Decentralized Control, Distribution Automation System, DAS Hardware, DAS Software, DA Capabilities, Automation system computer facilities. Commercially Available Distribution Automation Systems. | | | |
| Module 2: Components of Distribution Automation Systems | | | 15 Hrs |
| Layout of substations and feeders - design considerations. Distribution system load flow - optimal siting and sizing of substations - optimal capacitor placement. Distribution system monitoring and control - SCADA, Remote metering and load control strategies - Optimum feeder switching. Advanced Distribution Automation. | | | |
| Module 3: Communication Topologies | | | 15 Hrs |
| DA Communication Requirements - reliability, Cost Effectiveness, Data Rate Requirements, Two Way Capability - outages and faults, Ease of operation and maintenance - Communication Systems used - Distribution line carrier (Power line carrier), Telephone, Cable TV, Radio, AM Broadcast, FM SCA, VHF Radio, UHF Radio etc. Applications of IEC 61850 in distribution automation. Microwave, Satellite, Fiber Optics, Hybrid Communication system, Example in field tests. Impact of DA on Distribution systems. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | James A. Momoh, 'Electric Power Distribution, Automation, Protection, and Control', CRC Press, 2017. | | |
| 2 | James Northcote-Green, Robert Wilson, Control and Automation of Electrical Power Distribution Systems – CRC Press – 2017 | | |
| 3 | Nouredine Hadjsaïd, Jean-Claude Sabonnadière, "Smart Grids", Wiley-ISTE, May 2012. | | |
| Reference Books: | | | |
| 1 | Turan Gonen., 'Electric Power Distribution System Engineering', BSP Books, Pvt. Ltd 2007. | | |
| 2 | Electric Power Generation, Transmission, and Distribution, Third Edition 2012 by Leonard L. Grigsby. | | |
| Web References: | | | |
| 1 | IEEE Working Group on 'Distribution Automation' -2008. 201. | | |
| 2 | https://www.sgrwin.com/basic-understanding-iec-61850/ . | | |
| 3 | https://www.alstom.com/press-releases-news/2015/1/alstoms-substation-automation-solutions-sas-business-unveils-new-dap-io-modules-for-smart-grid-applications . | | |
| 4 | https://www.ge.com/digital/applications/advanced-distribution-management-solutions-adms | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
|----------------|---------------|------------------------|------------------------|
| C908.1 | Understand | Online Quiz | 20 |
| C908.2 | Analyse | Technical Presentation | 20 |
| C908.3 | Analyse | Assignment | 20 |
| C908.4 | Apply | Case Study | 20 |
| C908.5 | Understand | | |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|---|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 20 |
| Understand | 40 | 20 | 30 |
| Apply | 10 | 20 | 20 |
| Analyse | 40 | 60 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C908.1 | 2 | 1 | 1 | | | | | | | | | | 2 | | |
| C908.2 | 2 | 3 | 2 | 2 | | | | 1 | 2 | 2 | 2 | | 3 | | |
| C908.3 | 3 | 2 | 2 | 2 | | | | | | 2 | | | 3 | | |
| C908.4 | 2 | 2 | 1 | 2 | 2 | | 2 | | | 1 | | 2 | 3 | 2 | 2 |
| C908.5 | 3 | 2 | 1 | 2 | 3 | | | | | 1 | | 2 | 3 | 2 | 3 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|--|---------|
| 21EE909 | HVDC Transmission Systems | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Pre-requisites | | Generation, Transmission, and Distribution | |
| Course Objectives: | | | |
| 1 | To understand the concept, planning of DC power transmission, and comparison with AC power transmission. | | |
| 2 | To acquire knowledge about HVDC Converters and HVDC System Control. | | |
| 3 | To analyze the Harmonics of the HVDC system. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C909.1 | Summarize the basic concepts of AC and DC power transmission. | [U] | |
| C909.2 | Enumerate the configuration of converters in HVDC Transmission. | [U] | |
| C909.3 | Analysis of VSC topologies and firing schemes. | [A] | |
| C909.4 | Explain the Principles of DC link control, Firing angle control, Current and Extinction angle control for HVDC system. | [U] | |
| C909.5 | Analysis of AC and DC filters for Reactive power and Harmonic control in HVDC system. | [A] | |
| Course Contents: | | | |
| Module 1: Introduction to HVDC Transmission 15 Hrs | | | |
| Need for DC power transmission technology, Comparison of AC and DC Transmission, Components Description of HVDC transmission system, Types of HVDC System, Planning for HVDC Transmission Modern trends in HVDC Technology, HVDC Transmission Based on Voltage Source Converters and Line commutated converters, MTDC System-Types and applications of MTDC systems, Analysis of HVDC Converters - Analysis of Graetz circuit with and without overlap, Pulse number, Choice of converter configuration, Converter bridge characteristics, Multiple pulse Converters - Analysis of VSC and LCC topologies, Firing schemes. | | | |
| Module 2: HVDC System Control 15 Hrs | | | |
| Principles of DC-link control, Converter control characteristics, System control hierarchy, Firing angle control, Current and extinction angle control, Starting and stopping of DC Link, Power Control, Higher level controllers, Control of VSC-based HVDC link. Power Modulation: basic principles - synchronous and asynchronous links. Voltage Stability Problem in AC/DC systems. | | | |
| Module 3: Reactive Power and Harmonics Control 15 Hrs | | | |
| Principles of DC-link control, Converter control characteristics, System control hierarchy, Firing angle Reactive power requirements in steady-state - Sources of reactive power - SVC and STATCOM - Generation of harmonics - Design of AC and DC filters - Active filters. Per unit system for DC quantities - DC system model - Inclusion of constraints - Power flow analysis - Case study: Modern Trends in HVDC Technology. Introduction to Modular Multi-level Converters. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Padiyar, K. R., "HVDC Power Transmission System", New Age International (P) Ltd., New Delhi, Third Edition, 2017. | | |
| 2 | S Kamakshaia,h, V. Kamaraju., "HVDC Transmission" McGraw-Hill Education,2011 | | |
| Reference Books: | | | |
| 1 | Vijay K. Sood, Gil-Soo Jang, Seong-Joo Lim, Seok-Jin Lee, Chan-Ki Kim, "HVDC Transmission: Power Conversion Applications in Power Systems" Springer Publication. | | |

| | |
|------------------------|---|
| | 2013 |
| 2 | Dragan Jovcic, "High Voltage Direct Current Transmission: Converters, Systems and DC Grids", John Wiley & Sons Ltd, Second Edition, 2019 |
| 3 | Edwart, K., "Direct Current Transmission (Vol. 1)", John Wiley and Sons, 2008. |
| Web References: | |
| 1 | https://nptel.ac.in/courses/108104013/ |
| 2 | https://www.gegridsolutions.com/PowerD/catalog/hvdc.htm |
| 3 | https://www.youtube.com/watch?v=ZOTGuWCfS-A |
| 4 | https://www.youtube.com/watch?v=OMn653OhbLg |
| 5 | https://in.mathworks.com/videos/active-power-factor-correction-1546869199547.html |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C909.1 | Understand | Online Quiz | 20 |
| C909.2 | Understand | Case Study | 20 |
| C909.3 | Analyze | Assignment | 20 |
| C909.4 | Understand | Technical Presentation | 20 |
| C909.5 | Analyze | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|-------------------|-----|-----|-----|-----|-------------------|-----|-----|-----|------|------|-----------------|------|------|------|
| C909.1 | 2 | 1 | | | | | | | | | | 1 | 2 | | |
| C909.2 | 2 | 1 | | | | | | | | | | 2 | 2 | | |
| C909.3 | 3 | 3 | 2 | 2 | 1 | | | | | | | | 3 | 2 | 1 |
| C909.4 | 2 | 1 | | | | | | | | | | | 1 | 1 | |
| C909.5 | 3 | 3 | 2 | 2 | 1 | | | | | | | 1 | 2 | 1 | 1 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|---------------------------------|---------|
| 21EC941 | | Data Communication and Networks | 3/0/0/3 |
| Nature of Course | | C (Theory Concept) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To introduce the concept and technologies used in modern data communication and computer networking. | | |
| 2 | To introduce the various addressing mechanisms employed in computer networking | | |
| 3 | To understand the types and functions of transmission control protocols. | | |
| 4 | To allow students to get familiarized with the concepts behind the web and network security | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C941.1 | Understand the functions of OSI layered architecture and networking models. | | [R] |
| C941.2 | Understand the concept of different Error detecting techniques in data communications. | | [U] |
| C941.3 | Analyse the different routing algorithms and IP addressing modes in computer networks. | | [A] |
| C941.4 | Understand the concepts related to Congestion Control and QoS. | | [U] |
| C941.5 | Understand the concepts related to web Services. | | [U] |
| C941.6 | Employ the Cryptography algorithms in network security applications. | | [AP] |
| Course Contents: | | | |
| Module 1: Data Communications | | | 15 Hrs |
| Types of networks - Circuit Switching and Packet Switching - ISO / OSI model - Transmission Media - Coaxial Cable - Fiber Optics TCP/IP protocol suite. Flow Control and Error control - stop and wait - go back-N ARQ – selective repeat ARQ - sliding window - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 - FDDI. | | | |
| Module 2: Network, Transport and Application Layer | | | 15 Hrs |
| IP addressing methods – IPV4 – Next generation IP, IPV6, Subnetting - Routing - Distance Vector Routing - Link State Routing, Transport Layer Services –Multiplexing and Demultiplexing - User Datagram Protocol (UDP) - Principles of Reliable Data Transfer –Transmission Control Protocol (TCP), Congestion Control – Quality of services (QOS) - Integrated Services – Differentiated Services – WWW - HTTP - SMTP - FTP - Telnet - Domain name space. | | | |
| Module 3: Cryptography | | | 15 Hrs |
| Symmetric Key Cryptography - Asymmetric Key Cryptography - Network security, confidentiality, cipers, Digital signature, Authentication, Key management. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Behrouz A. Foruzan, “Data communication and Networking”, 5th Edition Tata McGraw-Hill, 2013. | | |
| 2 | William Stallings, “Data and Computer Communication”, Tenth Edition, Pearson Education, 2013. | | |
| 3 | Larry-L-Peterson& Bruce S David, “Computer-Networks a Systems Approach” Morgan Kaufmann Publishers, Fifth Edition, 2011. | | |
| Reference Books: | | | |
| 1 | E. Andrew S. Tannenbaum, “Computer Networks”, PHI, Fifth Edition, 2011. | | |
| 2 | CJames FKurouse& W. Rouse, “Computer Networking: A Top down Approach Featuring”, Pearson Education, Sixth Edition, 2012. | | |

| Web References: | |
|-----------------|---|
| 1 | https://nptel.ac.in/courses/106105082/ |
| 2 | https://www.coursera.org/learn/data-communication-network-services |
| 3 | https://www.tutorialspoint.com/data_communication_computer_network/ |
| 4 | http://library.aceondo.net/ebooks/Computer_Science/Data_Communication_and_Networking_by_Behrouz.A.Forouzan_4th.edition.pdf |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C941.1 | Remember | Online Quiz | 20 |
| C941.2 | Understand | Assignment | 20 |
| C941.3 | Analyse | Simulation Exercise | 20 |
| C941.4 | Understand | | |
| C941.5 | Understand | Technical Presentation | 20 |
| C941.6 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | - | - | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 50 | 50 | 40 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C941.1 | 2 | 1 | | | | 2 | 2 | 2 | | | | 1 | | | 1 |
| C941.2 | 3 | 3 | 2 | | | 2 | 3 | 1 | | | | 3 | 1 | 2 | 2 |
| C941.3 | 3 | 3 | 2 | 1 | | 2 | 3 | 1 | | 1 | | 3 | 1 | 2 | 1 |
| C941.4 | 3 | 3 | 2 | | | 2 | 3 | 1 | | | | 3 | 1 | 2 | 1 |
| C941.5 | 2 | 1 | | | | 2 | 3 | 1 | | | | 3 | 1 | 1 | 1 |
| C941.6 | 3 | 3 | 2 | 1 | | 2 | 3 | 1 | | 1 | | 3 | 1 | 2 | 1 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|-----------------------|-------------|
| 21EE910 | Introduction to Soft Computing | | 3/0/0/3 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To design and implement the fuzzy logic controller with case study. | | |
| 2 | To impart the knowledge about various architectures, modeling and controlling techniques of Artificial Neural Network with case study. | | |
| 3 | Capable of designing hybrid control schemes, selected optimization algorithms with case study | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C910.1 | Interpret the concepts of soft computing techniques and fuzzy logic modeling. | [U] | |
| C910.2 | Validate the fuzzy functioning for non-linear systems. | [A] | |
| C910.3 | Interpret the concept and logic of Artificial neural network to implement in engineering applications. | [AP] | |
| C910.4 | Categorize the functioning technologies in Artificial neural network for optimization. | [A] | |
| C910.5 | Apply engineering fundamentals to use optimization algorithms to obtain solution for complex engineering problems. | [AP] | |
| Course Contents: | | | |
| Module 1: Fuzzy Logic System | | 15 Hrs | |
| Evolution of Soft Computing - Soft Computing Constituents - Conventional AI to Computational Intelligence - Machine Learning Basics - Introduction to Fuzzy logic, crisp sets and fuzzy sets, Introduction to fuzzy logic modeling and control. Fuzzification, Fuzzy knowledge and rule bases Fuzzy membership functions, inferencing and Defuzzification. Case study: Implementation of fuzzy logic controller in Aerospace and in-home automation using Fuzzy logic Toolbox. | | | |
| Module 2: Artificial Neural Networks | | 18 Hrs | |
| Fundamentals - Biological neural network - Artificial neuron - Activation function - Learning rules - Learning factors - McCulloh-Pitts Neuron - Linear separability - Supervised Learning Neural Networks - Perceptron Networks - Adaline - Madaline - Back propagation networks - Radial Basis Function Networks - Hopfield Neural Network - Unsupervised Learning Neural Networks - Adaptive Resonance Architectures, Case study: Implementation of Pattern recognition application using ANN Toolbox. | | | |
| Module 3: Classical Optimization Techniques | | 12 Hrs | |
| Statement of optimization problem, Objective function, Classification of optimization problems. Single-variable and Multi-variable optimization without constraints. Multi-variable optimization with equality constraints. Lagrange multiplier method, Multi-variable optimization with inequality constraints, kuhn-Tucker conditions. Introduction to Genetic Algorithm - Operators in Genetic Algorithm. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, John Wiley and Sons Ltd, UK, 2011. | | |
| 2 | S.N.Sivanandam, S.N.Deepa, "Principles of Soft Computing", second edition, Wiley, India,2019 | | |
| 3 | E. K. P. Chong and S. H. Zak, An Introduction to Optimization, 2nd Edn., Wiley India Pvt. Ltd., 2010. | | |
| Reference Books: | | | |
| 1 | Simon Haykin, "Neural Networks and Learning Machines", Third edition, Pearson, 2016. | | |
| 2 | S. Rajasekaramand G.A. VijyalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI Learning Private Limited, India, 2013. | | |
| Web References: | | | |
| 1 | https://nptel.ac.in/courses/106105173/2 | | |

| | |
|---|---|
| 2 | http://user.engineering.uiowa.edu/~ie238/Lecture/Soft_computing |
| 3 | http://www.cse.iitm.ac.in/~vplab/courses/soft_computing.html |
| 4 | http://sftcmpgr2.github.io/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C910.1 | Understand | Online Quiz | 20 |
| C910.2 | Analyze | Technical Presentation | 20 |
| C910.3 | Apply | Assignment | 20 |
| C910.4 | Analyze | Simulation Exercises | 20 |
| C910.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 20 | 30 |
| Apply | 10 | 20 | 30 |
| Analyse | 40 | 60 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C910.1 | 2 | 1 | | | | | | | | | | | | | |
| C910.2 | 2 | 1 | | | 2 | | | | | | | | | | |
| C910.3 | 3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 3 | | |
| C910.4 | 3 | 3 | 2 | 2 | 2 | | | | | | | 2 | 3 | | |
| C910.5 | 3 | 2 | 1 | 1 | 2 | | | | | | | 2 | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|------------------------|---------|
| 21EC942 | VLSI Design and Technology | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | NIL | |
| Course Objectives: | | | |
| 1 | To understand the VLSI design problems, design methodologies and manufacturing technology. | | |
| 2 | To design the MOS circuits based on design rules and analyse the circuit as inverters and logic gates. | | |
| 3 | To expose the layouts of application specific devices and to become familiar with digital circuits programming. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C942.1 | Illustrate the VLSI design problems, design domains and CMOS fabrication Technology. | [U] | |
| C942.2 | Analyze the characteristics of MOS transistors and the design concepts of MOS circuits. | [A] | |
| C942.3 | Analyze the CMOS circuits as inverters and transmission gates. | [A] | |
| C942.4 | Interpret the device layouts of specific applications. | [U] | |
| C942.5 | Apply modeling concepts of HDL programming for the design of digital circuits. | [AP] | |
| Course Contents: | | | |
| Module 1: Introduction to VLSI design methodologies | | 15 Hrs | |
| Moore's law, VLSI design problem, design domains, design methods and technologies. VLSI Fabrication Technology & MOS transistors: Fabrication - NMOS, PMOS, CMOS, Twin tub process and Silicon on insulator Technology - MOS transistors - Enhancement mode & Depletion mode, NMOS transistor Current Equation - Second order effects. MOSFET as a Switch, Nano MOSFET - MOS Layers - Stick Diagrams - Design rules and Layout, Sheet Resistance, Area Capacitance of layers, Transistor sizing, Power Dissipation. | | | |
| Module 2: CMOS Circuit | | 15 Hrs | |
| NMOS Inverter - CMOS inverter - Switching characteristics. Pass Transistor and Transmission gates - NMOS and CMOS Logic gates - Stick Diagram, Layout Design Rules. ASICs: Types of ASICs - Physical Design flow - Programming Technology - Anti fuse - PREP Benchmarks - Actel ACT - Xilinx LCA - AlteraFLEX - Altera MAX - Xilinx I/Oblocks. | | | |
| Module 3: Programming VLSI | | 15 Hrs | |
| Review of VLSI Design automation tools - Fundamental VHDL units - Design of 2 bit Adders and Multipliers using VHDL. Verilog HDL - Module and ports - Gate level, Behavioral and Dataflow modeling for 2 bit Adders and Multipliers. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | D.A.Pucknell, K.Eshraghian, "Basic VLSI Design", Prentice Hall of India, New Delhi, 3 rd Edition, 2013. | | |
| 2 | M.J.S .Smith, "Application Specific Integrated Circuits", Addison –WesleyLongman Inc., 2013. | | |
| 3 | Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2 nd edition, Pearson 2013. | | |
| Reference Books: | | | |
| 1 | N.H.Weste, K.Eshraghian, "Principles of CMOS VLSI Design: a system Perspective" Pearson Education, India, 2013. | | |

| | |
|------------------------|---|
| 2 | Volnei A. Pedroni, "Circuit Design and Simulation with VHDL", MIT Press, 2 nd edition 2010. |
| 3 | S.H.Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2011. |
| Web References: | |
| 1 | https://nptel.ac.in/courses/117101058 |
| 2 | https://www.tutorialspoint.com/vlsi_design/index.htm |
| 3 | https://www.edaplayground.com/ |
| 4 | https://elearn.maven-silicon.com/ |
| 5 | VLSI Classroom Training Online VLSI Course -VLSIGuru.com |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C942.1 | Understand | Online Quiz | 20 |
| C942.2 | Analyse | Assignment | 20 |
| C942.3 | Analyse | Technical Presentation | 20 |
| C942.4 | Understand | Simulation Exercises | 20 |
| C942.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 20 | 30 |
| Apply | 10 | 20 | 30 |
| Analyse | 40 | 60 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C942.1 | 2 | 1 | | | | | | | | | | | | 3 | |
| C942.2 | 3 | 3 | 2 | 2 | | | | | | | | | | 3 | |
| C942.3 | 3 | 3 | 2 | 2 | | | | | | | | | | 3 | |
| C942.4 | 2 | 1 | | | | | | | | | | | | 3 | |
| C942.5 | 3 | 2 | 1 | 1 | 3 | 2 | | | 2 | 2 | | 1 | | 3 | 1 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|--------------------|---------|
| 21EC921 | Wireless Sensor Networks | | 3/0/0/3 |
| Nature of Course | | C (Theory Concept) | |
| Course Pre-requisites | | NIL | |
| Course Objectives: | | | |
| 1 | To obtain a broad understanding of wireless sensor networks | | |
| 2 | To study the challenges and design issues in wireless sensor networks | | |
| 3 | To focus on network architectures and energy efficiency | | |
| 4 | To study the concept of Time Synchronization and Localization | | |
| 5 | To focus on Routing Protocols and Operating Systems | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C921.1 | Learn the basics of wireless sensor networks and its applications. | | [R] |
| C921.2 | Understand the architecture and elements of wireless sensor networks | | [U] |
| C921.3 | Analyze the MAC protocols for wireless sensor networks. | | [A] |
| C921.4 | Apply the concept of Synchronization and Localization for sensor networks | | [AP] |
| C921.5 | Understand the various routing protocols of wireless sensor networks | | [U] |
| C921.6 | Understand the basics of operating systems needed to establish sensor networks | | [U] |
| Course Contents: | | | |
| Module 1: Overview of Wireless Sensor Networks | | | 15 Hrs |
| Characteristics-Types of Wireless Sensor Networks-Applications. Challenges for Wireless Sensor Networks - Enabling Technologies for Wireless Sensor Networks - Single-Node Architecture: Hardware Components - Energy Consumption of Sensor Nodes - Network Architecture: Sensor Network Scenarios - Optimization Goals and Figures of Merit -Design principles for WSNs – Gateway Concepts - Physical Layer and Transceiver design Considerations | | | |
| Module 2: Time Synchronization and Localization | | | 15 Hrs |
| MAC Protocols for Wireless Sensor Networks - S-MAC - Wakeup radio concepts – Introduction to the time synchronization problem - Protocols based on sender/receiver synchronization - Single-hop localization - Positioning in multi-hop environments - Topology-control: Aspects of topology-control algorithms | | | |
| Module 3: Routing Protocols and Operating Systems | | | 15 Hrs |
| Energy-Efficient unicast - Broadcast and multicast - Geographic Routing-Operating Systems for Wireless Sensor Networks: Operating System Design Issue - Examples of Operating Systems: TinyOS, Mate, MagnetOS and OSPM - Application specific support: Target detection and tracking. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Holger Karl and Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks”, John Wiley, 1 st edition, 2015. | | |
| 2 | KazemSohraby, Daniel Minoli and TaiebZnati, “Wireless Sensor Network-Technology, Protocolsand Applications”, John Wiley, 2 nd edition, 2012 | | |
| Reference Books: | | | |
| 1 | Feng Zhao and Leonidas J. Guibas, “Wireless Sensor Networks - An Information Processing Approach", Elsevier, 1 st edition, 2016. | | |
| 2 | WaltenegusDargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks – Theory and Practice”, John Wiley, 1 st edition, 2017. | | |
| 3 | C.S. Raghavendra, Krishna M. Sivalingam, TaiebZnati, “Wireless Sensor Networks”, Springer, 1 st edition, 2010. | | |
| Web References: | | | |
| 1 | http://profsite.um.ac.ir/~hyaghmae/ACN/WSNbook.pdf | | |
| 2 | http://ijcttjournal.org/Volume4/issue-8/IJCTT-V4I8P194.pdf | | |

| | |
|--------------------------|---|
| 3 | Profsite.um.ac.ir/~hyaghmae/ACN/WSNbook.pdf |
| 4 | https://pdfs.semanticscholar.org/e552/059d73eef06be26fd0e1a1e4118d4f4e4b20.pdf |
| Online Resources: | |
| 1 | https://www.coursera.org/lecture/internet-of-things-history/sensor-networks |
| 2 | https://nptel.ac.in/courses/106105160/21 |
| 3 | https://nptel.ac.in/courses/114106035/37 |
| 4 | https://www.edx.org/course/computer-networks-internet-kironx-fhlcnx |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C921.1 | Remember | Online Quiz | 20 |
| C921.2 | Understand | Assignment | 20 |
| C921.3 | Analyse | Simulation Exercise | 20 |
| C921.4 | Understand | | |
| C921.5 | Understand | Technical Presentation | 20 |
| C921.6 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | - | - | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 50 | 50 | 40 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C921.1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | - | - | - | - | 1 | 3 | 1 | 2 |
| C921.2 | 3 | 3 | 2 | 3 | 1 | 1 | 3 | - | - | - | - | 1 | 3 | 2 | 3 |
| C921.3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | - | - | - | - | 1 | 3 | 1 | 3 |
| C921.4 | 3 | 3 | 2 | 3 | 1 | 2 | 2 | - | - | - | - | 1 | 3 | 1 | 3 |
| C921.5 | 3 | 2 | 2 | 2 | 1 | 2 | 3 | - | - | - | - | 1 | 3 | 1 | 3 |
| C921.6 | 3 | 2 | 2 | 2 | 1 | 2 | 3 | - | - | - | - | 1 | 3 | 1 | 3 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|------------------------|------------------|
| 21EE911 | Automotive Electronics | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Analog Electronics | |
| Course Objectives: | | | |
| 1 | To instill a fundamental understanding of various electronic functionalities in automotive. | | |
| 2 | To make them gain knowledge on lighting system, sensors and accessories employed in automotive. | | |
| 3 | To make them familiar with Digital Engine Control System and electronic dashboard instruments. | | |
| 4 | To broaden the importance of vehicle intelligence system and future of autonomous cars. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C911.1 | Interpret construction of automotive batteries and charging system. | | [U] |
| C911.2 | Determine the functions of starting, ignition and injection system pertaining to electronic management techniques. | | [AP] |
| C911.3 | Categorize the functionalities and types of lighting system and accessories of automotive systems. | | [A] |
| C911.4 | Articulate the function of automotive sensors in suitable monitoring applications. | | [AP] |
| C911.5 | Correlate the role of electronic dashboard instruments for vehicle intelligence technology in advanced design of automotive. | | [A] |
| Course Contents: | | | |
| Module 1: Charging, Starting, Injection and Ignition System | | | 15 Hrs |
| Automotive fundamentals, Principles and construction of lead-acid battery. Characteristics of battery, rating capacity and efficiency of batteries, Types of batteries used in electric vehicles, Advanced charging system technology. Types, Construction and working of Starting system, Electronic Ignition systems, Distributor less ignition system, Electronic fuel injection systems and Digital Engine Control System. Case Study- Battery management system using software tools. | | | |
| Module 2: Lighting System, Accessories and Sensors | | | 15 Hrs |
| Lighting System – Overview of interior and exterior lights, Headlight dazzling and preventive methods, Intelligent lighting system Accessories - Electrical fuel pump, Speedometer, Horn, Wiper system, Automotive alarms, Parking System. Sensors - Basic sensor arrangement, Oxygen sensor, Vehicle speed sensor, Detonation sensor, Altitude sensor, Mass Air Flow sensor and Throttle position sensors. | | | |
| Module 3: Electronic dashboard instruments and Vehicle Intelligence | | | 15 Hrs |
| On-board diagnosis system, security and warning system - anti - lock braking system, Tyre pressure monitoring system, Collision avoidance system, Key less entry system and Electronic power steering system - Vehicle Intelligence - Introduction - Basics of OBD-II, CAN and LIN Protocols - Case Study: Architecture for vision based autonomous road vehicles features and applications. | | | |
| | | | Total Hours 45 |
| Text Books: | | | |
| 1 | Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 2012. | | |
| 2 | Vinal. G.W., Storage Batteries, John Wiley & Sons Inc., New York, 4 th edition, 2012. | | |
| 3 | Bosch Automotive Electrics and Automotive Electronics, Springer,5 th Ed,2014 | | |
| Reference Books: | | | |
| 1 | William B. Ribbens, Understanding Automotive Electronics, 6th Edition, Butterworth, Heinemann Woburn, 2003. | | |
| 2 | Automotive Hand Book, Robert Bosch, Bently Publishers, 2004. | | |
| 3 | Hod Lipson, Melba Kurman, Driverless: Intelligent Cars and the Road Ahead, MIT Press, 2016. | | |
| Web References: | | | |
| 1 | www.boschindia.com/.../automotive_electronics.../automotive-electronics.html | | |
| 2 | www.innovianstechnologies.com/automotive-electronics | | |
| 3 | https://www.electronicweekly.com/market-sectors/automotive-electronics | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
|----------------|---------------|------------------------|---------------------|
| C911.1 | Understand | Online Quiz | 20 |
| C911.2 | Apply | Technical Presentation | 20 |
| C911.3 | Analyse | Assignment | 20 |
| C911.4 | Apply | | |
| C911.5 | Analyse | Case Study | 20 |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 20 | 20 |
| Apply | 30 | 20 | 30 |
| Analyse | 30 | 50 | 40 |
| Evaluate | - | | |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C911.1 | 3 | 3 | 2 | 2 | 3 | | 1 | | | | | | 3 | 2 | |
| C911.2 | 3 | 3 | 2 | 2 | 3 | | 2 | | | | 2 | 2 | 3 | 2 | |
| C911.3 | 3 | 3 | 2 | 2 | 3 | | 2 | | | | 2 | 2 | 3 | 2 | |
| C911.4 | 2 | 1 | | | 2 | | 2 | | | | 2 | 2 | 2 | | |
| C911.5 | 2 | 1 | | | 2 | | 2 | | | | 2 | 2 | 2 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|------------------------|-------------|
| 21EC944 | Aviation Electronics Technology | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Analog Electronics | |
| Course Objectives: | | | |
| 1 | To acquire the knowledge of aircraft instruments. | | |
| 2 | To provide adequate knowledge of aircraft systems. | | |
| 3 | To understand the aircraft control systems | | |
| 4 | To impart the concept of aircraft navigation and radar systems. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C944.1 | Interpret the basic components aircraft instrumentation systems | | [U] |
| C944.2 | Categorize the different types of aircraft instruments | | [A] |
| C944.3 | Illustrate the concepts of aircraft engine, propulsion systems, structures and cabin system | | [U] |
| C944.4 | Examine major components of aircraft control and warning systems | | [AP] |
| C944.5 | Infer the aircraft navigation and surveillance systems | | [U] |
| Course Contents: | | | |
| Module 1: Aircraft Instruments | | | 15 Hrs |
| Flight Instruments and Navigation Instruments - Gyroscope, Accelerometers, Air Speed Indicators – Principles and Operations – True Air Speed (TAS), Equivalent Air Speed (EAS), Mach Meters, Altimeters – Study of various types of engine instruments - Temperature gauges, Pressure gauges - Operation and Principles. | | | |
| Module 2: Aircraft Management System | | | 15 Hrs |
| Engine systems - Typical examples for piston and jet engines - Fuel management – Lights - Cabin systems - Airframe control and indicating systems - Warning and protection systems - Fire and overheat protection - Terrain awareness warning system (TAWS) - Flight data and cockpit voice recorders. | | | |
| Module 3: Aircraft Navigation System | | | 15 Hrs |
| Automatic Direction Finders - Errors in Direction Finding - Distance Measuring Equipment - Instrument Landing System - Microwave Landing Systems - Tactical Air Navigation - Ground radar, Surveillance radar, Radar Ground Proximity Warning System - Traffic Collision Avoidance System. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | David Wyatt and Mike Tooley, "Aircraft Electrical and Electronics Systems", Second Edition, Routledge Publishers, 2018. | | |
| 2 | Ian Moir and Allan Seabridge, "Aircraft Systems: Mechanical, Electrical and Avionics-Subsystem Integration", Wiley India Pvt Ltd, 3rd edition, 2012. | | |
| 3 | Mike Tooley, "Aircraft Digital Electronic and Computer Systems", Taylor and Francis Ltd, 2013. | | |
| Reference Books: | | | |
| 1 | David A. Lambardo, "Aircraft Systems", Tata Mcgraw Hill Education Pvt. Ltd., 2009. | | |
| 2 | Anderson, J.D., "Introduction to Flight", 6th edition, McGraw-Hill Higher Education, 2015. | | |
| 3 | LalitGupta, O P Sharma, "Fundamentals of Flight Basic Aerodynamics, Aircraft Structures, Aircraft Propulsion, Aircraft Systems", 1st edition, 2006. | | |
| Web References: | | | |
| 1 | https://nptel.ac.in/courses/101/104/101104071/ | | |
| 2 | https://nptel.ac.in/courses/101/108/101108056/ | | |
| 3 | https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ae03/ | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
|----------------|---------------|------------------------|---------------------|
| C944.1 | Understand | Online Quiz | 20 |
| C944.2 | Analyse | Technical Presentation | 20 |
| C944.3 | Understand | Assignment | 20 |
| C944.4 | Apply | Case Study | 20 |
| C944.5 | Understand | | |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 60 | 40 |
| Apply | 40 | 30 | 30 |
| Analyse | 10 | 10 | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|---|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C944.1 | 3 | 3 | 2 | 2 | 3 | | 1 | | | | | | 3 | 2 | |
| C944.2 | 3 | 3 | 2 | 2 | 3 | | 2 | | | | 2 | 2 | 3 | 2 | |
| C944.3 | 3 | 3 | 2 | 2 | 3 | | 2 | | | | 2 | 2 | 3 | 2 | |
| C944.4 | 2 | 1 | | | 2 | | 2 | | | | 2 | 2 | 2 | | |
| C944.5 | 2 | 1 | | | 2 | | 2 | | | | 2 | 2 | 2 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|------------------------|---------|
| 21EC945 | Principles of Communication Engineering | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To introduce the concepts of mobile and satellite communications. | | |
| 2 | To realise the effect of noise on communication systems. | | |
| 3 | To introduce different methods of analog and digital communication and their significance. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C945.1 | Impart Knowledge on principle of communication system and sources of noise. | | [U] |
| C945.2 | Analyze different modulation and demodulation techniques used in analog communication. | | [A] |
| C945.3 | Infer the different modulation and demodulation schemes for digital communications. | | [U] |
| C945.4 | Analyze the digital communications techniques in various fields. | | [A] |
| C945.5 | Examine applications of data communication in mobile and satellite communication. | | [AP] |
| Course Contents: | | | |
| Module 1: Signal Analysis and Noise Analysis | | | 15 Hrs |
| Communication Process - Sources of Information - Communication Channels - Modulation Process - Types of Communication - External Noise - Internal Noise - White Noise - Narrow Band Noise - Representation of Narrow Band noise in phase and Quadrature Components - Noise Figure - Noise Bandwidth - Noise Temperature. | | | |
| Module 2: Analog Communication | | | 15 Hrs |
| AM - Frequency spectrum - power relations - generation of AM - DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM - frequency spectrum - power relations: NBFM & WBFM, Generation of FM and DM - Amstrong method - Simulation experiments on analog communication methods. | | | |
| Module 3: Digital Communication | | | 15 Hrs |
| Pulse modulation - concepts of sampling and sampling theorems, PAM, PWM, PPM, PTM, quantization and coding: DCM, DM, slope overload error. ADM, DPCM, OOK systems - ASK, FSK, PSK, BPSK, QPSK, applications of Data communication. Introduction to Mobile communication and Satellite communication - Global System for Mobile Communications (GSM) - Code Division Multiple Access (CDMA). | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Simon S. Haykin, "An Introduction to Analog and Digital Communications", 2 nd Edition, John Wiley & Sons, 2009. | | |
| 2 | Taub & Schilling "Principles of Communication Systems", Tata McGraw Hill 2014. | | |
| 3 | John G.Proakis and Masoud Salehi, "Communication Systems Engineering", Pearson Education, 2015. | | |
| Reference Books: | | | |
| 1 | B. Carlson, "Introduction to Communication Systems" (4/e), McGraw-Hill, 2009. | | |
| 2 | B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rdEdition, Oxford UniversityPress,2012. | | |
| 3 | Steven Roman,"Introduction to Coding and Information Theory", Springer-Verlag New York.2011. | | |

| Web References: | |
|-----------------|---|
| 1 | http://www.mee.tcd.ie/~sigmedia/pmwiki/uploads/Teaching.3C1/handout1.pdf |
| 2 | https://nptel.ac.in/courses/117101053/ |
| 3 | https://www.tutorialspoint.com/digital_communication/digital_communication_delta_modulation.html |
| 4 | https://www.elprocus.com/wireless-communication-project-ideas/ |
| 5 | https://www.tonex.com/wireless-training/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C945.1 | Understand | Online Quiz | 20 |
| C945.2 | Analyze | Assignment | 20 |
| C945.3 | Understand | Technical Presentation | 20 |
| C945.4 | Analyze | Case Study | 20 |
| C945.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 20 | 30 |
| Apply | 10 | 20 | 30 |
| Analyse | 40 | 60 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No .of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|------------------|-------------------|---------|---------|---------|---------|-------------------|---------|---------|---------|----------|----------|-----------------|----------|----------|----------|
| C945.1 | 2 | 1 | | | | | | | | | | | | 3 | |
| C945.2 | 3 | 3 | 2 | 2 | 2 | | | | | 2 | | | 2 | 3 | |
| C945.3 | 2 | 1 | | | | | | | | | | | | 3 | |
| C945.4 | 3 | 3 | 2 | 2 | | | | | | 2 | | | 2 | 3 | |
| C945.5 | 3 | 2 | 1 | 1 | | | | | | 2 | | | 2 | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|--------------------|---------|
| 21EC946 | Nano Electronics | | 3/0/0/3 |
| Nature of Course | | C (Theory Concept) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To understand the concept of semiconductor devices and materials | | |
| 2 | To learn about the concepts of Fabrication of Nanomaterials | | |
| 3 | To impart the concepts of quantum electronics with new device structure | | |
| 4 | To examine various applications of Tunneling effects | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C946.1 | Illustrate the basic concepts of Nano electronics. | [U] | |
| C946.2 | Examine the Fabrication methods and implications. | [A] | |
| C946.3 | Analyze the Features of Quantum Electron Devices. | [A] | |
| C946.4 | Appraise SET, RTD and Tunneling Devices on various Nano electronic Devices. | [A] | |
| C946.5 | Demonstrate the concepts of Advanced Nano electronics devices. | [U] | |
| Course Contents: | | | |
| Module 1: Basic of Nano electronics | | 15 Hrs | |
| Introduction to Nanotechnology - Impacts - Limitations of Conventional Microelectronics - Capabilities of Nano electronics - Physical fundamentals of Nano electronics - Scaling Principle, Fabrication of Nano electronics - Classification of Nano-Structures - Trends in microelectronics, optoelectronics and Nano electronics – Fabrication of Nano electronics . | | | |
| Module 2: Quantum Electron Devices | | 15 Hrs | |
| Quantum Particle - Quantum Dot Devices - Quantum Wire Devices - Electronic Structure of Material - Low Dimensional Structures Quantum Well - Density of States and Dimensionality - Electron Wavelet Propagation - Fundamental Limits in Computation. | | | |
| Module 3: Nano electronics Devices | | 15 Hrs | |
| Field Effect Transistors - Resonant Tunneling Diode - Quantum Cascade Laser - Single Electron Transistor – High Electron Transistor - Carbon Nanotube Devices - MODFESTs – Hetero junction Bipolar Transistor - Scanning Tunneling Microscope - Atomic Force Microscope - Transmission Electron Microscope - Advanced Nano electronics Devices - Nanostructured: LEDs, Photo detectors – Introduction to NEMS. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | W.R. Fahrner, “Nanotechnology And Nano electronics : Materials, Devices, Measurement Techniques”, Springer, 2011 | | |
| 2 | Edward L. Wolf, “Quantum Nano electronics - An Introduction to Electronic Nanotechnology and Quantum Computing”, Wiley, 2015 | | |
| 3 | Chattopadhyay Banerjee, “Introduction to Nano science & Technology”, PHI, 2012 | | |
| Reference Books: | | | |
| 1 | S. Datta, “Lessons from Nano electronics: A New Perspective on Transport (Lessons from Nanoscience: a Lecture Notes Series) World Scientific, 2012 | | |
| 2 | C P. Poole and F. J. Owens, “Introduction to nanotechnology”, John Wiley & Sons, 2003. | | |
| 3 | V. Mitin, V. Kochelap, and M. Stroscio “Introduction to Nano electronics: Science, Nanotechnology, Engineering, and Applications”, Cambridge University Press, 2008. | | |
| Web References: | | | |
| 1 | https://www.biolinscientific.com/blog/top-5-nanotechnology-blogs-2015 | | |
| 2 | https://science.discoveryplace.org/blog/nanotechnology-blog | | |
| 3 | https://engineeringonline.ucr.edu/blog/category/nanotechnology-engineering/ | | |

| | |
|-------------------------|---|
| 4 | https://nanohub.org/courses/FON1 |
| Online Resource: | |
| 1 | https://ocw.mit.edu/courses/6-701-introduction-to-nanoelectronics-spring-2010/pages/syllabus/ |
| 2 | https://nptel.ac.in/courses/117108047 |
| 3 | https://www.coursera.org/learn/nanotechnology1 |
| 4 | https://www.edx.org/course/fundamentals-of-nanoelectronics-part-b-quantum-tra |
| 5 | https://ocw.mit.edu/courses/6-701-introduction-to-nanoelectronics-spring-2010/pages/syllabus/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C946.1 | Understand | Online Quiz | 20 |
| C946.2 | Apply | Case Study | 20 |
| C946.3 | Apply | Technical Presentation | 20 |
| C946.4 | Apply | Assignment | 20 |
| C946.5 | Understand | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | | Component - II (20 Marks) |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|--------------------------|-----|-----|-----|----------|--------------------------|-----|-----|-----|------|----------|------------------------|------|------|------|
| C946.1 | 3 | 3 | 2 | 2 | | | 1 | | | | | | 3 | 2 | |
| C946.2 | 3 | 2 | 1 | 1 | 2 | | 2 | | | | 1 | 2 | 3 | 3 | |
| C946.3 | 3 | 3 | 2 | 2 | 2 | | 2 | | | | 1 | 2 | 3 | 3 | |
| C946.4 | 3 | 3 | 2 | 2 | 1 | | 2 | | | | 1 | 2 | 3 | 2 | |
| C946.5 | 2 | 1 | | | 1 | | | | | | | 2 | 3 | 2 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|--|---------|
| 21EE913 | Design of Electrical Machines | | 3/0/0/3 |
| Nature of Course | | G (Analytical) | |
| Pre-requisites: | | Electrical Machines - I and Electrical Machines – II | |
| Course Objectives: | | | |
| 1 | To understand the basic design concepts. | | |
| 2 | To analyze the design of electrical static and dynamic machines. | | |
| 3 | To implement the design optimization procedures of electrical machines. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C913.1 | Illustrate the basic parameters and design considerations of electrical machines. | [U] | |
| C913.2 | Investigate the design of DC machines. | [A] | |
| C913.3 | Analyze the design of core and shell type Transformers. | [A] | |
| C913.4 | Apply the design procedures of electrical machines using computational approach. | [AP] | |
| C913.5 | Examine the design of Induction and Synchronous machines. | [A] | |
| Course Contents: | | | |
| Module 1: Basic Design Concepts and Design of DC Machines | | 15Hrs | |
| Considerations and Limitations in design; Choice of specific electric and magnetic loadings; MMF calculation for various types of electrical machines; Real and apparent flux density of rotating machines. Design of DC machines: Output Equation - Main Dimensions; Choice of number of poles; Armature design; Design of air gap; Design of commutator and brushes. | | | |
| Module 2: Design of Transformers and Computational Approach | | 15 Hrs | |
| Output rating of single phase and three phase transformers; Optimum design of transformers; Design of core and windings for core-type and shell-type transformers; Design of tanks and cooling tubes of transformers. Introduction to Computer Aided Design of Electrical Machines - Different approaches of CAD, Design of optimization methods; Introduction to FEM based design. | | | |
| Module 3: Design of AC Machines | | 15 Hrs | |
| Design of Induction Machines: Output Equation - Main dimensions; Design of stator; Design of squirrel cage rotor - Design of slip ring rotor. Design of Synchronous Machines: Output Equation - Main dimensions - Short circuit ratio; Design of stator and rotor of cylindrical pole and salient pole machines; Design of damper winding; Design of turbo-alternators. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | A.K.Sawhney, “A Course in Electrical Machine Design”, Dhanpat Rai and Sons, New Delhi, 2016. | | |
| 2 | S. K. Sen, “Principles of Electrical Machine Design with Computer Programmes”, Oxford and IBH Publishing, 2020. | | |
| 3 | M.V. Deshpande “Design and Testing of Electrical Machine Design” Wheeler Publications, 2011. | | |
| Reference Books: | | | |
| 1 | R.K.Agarwal, “Principles of Electrical Machine Design”, S.K.Kataria and Sons, Delhi, 2014. | | |
| 2 | M.G. Say, “Theory & Performance and Design of AC Machines”, ELBS London,3 rd edition, 2005. | | |
| 3 | K. M. V. Murthy, “Computer Aided Design of Electrical Machines”, B.S. Publications, 2008. | | |

| Web References: | |
|-----------------|--|
| 1 | https://cusp.umn.edu/electric-machine-design-videos https://www.youtube.com/watch?v=LATwaGHEVbg |
| 2 | https://motorsolver.com/workshops/electric-machine-design-lectures/ |
| 3 | http://www.ppi-engineering.com/design/ |
| 4 | https://www.youtube.com/watch?v=PII4pz7ohpA |
| 5 | https://nptel.ac.in/courses/108105131/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|----------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C913.1 | Understand | Online Quiz | 20 |
| C913.2 | Analyze | Assignment | 20 |
| C913.3 | Analyze | Class Presentation | 20 |
| C913.4 | Apply | Case Study | 20 |
| C913.5 | Analyze | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 5 | 5 | 5 |
| Understand | 10 | 10 | 10 |
| Apply | 40 | 40 | 40 |
| Analyse | 45 | 45 | 45 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|---------------------------|----------------------------|--------------------|---------------------------|--|----------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component-I (20 Marks) | Component-II (20 Marks) | | Component-I (20 Marks) | | Component-II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C913.1 | 2 | 1 | | | | | | | | | | | 3 | | |
| C913.2 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | | |
| C913.3 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | | |
| C913.4 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | | |
| C913.5 | 3 | 2 | 1 | 1 | 3 | | | | | | | 1 | 3 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|------------------------|---------|
| 21EE914 | Special Electrical Machines | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Electrical Machines | |
| Course Objectives: | | | |
| 1 | To learn the working operation and performance characteristics of Stepper motor. | | |
| 2 | To realize the performance characteristics of Switched reluctance motors. | | |
| 3 | To impart knowledge on the performance of Permanent Magnet Brushless DC and Permanent Magnet Synchronous motors. | | |
| 4 | To know about the control strategies of Linear and Servo motor. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C914.1 | Enumerate the principle of operation and performance of Stepper motors. | [U] | |
| C914.2 | Analyze the performance of Switched reluctance motors. | [A] | |
| C914.3 | Apply the principle of Permanent magnet brushless D.C motor in appropriate field. | [AP] | |
| C914.4 | Illustrate the construction and operation of Permanent magnet synchronous motors. | [AP] | |
| C914.5 | Analyze the construction and operation of Linear and Servomotor. | [A] | |
| Course Contents: | | | |
| Module 1: Stepping Motors and Switched Reluctance Motor | | 15 Hrs | |
| Stepping Motors - Constructional features - Principle of operation - Variable reluctance motor - Hybrid motor - Permanent Magnet Stepper motor - Torque equations - Modes of excitations - Characteristics - Microprocessor control of stepping motors - Closed loop control. Switched Reluctance motor: Rotary and Linear SRMs - Constructional features - Principle of operation - Torque production mechanism- Power Converters and their controllers - Methods of Rotor position sensing - Sensor less operation - Closed loop control of SRM. | | | |
| Module 2: Permanent Magnet Motors | | 18 Hrs | |
| Permanent Magnet Brushless DC motors - Introduction -Principle of operation, Permeance coefficient - Types - Magnetic circuit analysis - EMF and torque equations - Commutation - Power controllers - Motor characteristics and control. Permanent Magnet Synchronous Motor - Principle of operation - Ideal PMSM - EMF and Torque equations - Armature reaction MMF - Synchronous Reactance - Sine wave motor with practical windings - Phasor diagram - Torque/speed characteristics - Power controllers - Converter Volt- ampere requirements. Torque Controllers, Self-control, Vector control, Current control schemes Application aspect related to vehicle and house hold. | | | |
| Module 3: Linear and Servomotors | | 12 Hrs | |
| Linear Induction motor (LIM) classification - construction - Principle of operation - DC Linear motor (DCLM) types - circuit equation - DCLM control applications. Servomotor-Constructional features, Principle of operation, Types, Characteristics, Control strategies, linear actuators with DC servo motors. Application of linear and servo motor in automation industries. Principle of operation and characteristics of Hysteresis motor - AC series motors - Flux switching and Flux reversal motors. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Berker Bilgin, James Weisheng Jiang, AliE madi, “ Switched Reluctance Motor Drives: Fundamentals To Applications” CRC press,2018. | | |
| 2 | T.J.E.Miller,” Switched Reluctance Motors and their Control” Magna Physics Publishing,2008. | | |

| | |
|---|---|
| 3 | Dr.Duanek Hansel man,” Brushless Motors: Magnetic Design, Performance, and Control of Brushless DC and Permanent Magnet Synchronous Motors” E-Man Press LLC,2012. |
| 4 | T.Kenjo,S.Nagamori,”Permanent magnet and brushless DC motors“ Oxford science publications,2003. |
| 5 | E.G Janardanan, “Special Electrical Machines” Prentice Hall India Learning PrivateLimited,2014. |

Reference Books:

| | |
|---|---|
| 1 | Ahmed Tahor, Abdel Ghani Aissabui,“ Switched Reluctance Motor- Concept, Control and Applications”, In Tech Open, 2017. |
| 2 | Riazollah Firoozian,“Servo Motors and Industrial Control Theory“ Springer International Publishing AG; 2nd edition, 2014. |
| 3 | V.V. Athani,“ Stepper Motors: Fundamentals, Applications and Design”, New Age publisher,2nd edition,2014. |
| 4 | R. Krishnan,“Permanent Magnet Synchronous and Brushless DC Motor Drives”, T and F India,2016. |

Web References:

| | |
|---|---|
| 1 | https://www.elprocus.com/stepper-motor-types-advantages-applications/ |
| 2 | https://electrical-engineering-portal.com/characteristics-and-work-principles-of-switched-reluctance-sr-motor |
| 3 | https://www.edn.com/design/sensors/4406682/Brushless-DC-Motors---Part-I--Construction-and-Operating-Principles |
| 4 | https://www.simpletecautomatics.com/company-video.html#product |
| 5 | http://www.ebs-automation.com/news/video/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
|----------------|---------------|------------------------|---------------------|
| C914.1 | Understand | Online Quiz | 20 |
| C914.2 | Analyze | Technical Presentation | 20 |
| C914.3 | Apply | Assignment | 20 |
| C914.4 | Apply | | |
| C914.5 | Analyze | Simulation Exercises | 20 |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | - | - | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 50 | 50 | 40 |

| | | | |
|----------|---|---|---|
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C914.1 | 2 | 1 | | | 2 | | | | | | | | | | |
| C914.2 | 3 | 2 | 1 | 1 | 3 | | | | | | | | 3 | 2 | |
| C914.3 | 2 | 1 | | | 2 | | | | | | | | | | |
| C914.4 | 3 | 3 | 2 | 2 | 3 | | | | 2 | | | | 3 | 2 | |
| C914.5 | 2 | 1 | | | 2 | | | | 2 | 2 | | | | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | | | |
|---|--|---|--|---------|------|
| 21EE915 | | PLC, SCADA and Automation | | 3/0/0/3 | |
| Nature of Course | | E (Theory Skill Based) | | | |
| Course Pre-requisites | | Analog Electronics, Control Systems | | | |
| Course Objectives: | | | | | |
| 1 | | To expose the rudiments of PLC and Industrial Automation. | | | |
| 2 | | To know various types and programming of programmable logic controllers. | | | |
| 3 | | To familiarize with different types of HMI and Installation and maintenance procedures for PLC. | | | |
| 4 | | To learn the architecture and tools of Supervisory Control and Data Acquisition System. | | | |
| 5 | | To learn the basic principles of communication protocols. | | | |
| Course Outcomes: | | | | | |
| Upon completion of the course, students shall have ability to | | | | | |
| C915.1 | | Enumerate the architecture of PLC, I/O modules and Wiring. | | | [U] |
| C915.2 | | Interpret the basic building blocks of PLC Programming. | | | [AP] |
| C915.3 | | Design PLC Ladder Logic Program for practical applications. | | | [A] |
| C915.4 | | Explain the installation and maintenance procedures of PLC and networking of PLC with HMI system. | | | [U] |
| C915.5 | | Implement the architecture and functions of SCADA. | | | [AP] |
| C915.6 | | Discuss the principle of communication protocols. | | | [U] |
| Course Contents: | | | | | |
| Module 1: Introduction 15 Hrs Sensors: Proximity sensor, Light sensor, Temperature sensor, Smart sensors, Programmable Logic Controllers - History and developments in Industrial automation, Architecture of Industrial automation, Control elements in industrial automation. PLC Introduction, Basics of PLC, Advantages, Capabilities of PLC - Architecture of PLC, Scan cycle, Types of PLC, Types of I/O modules - Configuring a PLC, PLC wiring. | | | | | |
| Module 2: PLC Programming 15 Hrs Types of Programming, Simple process control programs using Relay Ladder Logic, PLC logical functions - Timers and Counters, Data transfer - Comparison and Manipulation Instructions. HMI system and PLC networking: Necessity and Role in Industrial Automation, Text display, Operator panels, Touch panels, Panel PCs, Integrated displays, Interfacing PLC to HMI. Installation and maintenance procedures for PLC, Troubleshooting of PLC. | | | | | |
| Module 3: Interfacing PLC with SCADA 15 Hrs Overview, Architecture of SCADA, Tools, Tag, Internal & External graphics, Alarm logging, Tag logging, Structured tags, Trends-history-Report generation, Scripts for SCADA application. Communication protocols of SCADA: BUS configurations used for industrial automation - GPIB, HART and OLE/OPC protocols - Industrial field bus - FIP (Factory Instrumentation Protocol), PROFIBUS (Process field bus), Bit bus - Server/Client Configuration - Messaging - Recipe. User administration - Interfacing of SCADA with PLC. | | | | | |
| Total Hours: | | | | | 45 |
| Text Books: | | | | | |
| 1 | | William J. Weindorf, “Programmable Logic Controllers Principles and Applications”, 3rd Edition, 2021. | | | |
| 2 | | Robert Radvanovsky, “Handbook of SCADA/Control Systems Security”, CRC Press, Second Edition, 2020. | | | |
| Reference Books: | | | | | |
| 1 | | Frank D. Petruzella, “Programmable Logic controllers”, Mc Graw Hill, Fifth Edition, 2017. | | | |

| | |
|------------------------|---|
| 2 | John.W.Webb & Ronald A. Reis, "Programmable logic controllers: Principles and Applications", Prentice Hall India, 2009. |
| 3 | WinCC V7.2, Software Manual, 2013. |
| Web References: | |
| 1 | https://nptel.ac.in/courses/112102011/12 |
| 2 | https://swayam.gov.in/course/1395-industrial-automation-and-control |
| 3 | https://freevideolectures.com/course/2345/industrial-automation-and-control |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C915.1 | Understand | Online Quiz | 20 |
| C915.2 | Apply | Simulation Exercises | 20 |
| C915.3 | Analyse | | |
| C915.4 | Understand | Case Study | 20 |
| C915.5 | Apply | | |
| C915.6 | Understand | Technical Presentation | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | | Component - II (20 Marks) |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|-------------------|-----|-----|-----|-----|-------------------|-----|-----|-----|------|-----------------|------|------|------|------|
| C915.1 | 2 | 1 | | | | | | | | | | | 1 | | |
| C915.2 | 3 | 2 | 1 | 1 | | | | | 1 | | | | 1 | | |
| C915.3 | 3 | 3 | 2 | 2 | | | 1 | | 2 | 1 | 1 | | 3 | 2 | |
| C915.4 | 2 | 1 | | | | | 1 | | | | | | 2 | 2 | |
| C915.5 | 3 | 2 | 1 | 1 | | | 1 | | | | | | 2 | 2 | |
| C915.6 | 2 | 1 | | | | | | | | 1 | | | 1 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | | | |
|---|--|---|--|--------------|------|
| 21EE916 | | Servo Drives in Robotics | | 3/0/0/3 | |
| Course Pre-requisites | | Electrical Machines - I and Electrical Machines - II | | | |
| Nature of Course | | D (Theory Application) | | | |
| Course Objectives: | | | | | |
| 1 | | To impart the knowledge of servo motors drives and power transmission. | | | |
| 2 | | To understand the concepts of sensors and vision systems. | | | |
| 3 | | To understand the concepts of robots in various industries for automation. | | | |
| Course Outcomes: | | | | | |
| Upon completion of the course, students shall have ability to | | | | | |
| C916.1 | | Interpret the basic laws and concepts of robots. | | | [U] |
| C916.2 | | Explain the concepts of servo mechanisms and control of electric drives. | | | [U] |
| C916.3 | | Analyze the sensor systems to the robotic system. | | | [A] |
| C916.4 | | Analyze the power transmission systems in the robotic system. | | | [A] |
| C916.5 | | Apply the Robots in Manufacturing and Processing Industries. | | | [AP] |
| Course Contents: | | | | | |
| Module 1: Introduction to Fundamental concepts of Robotics | | | | 15Hrs | |
| History, Present status and future trends in Robotics and automation - Laws of Robotics - Robot definitions - Robotics systems and robot anatomy - Structure of a Robot, Classification of Robots: Cartesian, Cylindrical, Spherical, Articulated, SCARA - Specification of Robots - Degrees of freedom of serial and parallel manipulators - resolution, repeatability and accuracy of a manipulator. | | | | | |
| Module 2: Sensors and Vision Systems | | | | 15Hrs | |
| Principle of operation, types and selection of position and velocity sensors, Potentiometers, Encoders, Resolvers, LVDT, Tacho-generators, Internal and External State Sensors, Proximity sensors. Limit switch -Tactile sensors - Touch sensors - Force and torque sensors, Robot end effectors. Vision Systems. Vision Systems for Robotics: Robot vision systems, Image capture - solid state cameras - Image Representation - Grey scale and colour images, Image sampling and quantization - Image processing and analysis - Image data reduction Segmentation - Feature extraction - Object Recognition. | | | | | |
| Module 3: Motors Drives and Factory Automation | | | | 15Hrs | |
| Types Constructional features - Principle of operation - Feedback system - Sizing of servomotors - Robot drive mechanisms, hydraulic-electric servomotor- stepper motor - pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link - Rod systems - Rotary-to-Rotary motion conversion, Rotary to linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws, End effectors. Control of Electrical Drives: Introduction - Parts of Electrical Drives - Fundamental Torque Equations-Speed Torque Conventions and Multi-quadrant Operation - Nature & Classification of Load Torques - Modes of Operation-Closed - Loop Control of Drives. Factory Automation: Flexible Manufacturing Systems concept - Automatic feeding lines, transfer lines, automatic inspection - Computer Integrated Manufacture - CNC, intelligent automation. HMI Systems, DCS and SCADA, Wireless controls. | | | | | |
| | | | | Total Hours: | 45 |
| Text Books: | | | | | |
| 1. | | Sotiris Makris “ Cooperating Robots for Flexible Manufacturing”, Tata McGraw Hill Publishing, 2020. | | | |

| | |
|--------------------------|---|
| 2. | Ulrich Rembold, "Robot Technology and Applications", CRC Press, 2020. |
| 3. | Saeed B Niku," Introduction to Robotics Analysis, Systems, Applications", PHI Pvt Ltd, New Delhi, 2016. |
| 4. | Peter Corke, "Robotics, Vision and Control: Fundamental Algorithms In MATLAB" first edition 2011. |
| Reference Books: | |
| 1. | S K Saha - Introduction to Robotics, Tata Mcgraw Hill, 2010. |
| 2. | Mittal R K, Nagrath I J, Robotics and Control, Tata McGraw Hill, 2010. |
| 3. | Richard D Klaffer, Thomas A Chmielewski, Michael Negin, "Robotics Engineering - An Integrated Approach", Eastern Economy, Prentice Hall of India Pvt Ltd., 2010. |
| Online Reference: | |
| 1. | https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/ |
| 2. | https://www.edx.org/course/robotics-columbiacx-csmm-103x |
| 3. | https://www.futurelearn.com/courses/begin-robotics |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|----------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C916.1 | Understand | Online Quiz | 20 |
| C916.2 | Understand | Simulation Exercises | 20 |
| C916.3 | Analyze | Case Study | 20 |
| C916.4 | Analyze | Assignment | 20 |
| C916.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination |
|---|
|---|

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|---|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|------------------|--------------------------|-----|-----|-----|----------|--------------------------|-----|-----|-----|------|----------|------------------------|------|------|------|
| C916.1 | 2 | 1 | | | 2 | | | | | | | | 3 | | |
| C916.2 | 2 | 1 | | | | | 1 | | | | | | 2 | | |
| C916.3 | 3 | 3 | 2 | 2 | | | 1 | | | | | | 3 | 1 | |
| C916.4 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | | |
| C916.5 | 3 | 2 | 1 | 1 | 2 | | | | | | | | 3 | 1 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|--|---------|
| 21EE917 | Flexible AC Transmission Systems | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Power Electronics, Power System Analysis | |
| Course Objectives: | | | |
| 1 | To understand the concepts of FACTS. | | |
| 2 | To expose the applications of FACTS controllers in power systems. | | |
| 3 | To learn about shunt and series compensation schemes and simulation of FACTS Controllers. | | |
| 4 | To understand the phenomenon of SSR and its mitigation techniques. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C917.1 | Describe the concept of FACTS. | | [U] |
| C917.2 | Analyze the various types of compensation schemes. | | [A] |
| C917.3 | Implement the various FACTS controllers. | | [AP] |
| C917.4 | Apply the compensation techniques to simulate various FACTS controllers. | | [AP] |
| C917.5 | Illustrate the phenomena of sub synchronous resonance. | | [U] |
| Course Contents: | | | |
| Module 1: Introduction | | 15 Hrs | |
| Introduction, Electrical Transmission Network, Necessity, Power Flow in AC system, Relative importance of controllable parameter, Opportunities for FACTS, Possible benefits for FACTS Technology, Types of FACTS Controllers & its Applications. Advanced FACTS devices. Case Study: Practical Application of FACTS devices in Power quality improvement. | | | |
| Module 2: Types of Compensation Techniques | | 15 Hrs | |
| Need for compensation, shunt and series compensation, Configuration - Operating characteristics, Static VAR Compensator (SVC), Thyristor Controlled Reactor (TCR), Thyristor Switched Capacitor (TSC), Comparison of TCR and TSC, Variable impedance type series compensation, Thyristor Switched Series Capacitor (TSSC), Thyristor Controlled Series Capacitor (TCSC), Basic operating control schemes for TSSC & TCSC. | | | |
| Module 3: Static Voltage Phase Angle Regulator and Second-Generation FACTS Controllers | | 15 Hrs | |
| Objectives of voltage and phase angle Regulators- Operations and Control Applications - TCVR Model and Thyristor Controlled Voltage and Phase Angle Regulator, TCPAR Model characteristics, STATCOM and UPFC, Circuit model, Basic operating principles and control structure, Introduction to sub synchronous resonance (SSR) - mitigation by FACTs controllers, NGH, SSR damping scheme, Simulation and study of FACTS under dynamic conditions. Enhanced renewable integration through Flexible Transmission option (ERIFT) NGHSSR damper, thyristor-controlled braking resistor (TCBR). | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Narain G.Hingorani, Laszlo Gyugyi, "Understanding FACTS concept and Technology", Standard Publisher, Delhi, 2017. | | |
| 2 | K.R. Padiyar, "FACTS Controllers for Power Transmission and Distribution" New Age International Publishers, 2016. | | |
| 3 | Rajiv K. Varma R. Mohan Mathur "Thyristor-Based FACTS Controllers for Electrical Transmission Systems" Wiley ,2011. | | |
| Reference Books: | | | |
| 1 | Zhang, Xiao-Ping, Rehtanz, Christian, Pal, Bikash "Flexible AC Transmission Systems: Modelling and Control" Springer 2012. | | |

| | |
|---|---|
| 2 | Gyugyi L., "Unified power flow control concept for flexible AC transmission ", IEEE Proc-C, Vol.139, No.4, July 2013. |
| 3 | A.T.John, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 2017. |

Web References:

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|---|---|
| 1 | http://www.infocobuild.com/education/audio-video-courses/electronics/flexible-ac-transmission-systems-devices-iit-roorkee.html |
| 2 | https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108107114/lec1.pdf |
| 3 | https://www.youtube.com/watch?v=YW9BGz80Yz4 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)
Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
|----------------|---------------|------------------------|---------------------|
| C917.1 | Understand | Online Quiz | 20 |
| C917.2 | Analyse | Technical Presentation | 20 |
| C917.3 | Apply | Assignment | 20 |
| C917.4 | Apply | Case Study | 20 |
| C917.5 | Understand | | |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|--------------------------|-----|-----|-----|----------|--------------------------|-----|-----|-----|------|----------|------------------------|------|------|------|
| C917.1 | 2 | 1 | | | | 1 | | | | | | | 2 | 2 | 1 |
| C917.2 | 3 | 3 | 2 | 2 | 1 | | | | | | | | 3 | 1 | 1 |
| C917.3 | 3 | 2 | 1 | 1 | | | | | | | | | | | |
| C917.4 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 2 | 1 |
| C917.5 | 3 | 2 | 1 | 1 | | | | | | | | | | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|------------------------|---------|
| 21EE918 | Digital Simulation of Power Electronic Circuits | | 3/0/0/3 |
| Nature of Course | | E (Theory Skill Based) | |
| Course Pre-requisites | | Power Electronics | |
| Course Objectives: | | | |
| 1. | To expose the basic theoretical and practical applications of power semiconductor. | | |
| 2. | To develop basic AC-DC, DC-DC, DC-AC conversion circuit fed drives. | | |
| 3. | To provide the basis for further study of controllers in power electronics circuits. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C918.1 | Describe the basic applications of various power semiconductor devices. | | [U] |
| C918.2 | Analyze and design various machine models in Simulation Tool. | | [A] |
| C918.3 | Construct AC / DC rectifier circuits in Simulation Tool. | | [AP] |
| C918.4 | Design basic and advanced DC/DC converter circuits in Simulation Tool. | | [A] |
| C918.5 | Investigate the role of power electronic systems for improvement of power quality | | [AP] |
| C918.6 | Analyze and design inverter circuits for control of drives. | | [A] |
| Course Contents: | | | |
| Module 1: Principle and Models of Semiconductor Devices | | | 15 Hrs |
| Introduction to Sim Power Systems Tool Box, Modelling of Diode with R, R-L, R-C and RLE -load, SCR, MOSFET, IGBT, TRIAC in Simulation, Simulation of gate/base drive circuits, Simulation of Snubber circuit. Introduction to electrical machine modelling: Induction, DC and Synchronous machines, simulation of basic electric drives, Development of mathematical model for solar cell. | | | |
| Module 2: Simulation of Rectifier and Chopper fed drives | | | 15 Hrs |
| Simulation of single and three phase converters - Uncontrolled, Semi controlled and fully controlled converter for R, RL, RLE load, Dual Converter. Simulation of DC-DC converter fed dc motor drives - Buck, Boost, Buck - Boost Converters for continuous and discontinuous current and Simulation of four quadrant operations of DC-DC converter. Investigation on Power factor correction schemes with controllers PWM. | | | |
| Module 3: Simulation of Inverter fed drives | | | 15 Hrs |
| Simulation of single and three phase inverters with MOSFET and IGBT, Space Vector Representation, Pulse-width modulation methods for voltage and waveform control. Simulation of Inverter fed Induction and BLDC motor drives. Single and three phase AC voltage converter with R and RL load, Cycloconverters. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1. | Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2014. | | |
| 2. | Randall Shaffer., "Fundamentals of Power Electronics with MATLAB", Firewall Media, India, 2010. | | |
| 3. | Dr. Shailendra Jain "Modelling and Simulation using MATLAB Simulink", Wiley, 2nd Edition, 2015. | | |
| 4. | Farzin Asadi, Simulation of Power Electronics Circuits with MATLAB®/Simulink®: Design, Analyze, and Prototype Power Electronics (Maker Innovations Series), Apress; 1st ed. edition, 2022 | | |

| Reference Books: | |
|------------------|---|
| 1. | Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications and Design", 3rd Edition, John Wiley & Sons, 2009. |
| 2. | Haitham Abu-Rub., Etal., "High Performance Control of AC Drives with Matlab / Simulink Models", Wiley Publications, 2012. |
| 3. | M.B. Patil, V. Ramanarayanan, V.T. Ranganathan. Patil, Mahesh B, "Simulation of power electronic circuits", Oxford, U.K. Alpha Science International, 2009. |
| Web References: | |
| 1. | http://nptel.ac.in/downloads/108105066/ |
| 2. | https://www.coursera.org/specializations/power-electronics |
| 3. | https://www.mathworks.com/academia/courseware.html |
| 4. | https://www.mathworks.com/support/books/book54209.html?category=1 |
| 5. | https://www.electronicshub.org/matlab-projects-for-engineering-students/ |
| 6. | https://www.learnfly.com/matlab-for-power-electronics-simulation-analysis |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C918.1 | Understand | Online Quiz | 20 |
| C918.2 | Analyze | Technical Presentation | 20 |
| C918.3 | Apply | Assignment | 20 |
| C918.4 | Analyze | | |
| C918.5 | Apply | Simulation Exercises | 20 |
| C918.6 | Analyze | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | | Component - II (20 Marks) |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|-------------------|-----|-----|-----|-----|-------------------|-----|-----|-----|------|------|-----------------|------|------|------|
| C918.1 | 2 | 1 | | | 2 | | | | | | | 1 | 3 | 2 | |
| C918.2 | 3 | 3 | 2 | 2 | 3 | | | | 2 | 2 | | 2 | 3 | 3 | |
| C918.3 | 3 | 2 | 1 | 1 | 3 | | | | | | | 2 | 3 | 3 | |
| C918.4 | 3 | 3 | 2 | 2 | 3 | | | | 2 | 2 | | 2 | 3 | 3 | |
| C918.5 | 3 | 2 | 1 | 1 | 3 | | | | | | | 2 | 3 | 3 | |
| C918.6 | 3 | 3 | 2 | 2 | 3 | | | | 2 | 2 | | 2 | 3 | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|---|----------------|
| 21EE919 | Electric Drives and Control | | 3/0/0/3 |
| Nature of Course | | E (Theory Skill Based) | |
| Course Pre-requisites | | Electrical Machines – I & II, Power Electronics | |
| Course Objectives: | | | |
| 1 | To understand the basic concepts and various control techniques involved with DC and AC Drives. | | |
| 2 | To study and analyze the operation of the converter / chopper fed DC drive and to solve simple problems. | | |
| 3 | To study and understand the operation of both classical and modern induction motor drives and synchronous motor drives. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C919.1 | Infer the basic concepts and application of drive system. | [U] | |
| C919.2 | Analyse the characteristics and control of DC motors drives. | [A] | |
| C919.3 | Correlate characteristics and control of induction motor drives. | [A] | |
| C919.4 | Discriminate the characteristics and control of synchronous motor drives. | [A] | |
| C919.5 | Construct digital control techniques in AC and DC drives. | [AP] | |
| Course Contents: | | | |
| Module 1: Introduction to Electrical Drives and DC Motor Drives | | | 12 Hrs |
| Introduction - Choice of Electric Drives and Losses, Torque equation, Mathematical condition for steady state stability, speed-torque convention and multi-quadrant operation. Control of Electrical Drives: Modes of operation, speed control and drive classifications, closed loop control of drives, Speed control of DC motors - Single phase fully controlled and half controlled rectifiers - Chopper controlled DC drive, Design of controllers: current and Speed controller. | | | |
| Module 2: Induction Motor and Synchronous Motor Drives | | | 18 Hrs |
| Types of Braking and plugging, Stator voltage control - Slip-power recovery drives, Control of AC drives: v/f control, constant slip-speed control and constant air-gap flux control, Basics of voltage/current fed inverters, Block diagram of closed loop drive, Vector Control Synchronous Motor Drive: Open loop volts/hertz control and self - Control of synchronous motor - Marginal angle control and power factor control, Permanent magnet synchronous motor. Applications of Vector control in induction motor, Variable frequency drives (VFDs) and Adjustable Speed Drives (ASDs) in Industries. | | | |
| Module 3: Digital Control and Drive Applications | | | 15 Hrs |
| Digital techniques in speed control - Advantages and limitations, Microprocessor / Microcontroller, PLC based control of drives and SCADA for drives, networking of drives - Selection of drives and control schemes for Steel rolling mills, Paper mills, Cement mills, Machine tools, Lifts and Cranes, Solar and battery powered drives, Simulation of DC and AC drives. | | | |
| | | | Total Hours 45 |
| Text Books: | | | |
| 1. | R. Krishnan, "Electric Motor and Drives: Modeling, Analysis and Control", Prentice Hall of India, New Delhi, 2017. | | |
| 2. | Gopal.K.Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2018. | | |
| 3. | P.C.Sen, "Principles of Electric Machines and Power Electronics", Wiley, 2018. | | |
| 4. | Mohammed Fazlur Rahman , Sanjeet K. Dwivedi , "Modeling, Simulation and Control of Electrical Drives", IET, 2019. | | |
| Reference Books: | | | |
| 1. | Bimal K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, 2015. | | |
| 2. | S.K. Pillai, "A First Course on Electrical Drives", Wiley Eastern Limited, 2015. | | |
| 3. | Vedam Subramanyam, "Electric Drives: Concepts and Applications", Tata McGraw Hill Ltd, New Delhi, 2014. | | |
| 4. | Shaahin Filizadeh, "Electric Machines and Drives: Principles, Control, Modeling, and Simulation", CRC Press LLC, New York, 2013. | | |
| Web References: | | | |

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|----|---|
| 1. | https://www.coursera.org/learn/electronics/ |
| 2. | https://nptel.ac.in/courses/108108077/ |
| 3. | https://nptel.ac.in/courses/108104140 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C919.1 | Understand | Online Quiz | 20 |
| C919.2 | Analyze | Technical Presentation | 20 |
| C919.3 | Analyze | Simulation Exercises | 20 |
| C919.4 | Analyze | Assignment | 20 |
| C919.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|--------------------------|-----|-----|-----|----------|--------------------------|-----|-----|-----|------|----------|------------------------|------|------|------|
| C919.1 | 2 | 1 | | | | | | | | | | | 1 | 2 | 2 |
| C919.2 | 1 | | | | | | | | | | | | | 1 | 1 |
| C919.3 | 2 | 1 | | | | | | | | | | | 1 | 2 | 2 |
| C919.4 | 2 | 1 | | | 2 | | | | | | | | 1 | 2 | 2 |
| C919.5 | 3 | 2 | 1 | | 3 | | | | | | | | 2 | 3 | 3 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|--|-----------------------|-------------|
| 21EE920 | Active PWM Rectifiers | | 3/0/0/3 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | Power Electronics | |
| Course Objectives: | | | |
| 1 | To analyze the performance of controlled rectifier with passive filters. | | |
| 2 | To acquire the knowledge about multi-phase voltage generation for converters. | | |
| 3 | To assess the performance of AC / DC single switch and bidirectional boost converter. | | |
| 4 | To analyze the performance of isolated single-phase AC/DC fly back converters. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C920.1 | Analyze the performance of controlled rectifiers with different passive filter configuration. | [A] | |
| C920.2 | Interpret the concept of generation of multiphase voltage generation for converter. | [U] | |
| C920.3 | Examine the basic concept of single switch AC/DC boost Converter. | [A] | |
| C920.4 | Appraise AC/DC bidirectional boost converter in steady state and at different power factors. | [E] | |
| C920.5 | Analyze the performance of isolated single-phase AC/DC fly back Converter. | [A] | |
| Course Contents: | | | |
| Module 1: Thyristor rectifiers with passive filtering | | | 15 Hrs |
| Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L, C and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current wave shape. Multi-Pulse converter: Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, Commutation overlap, notches during commutation. | | | |
| Module 2: Single-phase AC-DC single-switch Bidirectional boost converter | | | 18 Hrs |
| Power circuit of single-switch AC-DC converter - steady state analysis, unity power factor operation, closed-loop control structure. AC-DC bidirectional boost converter: Power circuits of 1-phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure, voltage doubler mechanism. Bridge Boost Converter Topologies – Applications | | | |
| Module 3: Isolated single-phase AC-DC fly back converter | | | 12 Hrs |
| Power circuit of AC-DC fly back converter - Steady state analysis, unity power factor operation, closed loop control structure. Single-phase single-stage AC-DC stacked fly back converter, Fly back converter with energy regenerative snubber, Multi-output fly back converter - Principle and Application. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | Muhammad H.Rashid, Power Electronics Handbook,4th edition, Elsevier, 2018. | | |
| 2 | R. W. Erickson and D. Maksimovic, Fundamentals of Power Electronics, Springer Science and Business Media, 2013. | | |
| 3 | Ned Mohan, Tore M.Undeland, William P. Robbins, Power Electronics, 3 rd edition (An Indian Adaption, Converter, Application and Design) , Wiley Editorial Team, 2022. | | |
| Reference Books: | | | |
| 1 | L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009. | | |
| 2 | Keng Chih Wu, Pulse Width Modulated DC-DC Converters, 3rd edition, Springer Science Business Media, 2012. | | |
| 3 | J.G. Kassakian, M.F.Schlecht and G.C.Verghese,“Principles of Power Electronics”, Addison – Wesley Publication, 2010. | | |

| Web References: | |
|-----------------|---|
| 1 | https://nptel.ac.in/syllabus/108999902/ |
| 2 | https://archive.nptel.ac.in/courses/108/102/108102145/ |
| 3 | https://nptel.ac.in/courses/108108036 |
| 4 | https://nptel.ac.in/courses/108107128 |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C920.1 | Analyze | Online Quiz | 20 |
| C920.2 | Understand | Technical Presentation | 20 |
| C920.3 | Analyze | Assignment | 20 |
| C920.4 | Evaluate | Case Study | 20 |
| C920.5 | Analyze | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 10 | 20 |
| Apply | 10 | 20 | 30 |
| Analyse | 40 | 60 | 30 |
| Evaluate | - | 10 | 10 |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C920.1 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | 2 | |
| C920.2 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | 2 | |
| C920.3 | 3 | 3 | 3 | 3 | | | | | | 2 | | | 3 | 2 | |
| C920.4 | 3 | 3 | 3 | 3 | | | | | | | | | 3 | 2 | |
| C920.5 | 3 | 3 | 2 | 2 | | | | | | 2 | | | 3 | 2 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|--|---------|
| 21EE921 | Electric and Hybrid Vehicles | | 3/0/0/3 |
| Nature of Course | | C (Theory Concept) | |
| Course Pre-requisites | | Electrical Machines, Power Electronics | |
| Course Objectives: | | | |
| 1 | To study about the working of electric vehicles. | | |
| 2 | To understand the configuration of hybrid vehicles. | | |
| 3 | To impart the knowledge on energy storage device. | | |
| 4 | To learn electric vehicle drive systems. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C921.1 | Describe the basic fundamentals, working principles of Electric Vehicles and types of engines. | | [U] |
| C921.2 | Analyze the transmission characteristics and mathematical models of Electric Vehicles. | | [A] |
| C921.3 | Analyze the configuration and control methods of Electric Propulsion unit. | | [A] |
| C921.4 | Enumerate the Energy Storage Requirements in Hybrid and Electric Vehicles. | | [U] |
| C921.5 | Apply the energy management strategies to hybrid and electric vehicles. | | [AP] |
| Course Contents: | | | |
| Module 1: Hybrid Electric Vehicles | | | 15 Hrs |
| Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. Stratified charge engines, Learn burn engines, Low heat rejection engines. | | | |
| Module 2: Hybrid Electric Drive-Trains and Electric propulsion unit | | | 15 Hrs |
| Electric Drive-trains: Introduction to various electric drive-train topologies, power flow control in electric drive-train topologies. Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drive and Induction Motor drive. Autonomous driving system. | | | |
| Module 3: Energy Storage and Sizing the drive system | | | 15 Hrs |
| Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery and Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices. Sizing of the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology. Design of a Battery Electric Vehicle (BEV). | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press, 2018. | | |
| 2 | T. Denton, “Electric and Hybrid Vehicles”, Second Edition , Routledge, 2020. | | |
| 3 | M. Ehsani, Y. Gao and A. Emadi, ‘Modern electric, hybrid electric and fuel cell vehicles: Fundamentals,Theory and design’,3 rd edition, CRC press, 2018. | | |

| Reference Books: | |
|------------------|---|
| 1 | C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2017. |
| 2 | S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015. |
| 3 | K. T. Chau, 'Electric vehicle machines and drives: Design, analysis and application', first edition, John Wiley and Sons Singapore pvt. ltd., 2015. |
| Web References: | |
| 1 | https://nptel.ac.in/syllabus/108103009/ |
| 2 | http://web.mit.edu/evt/links.html |
| 3 | http://www.chalmers.se/SiteCollectionDocuments/Energi%20och%20milj%C3%B6/Elteknik/EmmaGrunditz_PhDthesis_lowrez |
| 4 | https://www.hyundai.com/in/en/find-a-car/kona-electric/highlights.html |
| 5 | https://tech.hyundaimotorgroup.com/tag/futuretechnology/?gclid=EAlaIqobChMImdOH6T06AlViH0rCh2V4w5PEAAAYASAAEgl90_D_BwE |
| 6 | https://afdc.energy.gov/files/pdfs/hev_ev_ghgreductions.pdf&ved=2ahUKEwi_tv-KpPT0AhV06nMBHdeSAcQFjAAegQIBBAB&usq=AOvVaw2KfAnH97Y4gTmkGP5xJQWN |
| 7 | http://support.skillscommons.org/showcases/open-courseware/energy/e-vehicle-tech-cert/ |
| 8 | https://www.edu.autobotindia.com |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|-------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C921.1 | Understand | Online Quiz | 20 |
| C921.2 | Analyze | Techniccal Presentation | 20 |
| C921.3 | Analyze | Simulation Exercises | 20 |
| C921.4 | Understand | Assignment | 20 |
| C921.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 20 | 10 |
| Understand | 30 | 40 | 40 |
| Apply | 30 | 40 | 30 |
| Analyse | 30 | - | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | | |

| No. of the CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------------|-------------------|-----|-----|-----|-----|-------------------|-----|-----|-----|------|-----------------|------|------|------|------|
| C921.1 | 2 | 1 | | | | | | | | | | | 2 | 3 | |
| C921.2 | 2 | 1 | | | | | | | | | | | 2 | 3 | |
| C921.3 | 3 | 3 | 1 | 1 | | | | | | | | | | 3 | |
| C921.4 | 3 | 3 | 2 | 2 | | | | | 2 | | | | 2 | 3 | |
| C921.5 | 3 | 2 | 2 | 2 | | | | | 2 | 2 | | | | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

OPEN ELECTIVES

| | | | |
|---|---|------------------------|-------------|
| 21EE001 | Power Generation Systems | | 3/0/0/3 |
| Nature of Course | | D (Theory application) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To compare the working of different types of Conventional Power Plants. | | |
| 2 | To interpret in detail about the necessity and importance of Combined Operation of Power Plants. | | |
| 3 | To understand the Power Generation Techniques using different non-conventional energy sources and Major Electrical Equipment in Power Plants. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C001.1 | Interpret the working of thermal and .Hydro Power Plant and analyze various techniques for Pollution Control in Steam Power Plant. | | [AP] |
| C001.2 | Illustrate the operation and subsystems of Nuclear and Gas Turbine Power Plant. | | [U] |
| C001.3 | Compare the various aspects of different Conventional Power Generation Methods and discuss its merits and Demerits | | [A] |
| C001.4 | Model New Combined Power Generation Cycle Options | | [AP] |
| C001.5 | Discuss the Power Generation using renewable energy and their energy scenarios. | | [U] |
| Course Contents: | | | |
| Module 1: Thermal and Hydropower Plants | | | 15 Hrs |
| Layout of modern coal power plant- Operational Circuits of Thermal Power Plant, Selection of site, Pollution Control Techniques, Steam Turbines, Control and auxiliaries, Binary cycles. Hydro Electric power Plants - Typical layout and components, Classification, Selection of site, Water Turbines, Pumped Storage Plants. Case studies on thermal and hydro power plants. | | | |
| Module 2: Nuclear and Gas Turbine Power Plants | | | 15 Hrs |
| Layout and subsystems of nuclear power plants, Types of reactors, Selection of site, Safety waste disposal for nuclear power plants, Case study on nuclear power plant, Layout of Gas turbine power plant, Types of Gas Turbine Power Plant, Combined Operation of Different power plants - Integrated Gasifier based Combined Cycle (IGCC) systems, Hydro Electric Plant in combination with Steam Plant, Pumped Storage Plant with Nuclear Power Plant. | | | |
| Module 3: Renewable Energy Sources | | | 15 Hrs |
| Construction and working of Wind, Tidal, solar PV and Solar thermal, Geothermal, Biogas and Fuel cell systems. Major Electrical equipment in power plants - Switchgear, Control room, Substations - Classifications. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | Rai,G.D,“Non-Conventional Energy Sources”, Khanna Publishers,2011. | | |
| 2 | El Wakil M.M., “Power Plant Technology”, Tata McGrawHill,2013. | | |
| 3 | R.K.Hegde.,”Power Plant Engineering”, Pearson Publisher Limited Ltd.,2015. | | |
| Reference Books: | | | |
| 1 | PC Sharma, “Power Plant Engineering „”, S.K.Kataria and Sons, New Delhi,2013. | | |
| 2 | Deshpande.M.V, “Elements of Electrical Power Station Design”, PHI Learning Pvt Ltd,2018. | | |
| 3 | Wadhwa.C.L,“ Generation, Distribution and Utilization of Electrical Energy”, Wiley Eastern Limited,3 rd Edition, 2011. | | |
| Web References: | | | |
| 1 | https://nptel.ac.in/courses/108105058/8 | | |
| 2 | http://indianpowersector.com/home/power-station/thermal-power-plant/ | | |
| 3 | www.altenergy.org/renewables/renewables.html | | |
| 4 | https://www.energy.gov/fe/how-gas-turbine-power-plants-work | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
|----------------|---------------|------------------------|---------------------|
| C001.1 | Apply | Case Study | 20 |
| C001.2 | Understand | Online Quiz | 20 |
| C001.3 | Analyze | Assignment | 20 |
| C001.4 | Apply | Technical Presentation | 20 |
| C001.5 | Understand | | |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | - | 10 |
| Understand | 40 | 20 | 30 |
| Apply | 10 | 20 | 30 |
| Analyse | 30 | 60 | 20 |
| Evaluate | - | - | - |
| Create | 10 | - | 10 |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|---|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C001.1 | | 3 | | | | | | | | | | | 3 | | |
| C001.2 | 2 | 1 | | | | 3 | | 2 | | | | | 3 | | 3 |
| C001.3 | 2 | 1 | | | | | 3 | 2 | | | | | 3 | | 3 |
| C001.4 | 2 | 1 | | | | | 3 | 2 | | | | | 3 | | 3 |
| C001.5 | 1 | | | | | | | | | | | | | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | |
|--|---|------------------------|---------|
| 21EE002 | Autonomous Vehicle | | 3/0/0/3 |
| Nature of Course | | D (Theory application) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To introduce the concepts of mobile and satellite communications. | | |
| 2 | To realise the effect of noise on communication systems. | | |
| 3 | To introduce different methods of analog and digital communication and their significance. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C002.1 | Understand the fundamental theory of operation of electronic control systems | | [U] |
| C002.2 | Understand the basics of how automotive ECUs function in conjunction with the vehicle data bus networks and sensors | | [U] |
| C002.3 | Understand the concept of remote sensing and the types of sensor technology needed to implement remote sensing. | | [U] |
| C002.4 | Understand the basic concepts of wireless communications and wireless data networks | | [U] |
| C002.5 | Analyze the various types of advanced driver assistance systems and issues. | | [A] |
| Course Contents: | | | |
| Module 1: Connected and Autonomous Vehicle Technology | | | 15 Hrs |
| Basic Control System Theory applied to Automobiles - Overview of the Operation of ECU - Basic Cyber-Physical System Theory and Autonomous Vehicles - Role of Surroundings Sensing Systems and Autonomy. | | | |
| Module 2: Sensor Technology for Advanced Driver Assistance Systems | | | 15 Hrs |
| Basics of Radar Technology and Systems - Ultrasonic Sonar Systems - Lidar Sensor Technology and Systems - Camera Technology - Night Vision Technology - Use of Sensor Data Fusion. | | | |
| Module 3: Advanced Driver Assistance System Technology | | | 15 Hrs |
| Basics of Theory of Operation - Integration of ADAS Technology into Vehicle Electronics - Role of Sensor Data Fusion - Driverless Car Technology - Moral, Legal, Roadblock Issues - Technical Issues -Security Issues. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | G. Mullett, Wireless Telecommunications Systems and Networks, Thomson Delmar Learning, ISBN#1-4018-8659-0,2006. | | |
| 2 | G. Mullett, Basic Telecommunications : The Physical Layer, Thomson – Delmar Learning, ISBN#1-4018-4339-5, 2003 | | |
| Reference Books: | | | |
| 1 | Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc Gaudiot, “Creating Autonomous Vehicle Systems” Morgan & Claypool Publishers, 2020. | | |
| Web References: | | | |
| 1 | https://freevideolectures.com/course/4278/nptel-advanced-iot-applications/19 | | |
| 2 | https://www.coursera.org/specializations/self-driving-cars | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|------------------------------|-----------------------------|--------------|------------------------------------|---------------------------------|--------------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C002.1 | Understand | Technical Presentation | 20 |
| C002.2 | Analyze | Online Quiz | 20 |
| C002.3 | Understand | Assignment | 20 |
| C002.4 | Analyze | Case Study | 20 |
| C002.5 | Apply | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 70 | 30 | 30 |
| Apply | - | 30 | 30 |
| Analyse | 10 | 20 | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-----------------|-------|-------|-------|-------|
| C002.1 | 2 | 1 | | | | | | | | | | | 2 | 3 | |
| C002.2 | 2 | 1 | | | | | | | | | | | 2 | 3 | |
| C002.3 | 3 | 3 | 2 | 2 | | | | | | | | | | 3 | |
| C002.4 | 3 | 3 | 2 | 2 | | | | | 2 | | | | 2 | 3 | |
| C002.5 | 3 | 2 | 1 | 1 | | | | | 2 | 2 | | | | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | 3 | Strongly Agreed | | | | |

| | | | | | |
|---|--|--------------------------|--|---------|-------------|
| 21EE003 | | Special Purpose Machines | | 3/0/0/3 | |
| Nature of Course | | G (Theory Analytical) | | | |
| Course Pre-requisites | | Nil | | | |
| Course Objectives: | | | | | |
| 1 | To learn the working operation and performance characteristics of Stepping and Switched reluctance motors. | | | | |
| 2 | To realize the constructional features of Synchronous reluctance motor. | | | | |
| 3 | To impart knowledge on the performance of Permanent Magnet Brushless DC and PermanentMagnet Synchronous motors. | | | | |
| 4 | To know about the control strategies of Servo motor. | | | | |
| Course Outcomes: | | | | | |
| Upon completion of the course, students shall have ability to | | | | | |
| C003.1 | Enumerate the principle of operation and performance of Stepper motors | | | | [U] |
| C003.2 | Apply the principle of operation and performance of Switched Reluctanceand Servomotors | | | | [AP] |
| C003.3 | Analyze the construction and operation of Permanent Magnet BrushlessDC motor | | | | [A] |
| C003.4 | Illustrate the construction and operation of Permanent Magnet Synchronous Motors. | | | | [U] |
| C003.5 | Analyze the characteristics and select special motors for specificapplications | | | | [A] |
| Course Contents: | | | | | |
| Module 1: Stepping Motors and Switched Reluctance Motor | | | | | 15 Hrs |
| Stepper motor: Constructional features, Principle of operation, Special features of stepper motors, Variable reluctance, Permanent magnet stepping motor, Torque versus stepping rate characteristics - Linear actuators with Stepper Motors. Application aspects related to textile industries and integrated circuit fabrications. Switched Reluctance Motor: Constructional features, Principle of operation, Torque equation, Characteristics, Control Techniques and Drive Concept. | | | | | |
| Module 2: Permanent Magnet DC and Synchronous Motor | | | | | 15 Hrs |
| Brushless DC. Motors - Commutation in DC motors, Difference between mechanical and electroniccommutators, Torque and EMF equation, Rotor position sensors, Multiphase Brushless DC motor, Square wave permanent magnet brushless DC motor drives and their torque-speed characteristics. Application aspect related to vehicle and house hold-Permanent Magnet Synchronous Motor - Principle of operation, EMF, Power input and torque expressions, phasor diagram, Power Controllers,Torque speed characteristics. | | | | | |
| Module 3: Servomotor | | | | | 15 Hrs |
| Servomotor - Constructional features, Principle of Operation, Types, Characteristics, Control strategies. Applications of servomotor requiring precise position control - AC Tachometer Operating principle and its schematic diagram, Case study-Selection of motors for hydraulic and Pneumatic systems - Gear, Piston and Vane motors. | | | | | |
| | | | | | Total Hours |
| | | | | | 45 |
| Text Books: | | | | | |
| 1 | Berker Bilgin, James Weisheng Jiang, Ali Emadi "Switched Reluctance Motor Drives: Fundamentals to Applications" CRC press, 2018 | | | | |
| 2 | R.Krishnan, "Permanent Magnet Synchronous and Brushless DC Motor Drives" T&FIndia, 2016 | | | | |
| 3 | Dr.Duanek Hanselman,"Brushless Motors: Magnetic Design, Performance, and Control of Brushless DC and Permanent Magnet Synchronous Motors" E-Man Press LLC,2012 | | | | |
| Reference Books: | | | | | |
| 1 | Ahmed Tahor, Abdel Ghani Aissabui "Switched Reluctance Motor Concept, Control and Applications",InTech Open,2017 | | | | |
| 2 | Riazollah Firoozian "Servo Motors and Industrial Control Theory" Springer International Publishing AG;2nd edition.2014 | | | | |
| 3 | V.V. Athani, "Stepper Motors: Fundamentals, Applications and Design" New Age publisher.2nd edition.2014 | | | | |

| Web References: | |
|------------------------|---|
| 1 | https://www.elprocus.com/stepper-motor-types-advantages-applications/ |
| 2 | https://electrical-engineering-portal.com/characteristics-and-work-principles-of-switched-reluctance-sr-motor |
| 3 | http://machineryequipmentonline.com/hydraulics-and-pneumatics/applications-on-pneumatic-air-motors/ |
| 4 | https://www.site.uottawa.ca/~rhabash/ELG2331SPM.pdf |

| Continuous Assessment | | | | End Semester Examination | Total |
|------------------------------|-----------------------------|--------------|------------------------------------|---------------------------------|--------------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|--|----------------------|-----------------------------|----------------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C003.1 | Understand | Assignment | 20 |
| C003.2 | Apply | Online Quiz | 20 |
| C003.3 | Analyse | Technical Presentation | 20 |
| C003.4 | Understand | | |
| C003.5 | Analyse | Case Study | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|---|---|--------------------------|---|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 50 | 20 | 40 |
| Understand | 50 | 40 | 40 |
| Apply | | 20 | 20 |
| Analyse | - | 20 | - |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C003.1 | 2 | 1 | | | 2 | | | | | | | | | | |
| C003.2 | 3 | 2 | 1 | 1 | 3 | | | | | | | | 3 | 2 | |
| C003.3 | 2 | 1 | | | 2 | | | | | | | | | | |
| C003.4 | 3 | 3 | 2 | 2 | 3 | | | | | | | | 3 | 2 | |
| C003.5 | 2 | 1 | | | 2 | | | | | | | | | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|--|---|------------------------|---------|
| 21EE004 | Renewable Energy Sources | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To study different non- conventional energy systems and its applications. | | |
| 2 | To enhance student's knowledge and assimilate new technologies. | | |
| 3 | To learn techno-economical storage methods of renewable energy systems. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C004.1 | Enumerate the need of renewable energy and Analyze the concept of Kyoto protocol, energy scenario in India and Integrated Resource Plan | | [A] |
| C004.2 | Assess the role of Solar and wind energy in power plants | | [U] |
| C004.3 | Apply the ideas of renewable energy sources to perform case studies | | [AP] |
| C004.4 | Assess the role of biomass, tidal and geothermal in power plants | | [A] |
| C004.5 | Illustrate the operation and importance of different energy storage methods | | [U] |
| C004.6 | Investigate the integration of renewable energy systems in Power plants | | [AP] |
| Course Contents: | | | |
| Module1: Introduction | | 15 Hrs | |
| Importance and types of renewable sources of energy, Limitations of RE sources, Present Indian and international energy scenario of conventional and renewable energy sources, Kyoto protocol, concept of clean development mechanism and prototype carbon funds, Integrated resource plan. | | | |
| Module2: Wind Energy and Solar Energy | | 15 Hrs | |
| in the Wind, Types of Wind Power Plants (WPPs) - Components of WPPs - Working of WPPs - Site selection of WPPs, Solar Power, Solar thermal, Solar photovoltaic - Module, panel and array - series and parallel connections. Maximum Power Point Tracking, Applications. Case studies on solar PV system, wind energy system. | | | |
| Module3: Other Energy Sources and Storage Methods | | 15 Hrs | |
| Methods to generate - Biomass energy, tidal energy, geothermal energy and Fuel cell, applications, Storage methods of mechanical, chemical, electromagnetic, electrostatic and thermal energy - Selection and significance of Batteries - Hybrid energy systems and hybrid electric vehicles. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | John T. Widwell and Tony Weir, "Renewable Energy Resources", 4 th Edition, Routledge, 2021. | | |
| 2 | B.H.Khan, "Non-Conventional Energy Resources", 3 rd Edition, Tata McGraw Hill, New Delhi, 2017. | | |
| 3 | G D Rai, "Non-conventional Energy sources", Khanna Publishers, 5th Edition, 2014. | | |
| Reference Books: | | | |
| 1 | G.N.Tiwari, "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009. | | |
| 2 | Aldo Vieira Da Rosa, "Fundamentals of Renewable Energy Processes", Academia Press, 2012. | | |
| 3 | G.Masters, "Renewable and Efficient Electric Power Systems", IEEE-Wiley Publishers, 2013. | | |
| Web References: | | | |
| 1 | http://unfccc.int/kyoto_protocol/items/2830.php | | |
| 2 | https://www.coursera.org/learn/wind-energy | | |
| 3 | https://www.edx.org/course/solar-energy-delftx-et3034x-0 | | |
| 4 | http://unfccc.int/kyoto_protocol/items/2830.php | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
|----------------|---------------|------------------------|---------------------|
| C004.1 | Analyze | Online Quiz | 20 |
| C004.2 | Understand | Technical Presentation | 20 |
| C004.3 | Apply | Assignment | 20 |
| C004.4 | Analyze | | |
| C004.5 | Understand | Case Study | 20 |
| C004.6 | Apply | | |

Assessment based on Summative and End Semester Examination

| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
|---------------|--|-------------------|--|
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | | 5 |
| Understand | 60 | 10 | 15 |
| Apply | - | 50 | 30 |
| Analyse | 30 | 40 | 50 |
| Evaluate | - | - | - |
| Create | - | - | - |

Assessment based on Continuous and End Semester Examination

| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] |
|--|-----------------------------|------------------------------|--------------------|-----------------------------|--|
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C004.1 | 2 | 1 | | | | 2 | 2 | 2 | | | | 1 | | | 1 |
| C004.2 | 3 | 3 | 2 | | | 2 | 3 | 1 | | | | 3 | 1 | 2 | 2 |
| C004.3 | 3 | 3 | 2 | 1 | | 2 | 3 | 1 | | 1 | | 3 | 1 | 2 | 1 |
| C004.4 | 3 | 3 | 2 | | | 2 | 3 | 1 | | | | 3 | 1 | 2 | 1 |
| C004.5 | 2 | 1 | | | | 2 | 3 | 1 | | | | 3 | 1 | 1 | 1 |
| C004.6 | 3 | 3 | 2 | 2 | | 2 | 3 | 2 | | 1 | | 3 | 1 | 2 | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|------------------------|-------------|
| 21EE005 | Servo and Robot Drives | | 3/0/0/3 |
| Nature of Course | | D (Theory application) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To impart the knowledge of servo motors drives and power transmission. | | |
| 2 | To understand the concepts sensors and vision systems. | | |
| 3 | To understand the concepts of robots in various industries for automation | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C005.1 | Interpret the basic laws and concepts of robots. | | [U] |
| C005.2 | Explain the classification of robots and degrees of freedom of serial and parallel manipulators | | [U] |
| C005.3 | Analyze the sensor systems to the robotic system. | | [A] |
| C005.4 | Analyze the power transmission systems in the robotic system. | | [A] |
| C005.5 | Apply the Robots in Manufacturing and Processing Industries. | | [AP] |
| Course Contents: | | | |
| Module 1: Introduction to Fundamental Concepts of Robotics | | | 15 Hrs |
| History, Present status and future trends in Robotics and automation - Laws of Robotics- Robot definitions - Robotics systems and robot anatomy - Structure of a Robot, Classification of Robots: Cartesian, Cylindrical, Spherical, Articulated, SCARA - Specification of Robots - Degrees of Freedom of Serial and Parallel Manipulators- resolution, repeatability and accuracy of a manipulator. | | | |
| Module 2: Sensors and Vision Systems | | | 15 Hrs |
| Principle of operation, types and selection of position and velocity sensors, Potentiometers, Encoders, Resolvers, LVDT, Tacho-generators, Internal and External State Sensors, Proximity sensors. Limit Switches-Tactile sensors -Touch sensors -Force and torque sensors, Robot End Effectors. Vision Systems. Vision Systems for Robotics: Robot vision systems, Image capture-Solid State Cameras-Image Representation-Grey scale and colour images, image sampling and quantization - Image processing and analysis - Image data reduction Segmentation - Feature extraction — Object Recognition. | | | |
| Module 3: Motors Drives and Factory Automation | | | 15 Hrs |
| Types Constructional features — Principle of operation- Feedback system - Robot drive mechanisms, hydraulic-electric servomotor- stepper motor - pneumatic drives. Control of Electrical Drives: Introduction-Parts of Electrical Drives- Fundamental Torque Equations- Speed Torque Conventions and Multi - quadrant Operation-Nature and Classification of Load Torques - Modes of Operation-Closed - Loop Control of Drives. Factory Automation: Flexible Manufacturing Systems concept - Automatic feeding lines, transfer lines, automatic inspection - Computer Integrated Manufacture-CNC, intelligent automation HMI Systems, DCS and SCADA, Wireless controls. | | | |
| | | | Total Hours |
| | | | 45 |
| Text Books: | | | |
| 1 | Deh SR., "Robotics Technology and Flexible Automation", Tata Mc Graw Hill Publishing, Company Ltd., 2 nd edition, 2017. | | |
| 2 | Mikel IP Groover et.al., "Industrial Robots- Technology, Programming and Applications", Mc Graw Hill, New York, 2017. | | |
| 3 | Saeed B Niku, "Introduction to Robotics Analysis, Systems, Applications", PHI Pvt Ltd, New Delhi, 2016. | | |
| 4 | Peter Corke, "Robotics, Vision and Control: Fundamental Algorithms In MATLAB" first Edition 2011. | | |
| Reference Books: | | | |

| | |
|------------------------|---|
| 1 | SK Saha-Introduction to Robotics, Tata Mcgraw Hill, 2010 |
| 2 | Mittal RK, Nagrath IJ, „Robotics and Control, Tata McGrawHill, 2010 |
| 3 | Richard D Klafter, Thomas A Chmielewski, Michael Negin,“Robotics Engineering – An Integrated Approach”, Eastern Economy, Prentice Hall of India Pvt Ltd.,2010. |
| Web References: | |
| 1 | https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/ |
| 2 | https://www.edx.org/course/robotics-columbiacx-csmm-103x |
| 3 | https://www.futurelearn.com/courses/begin-robotics |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C005.1 | Understand | Online Quiz | 20 |
| C005.2 | Understand | Technical Presentation | 20 |
| C005.3 | Analyze | Assignment | 20 |
| C005.4 | Analyze | | |
| C005.5 | Apply | Case Study | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 40 | 20 | 20 |
| Understand | 60 | 40 | 40 |
| Apply | - | 20 | 20 |
| Analyse | - | 20 | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|------------------------------|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | | | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C005.1 | 2 | 1 | | | 2 | | | | | | | | 3 | | |
| C005.2 | 2 | 1 | | | | | 1 | | | | | | 2 | | |
| C005.3 | 3 | 3 | 2 | 2 | | | 1 | | | | | | 3 | 1 | |
| C005.4 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | | |
| C005.5 | 3 | 2 | 1 | 1 | 2 | | | | | | | | 3 | 1 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|--|---------|
| 21EE006 | Industrial Electrical system | | 3/0/0/3 |
| Nature of Course | C (Theory Concept) | | |
| Course Pre-requisites | NIL | | |
| Course Objectives: | | | |
| 1 | To equip with knowledge of basic maintenance of industrial electrical systems in a safe and environmentally sound manner | | |
| 2 | To imbibe knowledge on protection systems. | | |
| 3 | To study about protective devices to protect from electrical hazards. | | |
| 4 | To know about the automation in electrical systems. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C006.1 | Illustrate the extreme importance of observing all safety requirements and practices connected with electricity | | [R] |
| C006.2 | Summarize about various electrical hazards and demonstrate what to do during an electrical accident. | | [U] |
| C006.3 | Analyze various protection methods for hazardous electrical equipment. | | [A] |
| C006.4 | Enumerate various components of industrial electrical systems. | | [U] |
| C006.5 | Paraphrase the role of automation in electrical systems. | | [U] |
| Course Contents: | | | |
| Module 1: Concepts and Statutory Requirements | | | 12 Hrs |
| Working principles of electrical equipment - Indian electricity act and rules-statutory requirements from electrical inspectorate-international standards on electrical safety – first aid - cardio pulmonary resuscitation (CPR). | | | |
| Module 2: Electrical Hazards | | | 15 Hrs |
| Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity, Safety in handling of war equipment, hazardous conditions, control, electrical causes of fire and explosion. | | | |
| Module 3: Protection Systems | | | 18 Hrs |
| Protection components- Fuse, MCB, MCCB, ELCB -Personal protective equipment – safety in handling hand held electrical appliances tools and medical equipment. Industrial Electrical Systems- DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks. Industrial Electrical System Automation- Study of basic PLC, Role of PLC in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Mary Capelli-Schellpfeffer , Dennis Neitzel, John Cadick, Al Winfield “Electrical Safety Handbook”, McGraw-Hill Education,4th Edition,2012. | | |
| 2 | Hemant Joshi ,” Residential, Commercial and Industrial Electrical Systems: Equipment and Selection, McGraw Hill Education,2008 | | |
| 3 | S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & Costing”, Khanna publishers, 2008. | | |

| Reference Books: | |
|------------------|--|
| 1 | Power Engineers – Handbook of TNEB, Sixth Edition, Chennai, 2002. |
| 2 | Indian Electricity Act and Rules, Government of India, The Electricity Act, 2003. |
| 3 | Martin Glov Electrostatic Hazards in powder handling, Research Studies Pvt. LTd., England, 2003. |
| Web References: | |
| 1 | www.osha.gov https://library.e.abb.com |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C006.1 | Remember | Online Quiz | 20 |
| C006.2 | Understand | Case Study | 20 |
| C006.3 | Analyze | Assignment | 20 |
| C006.4 | Understand | Technical Presentation | 20 |
| C006.5 | Understand | | |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 30 | 10 | 10 |
| Understand | 30 | 20 | 40 |
| Apply | 60 | 20 | 20 |
| Analyse | - | 50 | 30 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|-------------------|------|------|------|-------|-------|-----------------|-------|-------|-------|
| C006.1 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | 2 | |
| C006.2 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | 2 | |
| C006.3 | 3 | 3 | 3 | 3 | | | | | | 2 | | | 3 | 2 | |
| C006.4 | 3 | 3 | 3 | 3 | | | | | | | | | 3 | 2 | |
| C006.5 | 3 | 3 | 2 | 2 | | | | | | 2 | | | 3 | 2 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |



EMERGING ELECTIVES

| | | | |
|---|--|---|---------|
| 21EE007 | Machine Learning Applications in Energy Systems | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Power System Analysis, Python Programming | |
| Course Objectives: | | | |
| 1 | Understand the concept of Machine Learning (ML). | | |
| 2 | Recognize the applications in Renewable energy sources. | | |
| 3 | To investigate the effectiveness of ML in power systems. | | |
| 4 | To Study about load forecasting and fault detection in power system using ML topics. | | |
| 5 | To accomplish the approach of machine learning based Artificial Neural Network (ANN) and Genetic Algorithm (GA) in power system. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C007.1 | Perceive knowledge about Machine learning concepts and its classifications. | [U] | |
| C007.2 | Analyze load forecasting and fault detection in power system using Machine Learning concepts. | [A] | |
| C007.3 | Understand the concept of GA and ANN in power system. | [U] | |
| C007.4 | Demonstrate Machine learning applications in smart grid. | [AP] | |
| C007.5 | Analyze the concepts of machine learning in Renewable energy generation and monitoring. | [A] | |
| Course Contents: | | | |
| Module 1: Introduction | | 15 Hrs | |
| Introduction to Machine learning - History and early works - Theoretical aspects of ML - Different types of Machine Learning algorithms - Linear regression, Logistic regression, K - Nearest Neighbour, Artificial Neural Networks, Random Forest, and Support Vector. | | | |
| Module 2: Machine learning in Power Systems | | 15 Hrs | |
| Operation and control problems of load forecasting - Renewable energy forecasting - Load flow studies - Economic load dispatch, Unit commitment, power plant monitoring, fault identification and security assessment - Unconstrained and constrained optimization using Genetic Algorithm and NN in power system - Machine learning applications in smart grid. | | | |
| Module 3: Machine learning in Renewable Energy Systems | | 15 Hrs | |
| Machine learning techniques for renewable energy generation - Machine learning applications in Forecasting renewable energy sources (Wind, Solar and Hydro power) - Determining plant location, size and configuration, Managing renewable energy integrated smart grid - Forecasting accuracy of algorithms - Battery Management Using Machine Learning. Case Study: Wind power forecasting based on daily mean wind speed and standard deviation. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Andrew Kelleher, Adam Kelleher, 'Machine Learning in Production- Developing & Optimizing Data Science Workflows and Applications, 1 st Edition, Pearson publishers, 2020. | | |
| 2 | Saifullah Khalid, 'Applications of Artificial Intelligence in Electrical Engineering', 1 st Edition, GI Global Knowledge publisher, 2020. | | |
| 3 | Rakesh Sehgal, Neeraj Gupta, Anuradha Tomar, Mukund Dutt Sharma and Vigna Kumaran, 'Smart Electrical and Mechanical Systems: An Application of Artificial Intelligence and Machine Learning' Elsevier Science, 2022. | | |
| Reference Books: | | | |
| 1 | Mohssen Mohammed, Muhammad Badruddin Khan, Eihab Bashier Mohammed Bashier, "Machine Learning: Algorithms and Applications", CRC Press Taylor and Francis group, 1 st edition, 2020 | | |
| 2 | Morteza Nazari-Heris, Milad Sadat-Mohammadi, Houtan Jebelli, Moloud Abdar, Somayeh Asadi, Behnam Mohammadi-Ivatloo, 'Application of Machine Learning and Deep Learning Methods to Power System Problems' Springer International Publishing. 1 st edition, 2021. | | |

| Web References: | |
|-----------------|---|
| 1 | https://nptel.ac.in/courses/106105152 |
| 2 | https://www.datarevenue.com/en-blog/machine-learning-for-energy-distribution |
| 3 | https://www.mdpi.com/journal/energies/special_issues/Machine Learning Optimization Power System |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|----------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C007.1 | Understand | Technical Quiz | 20 |
| C007.2 | Analyze | Case Study | 20 |
| C007.3 | Understand | Class Presentation | 20 |
| C007.4 | Apply | | |
| C007.5 | Analyze | Assignment | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 10 | 20 |
| Understand | 40 | 30 | 20 |
| Apply | 20 | 40 | 20 |
| Analyse | 20 | 20 | 40 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C007.1 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | 2 | |
| C007.2 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | 2 | |
| C007.3 | 3 | 3 | 3 | 3 | | | | | | 2 | | | 3 | 2 | |
| C007.4 | 3 | 3 | 3 | 3 | | | | | | | | | 3 | 2 | |
| C007.5 | 3 | 3 | 2 | 2 | | | | | | 2 | | | 3 | 2 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|---|---------|
| 21EE008 | Big Data Analytics for Smart Grid | | 3/0/0/3 |
| Nature of Course | | D (Theory application) | |
| Course Pre-requisites | | Power System Analysis, Python Programming | |
| Course Objectives: | | | |
| 1 | To learn the infrastructure and technologies used in Smart Grid. | | |
| 2 | To realize the challenges in Power System and futuristic technologies for improving power system stability. | | |
| 3 | To impart knowledge on Intelligent data collection devices, Machine learning algorithms for Big Data Analytics. | | |
| 4 | To know about the Cloud and Edge Computing for Smart Grid Applications. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C008.1 | Examine the Challenges and provide Solutions in Power Systems. | [A] | |
| C008.2 | Describe the necessity for Smart Grid, its structure, tools and technologies. | [U] | |
| C008.3 | Implement the Machine learning algorithms for Big Data Analytics. | [AP] | |
| C008.4 | Illustrate the Potential Applications of Big Data Analytics in Smart Grids. | [AP] | |
| C008.5 | Investigate the Edge and Cloud computing solutions for the Smart Grid. | [A] | |
| Course Contents: | | | |
| Module 1: Data Analysis and Data Science in Smart Grid | | | 15 Hrs |
| Basics of Smart Grid - Use of Satellite Communication in Modern Power System - Challenges and Solutions in Power Systems - Need for Big Data Analytics 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. | | | |
| Module 2: Machine Learning Algorithms for Big Data Analytics | | | 15 Hrs |
| Introduction to machine learning - Logistic Regression - Support Vector Machine - Supervised and Unsupervised Learning - Artificial Neural Network and Models - Demonstration of NN implementation of Time Series of Data in the Google Colab using Python - Implementation of CNN of IMDB Data in Google Colab using Python | | | |
| Module 3: Cloud and Edge Computing for SG Applications | | | 5 Hrs |
| Cloud computing and cloud Analytics - Cloud Analytics - Edge Computing for Smart Grid Applications - Application of CC and EC in the field of system optimization, fault detection, intelligent protection, load analysis and forecasting, security and data management. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Shady S. Refaat, Omar Ellabban, Sertac Bayhan, Haitham Abu-Rub, Frede Blaabjerg and Miroslav M. Begovic, “Smart Grid and Enabling Technologies”, Wiley,2021. | | |
| 2 | Bernd M. Buchholz, Zbigniew A. Styczynski “Smart Grids Fundamentals and Technologies in Electric Power Systems of the Future”, Springer Berlin Heidelberg, 2020. | | |
| 3 | Carol L. Stimmel, “Big Data Analytics Strategies for the Smart Grid”,CRC Press, Taylor and Francis,2016. | | |
| Reference Books: | | | |
| 1 | Chun Sing Lai, Loi Lei Lai, Qi Hong Lai, “Smart Grids and Big Data Analytics for Smart Cities”, Springer International Publishing, 2021. | | |
| 2 | Yi Wang, Qixin Chen, and Chongqing Kang ‘Smart Meter Data Analytics’, Springer Singapore, 2020. | | |
| 3 | Pethuru Raj, S. Koteeswaran, “Novel Practices and Trends in Grid and Cloud Computing”, IGI Global, 2019. | | |
| Web References: | | | |
| 1 | https://onlinecourses.swayam2.ac.in/arp19_ap60/preview | | |
| 2 | https://www.coursera.org/lecture/electric-utilities/5-2-smart-grid-YUPgW | | |

| | |
|---|---|
| 3 | https://online.stanford.edu/courses/xeiet137-smart-grid-sensing-data-analytics-and-control |
|---|---|

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C008.1 | Analyse | Online Quiz | 20 |
| C008.2 | Understand | Technical Presentation | 20 |
| C008.3 | Apply | Assignment | 20 |
| C008.4 | Apply | | |
| C008.5 | Analyse | Case Study | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 20 | 20 | 20 |
| Understand | 30 | 30 | 30 |
| Apply | 20 | 30 | 30 |
| Analyse | 30 | 20 | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C008.1 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | | | | | | 3 | | |
| C008.2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | | | | 2 | 3 | 1 | |
| C008.3 | 3 | 3 | 3 | 3 | 3 | | | | 2 | | | 3 | | 3 | 3 |
| C008.4 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | | 2 | | | 3 | 1 | 3 | 3 |
| C008.5 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | | 2 | | | 3 | 1 | 3 | 3 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|-----------------------|---------|
| 21EE009 | Advanced Processors | | 3/0/0/3 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | Microcontrollers | |
| Course Objectives: | | | |
| 1 | To understand the Arduino controller with interfacing applications. | | |
| 2 | To analyse the programming concepts of ARM processor and its interfaces. | | |
| 3 | To realise the microcomputer and its peripheral programming. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C009.1 | Examine the features of Arduino controller. | | [A] |
| C009.2 | Apply the Arduino controller for various interfacing applications | | [AP] |
| C009.3 | Describe the concepts of embedded C programming. | | [U] |
| C009.4 | Develop advance programs using embedded C | | [AP] |
| C009.5 | Design the software and hardware structure of Raspberry Pi and Jetson Nano. | | [A] |
| Course Contents: | | | |
| Module 1: Arduino Environment and programming | | | 15 Hrs |
| Arduino program - setup and loop functions, main interface of an Arduino through its pins, UART communication protocol to gain controllability and observability, Serial library to communicate with the Arduino through the serial monitor. Transducer Interface - Sensor interface, LCD interface, Servo Control, PWM signal generation concepts, GPS, GSM interface with Arduino Uno. | | | |
| Module 2: Embedded C Programming | | | 15 Hrs |
| Review of data types - scalar types - Primitive types - Enumerated types, Subranges, Structure types - Character strings - Arrays - Functions Introduction to Embedded C -Introduction, Data types Bit manipulation, Interfacing C with Assembly. Embedded programming issues - Reentrancy, Portability, Optimizing and testing embedded C programs. Case Study: Modeling and Analysis of Real Time and Embedded systems. | | | |
| Module 3: Raspberry Pi and Jetson Nano | | | 15 Hrs |
| Introduction about Raspberry Pi and Jetson Nano: OS installation, GPIO, UART, SPI, I2C, C programming, basic computation, Python scripts based accessing of GPIO pins. Case Study: AI based irrigation system, Real time color detection and object tracking, IoT based Applications. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Richard Blum , "Arduino Programming in 24 Hours", Pearson Education; 1 st edition, 2015. | | |
| 2 | Simon Monk , "Programming Arduino: Getting Started with Sketches", McGraw-Hill Education; 2 nd edition, June 2016. | | |
| 3 | Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education, 2002. | | |
| 4 | Jeff Cicolani Beginning Robotics with Raspberry Pi and Arduino Using Python and OpenCV, Apress Publications, First Edition, 2020. | | |
| Reference Books: | | | |
| 1 | O'Reilly Media , "Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects", Michael Margolis Publisher, 2 nd edition, 2015. | | |
| 2 | J.m Hughes O'Reilly, "Arduino - A Technical Reference", 1 st edition, May 2016. | | |
| 3 | Simon Monk, Shroff/O'Reilly, "Raspberry Pi Cookbook: Software and Hardware Problems and Solutions", 2nd Edition, 2016. | | |
| Web References: | | | |
| 1 | https://www.coursera.org/lecture/arduino-platform/lecture-1-1-arduino-platform-0ozFC | | |
| 2 | https://doc.lagout.org/electronics/Game%20boy%20advance/ARM_BOOKS/ARM_System_Developers_Guide-Designing_and_Optimizing_System_Software.pdf | | |
| 3 | https://people.cs.clemson.edu/~yfeaste/cybersecurity/CPSC424/proiect/RaspberryPiTutori | | |

| | |
|---|---|
| | al.pdf |
| 4 | https://www.youtube.com/watch?v=fJWR7dBuc18 |
| 5 | https://www.youtube.com/watch?v=4ggKu1Rt8yg |
| 6 | https://www.youtube.com/watch?v=h0gWfVCSGQQ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C009.1 | Analyze | Online Quiz | 20 |
| C009.2 | Apply | Technical Presentation | 20 |
| C009.3 | Understand | Assignment | 20 |
| C009.4 | Apply | | |
| C009.5 | Analyze | Simulation Exercises | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | 10 | 10 | 10 |
| Understand | 10 | 20 | 20 |
| Apply | 30 | 20 | 30 |
| Analyse | 50 | 30 | 20 |
| Evaluate | - | 10 | 10 |
| Create | - | 10 | 10 |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] | |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C009.1 | 2 | 1 | | | 2 | | | | | | | 1 | | 3 | |
| C009.2 | 3 | 2 | 1 | 1 | 3 | 2 | 1 | | | | | 2 | | 3 | |
| C009.3 | 2 | 1 | | | 2 | | | | | | | 1 | | 3 | |
| C009.4 | 2 | 1 | | | 2 | 2 | 1 | | | | | 2 | | 3 | |
| C009.5 | 2 | 1 | | | 2 | 2 | 1 | | | | | 2 | | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|---|--|---------|
| 21EE010 | Internet of Things and its Applications | | 3/0/0/3 |
| Nature of Course | C (Theory Concept) | | |
| Course Objectives: | | | |
| 1 | To introduce evolution of internet technology and need of IoT. | | |
| 2 | To discuss about IoT reference layer, various protocols and software. | | |
| 3 | To train the students to build IoT systems using sensors, single board computers and open source IoT platforms. | | |
| 4 | To make the students to apply IoT data for business solution in various domain in secured manner. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C010.1 | Identify the IoT networking components with respect to OSI layer. | | [U] |
| C010.2 | Design and develop IoT based sensor systems. | | [AP] |
| C010.3 | Evaluate the wireless technologies for IoT. | | [E] |
| C010.4 | Appraise IoT applications in industrial and real world. | | [AP] |
| Course Contents: | | | |
| Module 1: Evolution of IoT and Components | | | 15 Hrs |
| Review of computer communication concepts: OSI layers - Components - Packet communication - Networks - TCP-IP - Subnetting - IPV4 addressing and challenges - IPV6 addressing - IoT architecture reference layer. IoT components: Characteristics IoT sensor nodes - Edge computer - Cloud and peripheral cloud - Single board computers - Open source hardware - Examples of IoT infrastructure. | | | |
| Module 2: IoT Protocol and Cloud Computation | | | 15 Hrs |
| IoT Protocol: MQTT, UDP, MQTT brokers - Publish subscribe modes - HTTP, COAP, XMPP and gateway protocols - IoT Communication Pattern - IoT protocol Architecture - Selection of Wireless technologies - 6LoWPAN, Zigbee, WIFI, BT, BLE, SIG, NFC, LORA, Lifi, Widi. | | | |
| Module 3: IoT Cloud Computation and Applications | | | 15 Hrs |
| Cloud Computation: Evolution of Cloud Computation - Commercial clouds and their features - Open source IoT platforms - Cloud dashboards. | | | |
| Case studies: IoT for smart cities - Health care - Agriculture - Smart meters - M2M - Web of things - Cellular IoT - Industrial IoT - Industry 4.0 - IoT standards. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Vijay Madiseti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga and Vijay Madiseti, 2014. | | |
| 2 | Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014. | | |
| 3 | Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010. | | |
| Reference Books: | | | |
| 1 | LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March, 2008. | | |
| 2 | Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata McGraw Hill, 2010. | | |
| 3 | RonaldL. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010. | | |
| Web References: | | | |
| 1 | https://onlinecourses.nptel.ac.in/noc19_cs65/preview | | |
| 2 | https://nptel.ac.in/courses/106105195 | | |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|--|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
| C010.1 | Understand | Online Quiz | 20 |
| C010.2 | Apply | Technical Presentation | 20 |
| C010.3 | Evaluate | Assignment | 20 |
| C010.4 | Apply | Case Study | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | - | - | - |
| Understand | - | - | - |
| Apply | 50 | - | 40 |
| Analyse | - | 60 | 30 |
| Evaluate | 50 | 40 | 30 |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|-------|----------|------------------------|-------|-------|
| C010.1 | 2 | 1 | | | | | | | | | | | 2 | | |
| C010.2 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | | |
| C010.3 | 3 | 3 | 2 | 2 | | | | | | | | | 3 | | |
| C010.4 | 3 | 2 | 1 | 1 | | 1 | | | | | | | 2 | | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | | 3 | Strongly Agreed | | |

| | | | |
|---|---|------------------------|---------|
| 21EE011 | Real Time Systems | | 3/0/0/3 |
| Nature of Course | | D (Theory Application) | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To study issues related to the design and analysis of systems with real-time constraints. | | |
| 2 | To discuss and analyze different task scheduling algorithms in uniprocessor and multi-processor environments | | |
| 3 | To discuss the features and algorithms for real-time communications to take place in different network structures. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C011.1 | Understand concepts of Real-Time systems | | [U] |
| C011.2 | Infer Real-time programming environments. | | [U] |
| C011.3 | Apply efficient algorithms for real-time task scheduling in uniprocessor and multi-processor environments. | | [AP] |
| C011.4 | Interpret the real time communication Protocols. | | [AP] |
| C011.5 | Analyze the design and functioning of existing real-time systems and real-time operating systems. | | [A] |
| Course Contents: | | | |
| Module 1: Introduction to Real Time Systems | | | 15 Hrs |
| Introduction to real time computing - Concepts; Example of real-time applications – Structure of a real time system – Characterization of real time systems and tasks - Hard and Soft timing constraints - Design Challenges - Performance metrics- Prediction of Execution Time : Source code analysis, Micro-architecture level analysis, Cache and Pipeline issues- Programming Languages for Real-Time Systems. | | | |
| Module 2: Real Time Task Scheduling | | | 15 Hrs |
| Real time OS - Threads and Tasks - Scheduling Algorithm - Clock driven scheduling, table driven scheduling, cyclic, schedulers, hybrid schedulers, event driven scheduling, EDF Scheduling, RMA, DMA, resource sharing among RT tasks, Priority inversion, Priority Inheritance Protocol, Highest Locker Protocol, Priority Ceiling Protocol, Scheduling Real-Time tasks in multiprocessor and distributed systems, Fault tolerant scheduling of tasks, clocks in distributed Real-Time systems. Deadlock: Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. | | | |
| Module 3: Real Time Communication | | | 15 Hrs |
| Real Time Communication - Network topologies and architecture issues - protocols -contention based, token based, polled bus, deadline based protocol, Fault tolerant routing. RTP and RTCP. | | | |
| Case studies: RTOS for Image Processing - Embedded RTOS for Network communication - RTOS for Control Systems. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | J. W. S. Liu, Real-time Systems, Pearson Education, 2018. | | |
| 2 | Raj Kamal, “Embedded Systems- Architecture, Programming and Design”, 3rd Edition, McGraw Hill Education, 2017. | | |
| 3 | R. Mall, Real-Time Systems, Pearson, 2007. | | |
| 4 | C.M. Krishna, Kang G. Shin “ Real Time Systems”, International Edition, McGraw Hill Companies, Inc., New York, 2004. | | |
| Reference Books: | | | |
| 1 | Philip A. Laplante and Seppo J. Ovaska, “Real-Time Systems Design and Analysis: Tools for the Practitioner” IV Edition IEEE Press, Wiley. 2011. | | |
| 2 | D.M.Dhamdhare,” Operating Systems,A Concept-Based Approach,TMH,2008. | | |

| | |
|------------------------|---|
| 3 | Kopetz H. Real-time Systems: Design Principles for Distributed Embedded Applications. Springer Science and Business Media; 2011 Apr 15. |
| Web References: | |
| 1 | https://nptel.ac.in/courses/106105172 |
| 2 | https://www.udemy.com/course/introduction-to-rtos/ |
| 3 | https://www.coursera.org/learn/real-time-systems |
| 4 | https://www.udemy.com/course/mastering-rtos-hands-on-with-freertos-arduino-and-stm32fx/ |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|------------------------|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component | FA (16%) [80 Marks] |
| C011.1 | Understand | Online Quiz | 20 |
| C011.2 | Understand | Technical Presentation | 20 |
| C011.3 | Apply | Assignment | 20 |
| C011.4 | Apply | | |
| C011.5 | Analyze | Case Study | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | - | - | - |
| Understand | 60 | 30 | 30 |
| Apply | 40 | 50 | 50 |
| Analyse | - | 20 | 20 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|------------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) | |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|--------------------------|------|------|------|----------|--------------------------|------|------|------|-------|----------|------------------------|-------|-------|-------|
| C011.1 | 3 | 3 | 2 | 2 | | | | | | | | | | 3 | |
| C011.2 | 3 | 2 | 2 | 2 | 2 | | 2 | | | | 1 | 2 | | 3 | |
| C011.3 | 3 | 3 | 2 | 2 | 2 | | 2 | | | | 1 | 2 | | 3 | |
| C011.4 | 3 | 2 | 2 | 2 | 1 | | 2 | | | | 1 | 2 | | 3 | |
| C011.5 | 3 | 3 | 3 | 2 | 2 | | 2 | | | | 2 | 2 | | 3 | 2 |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |

| | | | |
|---|--|-----------------------|---------|
| 21EE012 | Modern Power Converters | | 3/0/0/3 |
| Nature of Course | | G (Theory Analytical) | |
| Course Pre-requisites | | Power Electronics | |
| Course Objectives: | | | |
| 1 | To impart the knowledge on switched mode power supplies and the characteristics of Power Semiconductor devices. | | |
| 2 | To provide adequate knowledge of isolated converters and design constraints of reactive elements. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C012.1 | Analyze the operation of Switched Mode DC Power Supplies with and without isolation. | | [A] |
| C012.2 | Implement switching technique for switched mode AC-DC converters. | | [AP] |
| C012.3 | Examine the operation of bidirectional converter. | | [A] |
| C012.4 | Infer the implementation of modulation techniques for bidirectional converter. | | [U] |
| C012.5 | Acquire the design constraints of reactive elements in power electronic systems. | | [AP] |
| Course Contents: | | | |
| Module 1: Switched Mode Power Supplies 15 Hrs DC Power supplies and Classification: Switched mode DC power supplies - with and without isolation, single and multiple outputs, closed loop control and regulation. Switched mode AC-DC converters: Synchronous rectification - single and three phase topologies - switching techniques - high input power factor reduced input current harmonic distortion. | | | |
| Module 2: Single-phase Bidirectional Converter 15 Hrs Forward converter, Push-pull converter, Fly back converter - Matrix converters - Basic topology - Commutation - current path - Modulation techniques - Scalar modulation - Indirect modulation - Matrix converter AC-DC application. AC-AC converter with DC link - topologies and operation - with and without resonance link. | | | |
| Module 3: Design of Reactive Elements in Power Electronic Systems 15 Hrs Design of inductor- Transformer and capacitors for power electronic applications - Input filter requirement. State space averaging of converters - Transfer function of converters - Design of feedback compensators - Voltage and current loop. | | | |
| Total Hours | | | 45 |
| Text Books: | | | |
| 1 | Fang Lin Luo, "Advanced DC/DC Converters" , CRC Press, NewYork, 2016. | | |
| 2 | Simon Ang, Alejandro Oliva, "Power Switching Converters", Taylor and Francis, 3rd Edition, 2010. | | |
| 3 | Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics - Converters, Applications and Design", John Wiley and Sons edition 2011. | | |
| 4 | M.H. Rashid, "Power Electronics Circuits, devices and applications", Pearson Education, Inc. Edition 2014. | | |
| Reference Books: | | | |
| 1 | P.S. Bhimbra, "Power Electronics", Khanna Publishers edition 2018. | | |
| 2 | Agarwal, "Power Electronics: Converters, Applications, and Design", 3rd edition, Jai P, Prentice Hall, 2000. | | |

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|------------------------|---|
| 3 | Andrzej M. Trzynadlowski, "Introduction to Modern Power Electronics", 3rd Edition, Wiley Publication, 2015. |
| Web References: | |
| 1 | https://nptel.ac.in/courses/108107128 |
| 2 | https://www.tutorialspoint.com/power_electronics/index.htm |
| 3 | https://in.mathworks.com/videos/developing-dc-dc-converter-control-with-simulink.html |
| 4 | https://in.mathworks.com/videos/series/developing-dc-dc-converter-control-with-simulink.html |

| Continuous Assessment | | | | End Semester Examination | Total |
|-----------------------|----------------------|-------|-----------------------------|--------------------------|-------|
| Formative Assessment | Summative Assessment | Total | Total Continuous Assessment | | |
| 80 | 120 | 200 | 40 | 60 | 100 |

| Assessment Methods & Levels (based on Blooms' Taxonomy) | | | |
|---|---------------|--|---------------------|
| Formative Assessment based on Capstone Model | | | |
| Course Outcome | Bloom's Level | Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment) | FA (16%) [80 Marks] |
| C012.1 | Analyze | Online Quiz | 20 |
| C012.2 | Apply | Simulation exercises | 20 |
| C012.3 | Analyze | Technical Presentation | 20 |
| C012.4 | Understand | | |
| C012.5 | Apply | Assignment | 20 |

| Assessment based on Summative and End Semester Examination | | | |
|--|--|-------------------|--|
| Bloom's Level | Summative Assessment (24%) [120 Marks] | | End Semester Examination (60%) [100 Marks] |
| | CIA1 : [60 Marks] | CIA2 : [60 Marks] | |
| Remember | - | - | 10 |
| Understand | 20 | 20 | 20 |
| Apply | 30 | 30 | 30 |
| Analyse | 50 | 50 | 40 |
| Evaluate | - | - | - |
| Create | - | - | - |

| Assessment based on Continuous and End Semester Examination | | | | | |
|---|-----------------------------|------------------------------|--------------------|-----------------------------|--|
| Continuous Assessment (40%) [200 Marks] | | | | | End Semester Examination (60%) [100 Marks] |
| CA 1 : 100 Marks | | | CA 2 : 100 Marks | | |
| SA 1 (60 Marks) | FA 1 (40 Marks) | | SA 2 (60 Marks) | FA 2 (40 Marks) | |
| | Component - I (20 Marks) | Component - II (20 Marks) | | Component - I (20 Marks) | Component - II (20 Marks) |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|------------------|--------------------------|---------|---------|---------|----------|--------------------------|---------|---------|---------|----------|----------|------------------------|----------|----------|----------|
| C012.1 | 3 | 3 | 2 | 2 | | | 1 | | | | | | 3 | 2 | |
| C012.2 | 3 | 2 | 1 | 1 | 2 | | 2 | | | | 1 | 2 | 3 | 3 | |
| C012.3 | 3 | 3 | 2 | 2 | 2 | | 2 | | | | 1 | 2 | 3 | 3 | |
| C012.4 | 2 | 1 | 1 | 1 | | | 1 | | | | 1 | 2 | 3 | 3 | |
| C012.5 | 3 | 2 | 1 | 1 | 2 | | 2 | | | | 1 | 2 | 3 | 3 | |
| 1 | Reasonably Agreed | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | | |



MANDATORY COURSES

| | | | |
|--|--|---------------------|---------|
| 21MC101 | Induction Programme (FOR ALL BRANCHES OF B.E / B.TECH PROGRAMMES) | | 2/0/0/0 |
| Nature of Course | | Induction Programme | |
| Pre requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To have broad understanding of society and relationships | | |
| 2 | To nurture the character and fulfil one's responsibility as an engineer, a citizen and a human being | | |
| 3 | To incorporate meta skills and values | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C101.1 | Explore academic interest and activities | | [AP] |
| C101.2 | Work for excellence | | [AP] |
| C101.3 | Promote bonding and give a broader view of life and character | | [AP] |
| Course Contents: | | | |
| PHYSICAL ACTIVITY Yoga | | | |
| CREATIVE ARTS (students can select any one of their choice) Painting, sculpture, pottery, music, dance, craft making and so on | | | |
| UNIVERSAL HUMAN VALUES Enhancing soft skills | | | |
| LITERARY AND PROFICIENCY MODULES Reading, writing, speaking – debate, role play etc. Communication and computer skills | | | |
| LECTURES BY EMINENT PEOPLE Guest lecture by subject experts | | | |
| VISIT TO LOCAL AREAS Meditation centre/orphanage/Hospital | | | |
| FAMILIARIZATION TO DEPARTMENT/BRANCH INNOVATION Lectures by Department's Head and senior faculty members | | | |

| | | | | |
|---|---|---------------------------------|--|------------|
| 21MC102 | | Environmental Sciences | | 2 /0 /0 /0 |
| Nature of Course | | Theory Concept | | |
| Pre requisites | | Basics in Environmental Studies | | |
| Course Objectives: | | | | |
| 1 | To learn the integrated themes on various natural resources. | | | |
| 2 | To gain knowledge on the type of pollution and its control methods. | | | |
| 3 | To have an awareness about the current environmental issues and the social problems. | | | |
| Course Outcomes: | | | | |
| Upon completion of the course, students shall have ability to | | | | |
| C102.1 | Recall and play an important role in transferring a healthy environment for future generation. | | | [R] |
| C102.2 | Understand the importance of natural resources and conservation of biodiversity. | | | [U] |
| C102.3 | Understand and analyze the impact of engineering solutions in a global and societal context. | | | [U] |
| C102.4 | Apply the gained knowledge to overcome pollution problems. | | | [AP] |
| C102.5 | Apply the gained knowledge in various environmental issues and sustainable development. | | | [AP] |
| Course Contents: | | | | |
| Module 1: Natural Resources | | | | 10 Hrs |
| Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study-Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources- Soil erosion and desertification — Role of an individual in conservation of natural resources. | | | | |
| Module 2: Environmental Pollutions | | | | 10 Hrs |
| Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Greenhouse effect-Global warming- Ozone layer depletion — case study- Bhopal gas tragedy. Water pollution c. Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution. | | | | |
| Module 3: Social issues and the Environment | | | | 10 Hrs |
| Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard. HIV AIDS. | | | | |
| Total Hours | | | | 30 |
| Text Books: | | | | |
| 1 | AnubhaKaushik and C P Kaushik “Perspectives in Environmental Studies”4 th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi | | | |
| 2 | Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, Oxford University Press 2015. | | | |
| Reference Books: | | | | |
| 1 | Tyler Miller, Jr., “Environmental Science”, Brooks/Cole a part of Cengage Learning, 2014. | | | |
| 2 | William Cunningham and Mary Cunningham, “Environmental Science”, 13 th Edition, McGraw Hill, 2015. | | | |
| 3 | Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Third Edition, Pearson Education, 2014. | | | |

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| Web References: | | | |
| 1 | http://nptel.ac.in/courses/104103020/20 | | |
| 2 | http://nptel.ac.in/courses/120108002 | | |
| 3 | http://nptel.ac.in/courses/122106030 | | |
| 4 | http://nptel.ac.in/courses/120108004/ | | |
| 5 | http://nptel.ac.in/courses/122102006/20 | | |
| Online Resources: | | | |
| 1 | https://www.edx.org/course/subject/environmental-studies | | |
| 2 | www.environmentalscience.org | | |
| Assessment Methods and Levels (based on Bloom's Taxonomy) | | | |
| Formative assessment based on Capstone Model (Max. Marks:100) | | | |
| Course Outcome | Bloom's Level | Assessment Component | Marks |
| C102.1 | Remember | Quiz | 30 |
| C102.2 | Understand | Mini project based on environmental aspect | 30 |
| C102.3 | Understand | Class Presentation | 20 |
| C102.4 C102.5 | Apply | Group Assignment | 20 |

| | | |
|---|---|---------|
| 21MC103 | Soft Skills | 2/0/0/0 |
| Nature of Course | Theory Concept | |
| Pre requisites | Technical Communication Skills | |
| Course Objectives: | | |
| 1. | To develop the students competency level and their capabilities. | |
| 2. | To teach the students to be effective in workplace and social environments. | |
| 3. | To create self confidence among the students and to resolve stress and conflict within themselves. | |
| 4. | To help the students to enhance their career skills by increasing their productivity and performances. | |
| 5. | To concentrate more on conversation skills, presentation skills, verbal ability, critical and creative thinking. | |
| Course Outcomes: | | |
| Upon completion of the course, students shall have ability to | | |
| C103.1 | Remember the principles of soft skills required for their profession. | [R] |
| C103.2 | Understand the importance of Interpersonal communication Skills among individuals, groups and cultures. | [U] |
| C103.3 | Apply verbal and non-verbal communication skills in corporate environment. | [AP] |
| C103.4 | Analyze and apply creativity skills, critical thinking skills and problem solving skills. | [A] |
| C103.5 | Articulate oral and written messages in an appropriate and persuasive manner to suit specific purposes, audiences and contexts at work place. | [AP] |
| C103.6 | Apply good teamwork skills and Leadership Skills | [AP] |
| Course Contents: | | |
| Module 1: Professional Communication Skills | | 10 Hrs |
| Introduction to the Soft Skills, Performance Evaluation 1 –Significance of Soft Skills- Understanding the basic Communication Principles –Listening Skills- Listening Exercises- Speaking Skills- How to start and Sustain a Conversation- Speaking in Groups- Understanding self and Personal Branding, attitude, types of attitude, Positive Attitude, Self Confidence and Self-Motivation - Personal Application/Action Taken. | | |
| Advanced Writing Skills-Principles of Business Writing- E mails- Writing Reports- Types of Reports- Strategies for Report Writing- Personal Application/Action Taken. | | |
| Verbal Ability- Analogy- Classification- Odd One Out- Idioms and Phrases- Sentence Correction- Empathy and its importance in career -Personal Application/Action Taken. | | |
| Module 2: Interpersonal Communication | | 10 Hrs |
| Nonverbal Communication- Individual, Groups and Cultures- Body Language- Attire and Etiquettes- Interpersonal Skills- dealing with diverse People- Networking- Emotional Intelligence and its importance. Personal Application/Action Taken. Developing Creativity- Critical Thinking and Problem Solving Skills- Making the Right Choice- Never Give Up- Begin to Grow- Personal Application/Action Taken. | | |
| Interviews- Facing Job Interviews - Planning and Preparing- Effective Resume along with Covering Letter- Planning and Preparing- Personal Application/Action Taken. | | |
| Self-Discipline - Self Presentation - Personal Application/Action Taken. | | |
| Module 3: Teamwork and Leadership Skills | | 10 Hrs |
| Industry Expectations- Universal Hiring Rule- Personal Application/Action Taken. | | |
| Importance of Human Values-Importance of Team Work- Developing Key Traits in Motivation, Persuasion, Negotiation and Leadership Skills- Being an Effective Team Player- Personal Application/Action Taken. | | |

| | | | |
|--|---|----------------------|-------|
| Planning- Prioritization – Delegation - Conflict Management - Decision and its necessity in crucial situations- Group Discussion - Personal Application/Action Taken. Essential Skills in working Strategies- Presentation and Interaction Skills- What to Present and How- Being Assertive- Multimedia Presentation-Making Effective Presentations. Interview Skills - Do's and Don'ts - Body Language - Answering the Common Questions of Interview- Performance Evaluation 2 - Mock Interview | | | |
| Total Hours | | | 30 |
| Text Books: | | | |
| 1. | Business Communication for managers: An advanced approach, by Penrose, Cengage learning. | | |
| 2. | Professional Communication in Engineering. by H.E. Sales. Palgrave Macmillan 2009. | | |
| 3. | Communication for professional engineers by W. P. Scott, Bertil Billing. Thomas Telford, 1998. | | |
| Reference Books: | | | |
| 1. | Reason and professional ethics by Peter Davson-Galle. Ashgate Publishing, Ltd., 2009. | | |
| 2. | Cross Cultural and Inter Cultural Communication. by William B. Gudykunst. Sage Publications India Pvt Ltd, New Delhi.2003. | | |
| 3. | Corporate Communications: Theory and Practice. By JoepCornelissen. Sage Publications India Pvt Ltd, New Delhi.2004. | | |
| Web References: | | | |
| 1 | https://onlinecourses.nptel.ac.in/noc16_hs15/preview | | |
| 2 | https://www.getinternship.switchidea.com/NTAT/syllabus/Interpersonal-Communication. | | |
| 3 | https://smude.edu.in/smude/programs/bca/soft-skills.html | | |
| Online Resources: | | | |
| 1 | https://swayam.gov.in/course/4047-developing-soft-skills-and-personality | | |
| 2 | https://www.clearias.com/interpersonal-skills-including-communication-skills-for-csat/ | | |
| 3 | https://www.bizlibrary.com/soft-skills-training/ | | |
| Assessment Methods and Levels (based on Revised Bloom's Taxonomy) | | | |
| Formative assessment based on Capstone Model (Max. Marks:100) | | | |
| Course Outcome | Revised Bloom's Level | Assessment Component | Marks |
| C103.1 | Remember | Group Discussion | 30 |
| C103.2 and C103.3 | Understand and Apply | Listening Skills | 20 |
| C103.4 | Analyze | Interview | 20 |
| C103.5 and C103.6 | Apply | Formal Presentation | 30 |

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|--|--|--|---------|
| 21MC104 | Management Organizational Behaviour | | 2/0/0/0 |
| Nature of Course | Theory Concept | | |
| Pre requisites | Nil | | |
| Course Objectives: | | | |
| 1. | The objective of the course is to provide basic knowledge about management to familiarize the students with the management principles and organizational behavior. | | |
| 2. | The course is designed to enable the students to adapt and apply theoretical concepts in business | | |
| 3. | To know about the role of manager in the area of management. | | |
| 4. | To create and implement team building strategies for organization building. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C104.1 | Identify and understand different management principles techniques in business environment. | | [U] |
| C104.2 | Apply management fundamentals and planning to solve organization problems and make effective decisions. | | [AP] |
| C104.3 | Understand and analyze the changes within an individual will change the group as well as the organization | | [A] |
| C104.4 | Understand and analyze the leadership style and organization theories to create a productive environment to workforce. | | [A] |
| C104.5 | Analyze the organizational climate and change management strategies and tactics | | [A] |
| C104.6 | Apply the empowerment strategy and tactics for productivity | | [AP] |
| Course Contents: | | | |
| Module 1: Fundamentals of Management, Planning and Decision Making 10 Hrs Introduction to Management- Concept and functions- Thought Managerial roles and styles- Principles of Management - Levels of Management- Theories of Management - Classical, Scientific, Administrative, Behavioral, Management Sciences Theories. Organizational planning - Vision, Mission and goals, Types of plans, steps in planning process, Approaches to planning, Planning in Dynamic Environment. Decision making process, types of decisions, decision making styles, Behavioural influences on decision making - Group decision making - Vroom's Participative decision-making model. | | | |
| Module 2: Individual, interpersonal and group behavior 10 Hrs Definition, need and importance of Organizational behavior –Learning-Nature -Importance of Learning- Introduction and theories Motivation: Content and process theories-Leadership: Styles and Theories - Perception-Personality — Attitudes- Definition, need and importance - Nature and scope-Importance of Groups and Teams- Role relationships and conflict-Group dynamics- Work values. Organization Theories: Maslow's needs hierarchy theory, two factor theory of motivation, McGregor's theory, ERG theory, McClelland's needs theory, Valance Theory. | | | |
| Module 3: Organizational Development 10 Hrs Organizational culture: Elements - Organizational climate– Factors affecting organizational climate-Organizational Commitment, Organizational change- Importance- Stability Vs Change-Proactive Vs Reaction change- Change process– Resistance to change- Managing changes-Managing International Workforce - Productivity- Alternative change management approaches and cultural contingencies - power to manage effectively; Empowerment and Participation strategies and tactics. | | | |
| Total Hours: | | | 30 Hrs |
| Text Books: | | | |

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|----|---|
| 1. | Nelson, Quick, Khandelwal, "Organizational Behavior", 2nd edition, Cengage Learning, 2016. |
| 2. | Williams, Tripathy, "Principles of Management", Cengage Learning, 2016. |
| 3. | Aswathappa, K, "Organizational Behavior", 12th Edition, Himalaya Publication, 2016. |
| 4. | Stephen Robbins, Timothy A. Judge, "Organizational Behavior", 16th edition, Prentice Hall India Pvt. Ltd, 2014. |

Reference Books:

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|----|---|
| 1. | Chandrani Singh, Aditi Khatri, "Principles and Practices of Management and Organizational Behavior", Sage Publications, 2016. |
| 2. | Richard L. Daft, "Understanding the Theory and Design of Organizations", 11th edition, Cengage Learning, 2013. |
| 3. | John M Ivancevich and Robert Konopaske, "Organizational Behavior and Management", McGraw-Hill Education, 2013. |
| 4. | Udai Pareek, Sushama Khanna, "Organization Behavior", 3rd edition, Oxford Publishing, 2012. |

Web References:

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| 1. | https://iedunote.com/fundamental-concepts-of-organizational-behavior |
| 2. | https://nscpolteksby.ac.id/ebook/ |
| 3. | https://ebooks.lpude.in/management/mba/term_1/DMGT402_MANAGEMENT_PRACTICES_AND_ORGANIZATIONAL_BEHAVIOUR.pdf |
| 4. | https://www.studocu.com/in/document/vellore-institute-of-technology/organizational-behaviour/lecture-notes/ob-notes/3208134/view |

Online Resources:

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| 1. | https://nptel.ac.in/syllabus/110105034/ |
| 2. | https://nptel.ac.in/courses/110/105/110105033/ |
| 3. | https://freevideolectures.com/course/3502/organizational-behaviour-i |
| 4. | https://nptel.ac.in/courses/110/106/110106145/ |

Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:100)

| Course Outcome | Revised Bloom's Level | Assessment Component | Marks |
|------------------|-----------------------|----------------------|-------|
| C104.1 | Understand | Online Quiz | 30 |
| C104.2 C104.3 | Apply and Analyze | Listening Skills | 20 |
| C104.4 | Analyze | Group Discussion | 20 |
| C104.5 C104.6 | Analyze and Apply | Formal Presentation | 30 |

| | | | | |
|--|---|------------------|--|------------|
| 21MC105 | | General Aptitude | | 2 /0 /0 /0 |
| Nature of Course | | Theory Concept | | |
| Pre requisites | | NIL | | |
| Course Objectives: | | | | |
| 1 | To improve the verbal ability. | | | |
| 2 | To improve the mathematical skills. | | | |
| 3 | To develop problem solving skills. | | | |
| 4 | To equip them to face interview and Group Discussion. | | | |
| 5 | To inculcate critical thinking process. | | | |
| Course Outcomes: | | | | |
| Upon completion of the course, students shall have ability to | | | | |
| C105.1 | To teach the basics of Quantitative Techniques in a graded manner | | | [R] |
| C105.2 | Understand the verbal and non-verbal nature of problems in reality and now the shortcut methods of solving it. | | | [U] |
| C105.3 | Solve problems using their general mental ability | | | [AP] |
| C105.4 | To give intense focus on improving and increasing the ability of solving real problems | | | [AP] |
| C105.5 | Think critically about mathematical models for relating different quantities to reach conclusion | | | [AP] |
| C105.6 | Enable effective use of data interpretation, formulas, graphs and assumptions | | | [AP] |
| Course Contents: | | | | |
| Module 1: Number Theory and Statistic | | | | 14 Hrs |
| Number Systems– HCF and LCM of Numbers – Decimal Fractions – Simplification – Square Root and Cube Root of a number – Surds and Indices – Problems on numbers – Percentage– Ratio and Proportion – Divisibility – Mixtures – Averages- Polynomials – Solving Equationsand Inequalities – Discard’s rule of signs – Problems on ages – Chain rule – Time and Work – Time and Distance – Problems on Trains – Problems on Boats and Streams- Measures of central tendency – Mean, Median and Mode – Variance and Standard deviation Logarithms –Profit and Loss – Simple Interest – Compound Interest. | | | | |
| Module 2: Logic and Decision Making | | | | 8 Hrs |
| Analogy – Classification – Series completion – Coding and Decoding – Blood Relations –Puzzle Test – Direction Sense test – Logical Venn Diagrams - Number Ranking and Time Sequence Test – Decision Making – Assertion and Reason– Inserting the missing one – Logical Sequence of words – Syllogisms. | | | | |
| Module 3: Reasoning | | | | 8 Hrs |
| Logic – Statement and Arguments – Statements and Assumptions – Statements and Course of Action – Statements and Conclusions – Deriving conclusions from passages – Functions – Different kinds of functions – Miscellaneous sets- Series – Analogy – Classifications –Analytical Reasoning – Problems on Cubes and Dice – Mirror Images – Water Images – RuleDetection. | | | | |
| Total Hours: | | | | 30 |
| Text Books: | | | | |
| 1 | Aggarwal R. S. “Quantitative Aptitude” Revised Edition, S. Chand Publication. | | | |
| 2 | Abhijit Guha “Quantitative Aptitude” 5 th Edition, McGraw Hill Education. | | | |
| Reference Books: | | | | |
| 1 | Edgar Thorpe “Mental Ability and Quantitative Aptitude” 3 rd Edition, McGraw Hill Education. | | | |
| Web References: | | | | |
| 1 | https://www.wiziq.com/tutorial/815468-quantitative-aptitude-reasoning-data-interpretation-video-lectures | | | |
| 2 | https://learningpundits.com/contest?referrer=harsh.cse15@nituk.ac.in | | | |

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| 3 | https://nptel.ac.in/courses/114106041/8 | | |
| 4 | https://nptel.ac.in/courses/111103020/2 | | |
| Online Resources: | | | |
| 1 | http://aptitudetraining.in/home/index.php | | |
| 2 | https://www.udemy.com/vedicmaths/ | | |
| 3 | https://www.youtube.com/channel/UCtmn-DsF4BhPug-ff9LiDAA?disable_polymer=true | | |
| | | | |
| Reference Books: | | | |
| 1 | R.S. Aggarwal,"Quantitative Aptitude", S.Chand Publishers | | |
| 2 | R.S. Aggarwal,"A Modern Approach to Verbal and Non-verbal reasoning", S.Chand Publishers | | |
| 3 | Face Aptipedia - Aptitude Encyclopedia - Wiley | | |
| 4 | Dinesh Khattar, "The pearson guide to Quantitative Aptitude for Competitiveexaminations, Pearson Education | | |
| Web References: | | | |
| 1 | https://www.geeksforgeeks.org/placements-gq/ | | |
| 2 | https://www.indiabix.com/aptitude/questions-and-answers/ | | |
| Assessment Methods and Levels (based on Bloom’s Taxonomy) | | | |
| Formative assessment based on Capstone Model (Max. Marks:100) | | | |
| Course Outcome | Bloom’s Level | Assessment Component | Marks |
| C105.1 | Remember | Quiz | 30 |
| C105.2 C105.3 | Understand and Apply | Formal presentation | 20 |
| C105.4, C105.5 and C105.6 | Apply | Formal interview tests | 50 |

| | | | | | |
|---|---|------------------------|--|------------|--------|
| 21MC106 | | Life Skills and Ethics | | 2 /0 /0 /0 | |
| Nature of Course | | Theory Concept | | | |
| Pre requisites | | NIL | | | |
| Course Objectives: | | | | | |
| 1 | To develop communication competence in prospective engineers. | | | | |
| 2 | To enable them to convey thoughts and ideas with clarity and focus. | | | | |
| 3 | To develop report writing skills. | | | | |
| 4 | To equip them to face interview and Group Discussion. | | | | |
| 5 | To inculcate critical thinking process. | | | | |
| 6 | To prepare them on problem solving skills. | | | | |
| 7 | To provide symbolic, verbal, and graphical interpretations of statements in a problem description. | | | | |
| Course Outcomes: | | | | | |
| Upon completion of the course, students shall have ability to | | | | | |
| C106.1 | Define and Identify different life skills required in personal and professional life. | | | | [U] |
| C106.2 | Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress. | | | | [AP] |
| C106.3 | Explain the basic mechanics of effective communication and demonstrate these through presentations. | | | | [A] |
| C106.4 | Use appropriate thinking and problem solving techniques to solve new problems. | | | | [AP] |
| C106.5 | Understand the basics of teamwork and leadership | | | | [U] |
| Course Contents: | | | | | |
| Module 1 | | | | | 10 Hrs |
| Communication Skill: Introduction to Communication, The Process of Communication, Barriers to Communication, Listening Skills, Writing Skills, Technical Writing, Letter Writing, Job Application, Report Writing, Non-verbal Communication and Body Language, Interview Skills, Group Discussion, Presentation Skills, Technology-based Communication. | | | | | |
| Module 2 | | | | | 10 Hrs |
| Critical Thinking and Problem Solving: Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats Mind Mapping and Analytical Thinking. Teamwork: Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance and Team Conflicts. | | | | | |
| Module 3 | | | | | 10 Hrs |
| Ethics, Moral and Professional Values: Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE. Leadership Skills: Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid and leadership Formulation | | | | | |
| Total Hours | | | | | 30 |
| Reference Books: | | | | | |
| 1 | Barun K. Mitra; (2011), "Personality Development and Soft Skills", First Edition; Oxford Publishers. | | | | |
| 2 | Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd. | | | | |
| 3 | Larry James (2016); "The First Book of Life Skills"; First Edition; Embassy Books. | | | | |
| 4 | Shalini Verma (2014); "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) and Company | | | | |

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| 5 | John C. Maxwell (2014); “The 5 Levels of Leadership”, Centre Street, A division of Hachette Book Group Inc | | |
| Web References: | | | |
| 1 | https://www.coursera.org/courses?query=ethics | | |
| Assessment Methods and Levels (based on Bloom’s Taxonomy) | | | |
| Formative assessment based on Capstone Model (Max. Marks:100) | | | |
| Course Outcome | Bloom’s Level | Assessment Component | Marks |
| C106.1 | Understand | Online Quiz | 20 |
| C106.2 | Apply | Assignment | 20 |
| C106.3 | Analyse | Technical Presentation | 30 |
| C106.4 C106.5 | Apply Understand | Group Discussion | 30 |

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|--|--|-------------------|--|------------|------|
| 21MC107 | | Stress Management | | 2 /0 /0 /0 | |
| Nature of Course | | Theory Concept | | | |
| Pre requisites | | NIL | | | |
| Course Objectives: | | | | | |
| 1 | Understand the basic principles of stress management | | | | |
| 2 | Recognize your stress triggers and how to manage them | | | | |
| 3 | Develop proactive responses to stressful situations | | | | |
| 4 | Use coping tips for managing stress both on and off the job | | | | |
| 5 | Learn to manage stress through diet, sleep and other lifestyle factors | | | | |
| 6 | Develop a long term action plan to minimize and better manage stress | | | | |
| 7 | Understand the basic principles of stress management | | | | |
| Course Outcomes: | | | | | |
| Upon completion of the course, students shall have ability to | | | | | |
| C107.1 | Understand the basic principles of stress management | | | | [U] |
| C107.2 | Apply the concept of recognizing your stress triggers and find ways to manage them. | | | | [AP] |
| C107.3 | Develop proactive responses to stressful situations | | | | [A] |
| C107.4 | Develop a long term action plan to minimize and better manage stress | | | | [AP] |
| Course Contents: | | | | | |
| Module 1 10 Hrs | | | | | |
| Scientific Foundations of Stress: What is stress? – Sources of Stress – Types of Stress – Personality Factors and stress – Stress and the college student. Stress Psychophysiology: Stress and nervous system – Hypothalamic – Pituitary – Adrenal (HPA) Axis – Effect of Stress on Immune system – Health risk associated with chronic stress – Stress and Major Psychiatric disorders. | | | | | |
| Module 2 10 Hrs | | | | | |
| Developing Resilience to Stress: Understanding your stress level – Role of personality pattern, Self-esteem, Locus of control – Role of Thoughts Beliefs and Emotions – I and II – Lifesituation Intrapersonal: (Assertiveness, Time Management). | | | | | |
| Module 3 10 Hrs | | | | | |
| Strategies for Relieving Stress: Developing cognitive coping skills – Autogenic training, imagery and progressive relaxation – Other relaxation techniques – Exercise and Health – DIY strategies stress management. | | | | | |
| Total Hours | | | | | 30 |
| Reference Books: | | | | | |
| 1 | Jonathan C. Smith; (2011), "Stress Management: A Comprehensive Handbook of Techniques and Strategies", First Edition; Springer Publishing Company. | | | | |
| 2 | Bob Stahl, Elisha Goldstein, Jon Kabat-Zinn (2019); "A mindfulness-based stress reduction workbook"; Second Edition; New Harbinger Publications. | | | | |
| 3 | Ryan M. Niemiec (2019), "The Strengths-based workbook for stress relief", First edition, New Harbinger Publications. | | | | |
| Web References: | | | | | |
| 1 | https://thiswayup.org.au/courses/coping-with-stress-course/ | | | | |

| 2 | https://www.classcentral.com/course/swayam-stress-management-14309 | | |
|--|---|-----------------------------|--------------|
| Assessment Methods and Levels (based on Bloom’s Taxonomy) | | | |
| Formative assessment based on Capstone Model (Max. Marks:100) | | | |
| Course Outcome | Bloom’s Level | Assessment Component | Marks |
| C107.1 | Understand | Online Quiz | 20 |
| C107.2 | Apply | Group Discussion | 30 |
| C107.3 | Analyse | Class Presentation | 30 |
| C107.4 | Apply | Assignment | 20 |

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|--|---|----------------------|---------|
| 21MC108 | Constitution of India | | 2/0/0/0 |
| Nature of Course | Theory | | |
| Pre Requisites | NIL | | |
| Course Objectives: | | | |
| 1 | To familiarize with basic information about Indian constitution | | |
| 2 | To understand the fundamental rights and duties as citizens of India | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C108.1 | Explain the objectives of the Constitution of India and its formation | [U] | |
| C108.2 | Recall state and central policies (Union and State Executive), fundamental Rights and their duties. | [R] | |
| C108.3 | Make use of legal directions in developing solutions to societal issues | [AP] | |
| C108.4 | Utilized for competitive exams that requires knowledge of Indian Constitution | [AP] | |
| Course Contents: | | | |
| Module 1 | | 10 Hrs | |
| Historical perspective, The making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights, Directive Principles of State Policy, Fundamental Duties, Citizenship Article 5-11. | | | |
| Module 2 | | 10 Hrs | |
| Federal structure, Powers of the Union and the states, Centre-State Relations, Union Executive - President, Prime Minister, Union Cabinet, Parliament, Supreme Court of India, State Executives - Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Elections, Electoral Process, and Election Commission of India, Election Laws. Powers and Functions of Municipalities and Panchayat | | | |
| Module 3 | | 10 Hrs | |
| Amendments - Methods, Emergency Provisions, National Emergency, President Rule, Financial Emergency, Provisions for SC and ST, OBC, women, children and backward classes, Right to Property, Freedom of Trade and Commerce. Agricultural Law | | | |
| Total Hours: | | | 30 |
| Text Books: | | | |
| 1 | Dr.D.D.Basu, "Introduction to the Constitution of India", LexisNexis, New Delhi, 22 nd Edition, 2016. | | |
| 2 | "Bare act-constitution of India", The universal Publications, LexisNexis 2020, New Delhi, India. | | |
| Reference Books: | | | |
| 1 | Subhash.C.Kashyap, "Our Constitution: An Introduction to India's Constitution and Constitutional Law", National Book Trust, India, 5 th edition, 2019. | | |
| 2 | M. Laxmikanth, "Constitution of India", Cengage Learning India. 1 st edition 2018. | | |
| Web References: | | | |
| 1 | https://unacademy.com/course/the-indian-constitution/NSKQ8XXQ | | |
| 2 | https://unacademy.com/goal/upsc-civil-services-examination-ias-preparation/KSCGY | | |
| Assessment Methods and Levels (based on Blooms' Taxonomy) | | | |
| Formative assessment based on Capstone Model (Max. Marks:100) | | | |
| Course Outcome | Bloom'sLevel | Assessment Component | Marks |
| C108.1 | Understand | Online Quiz | 60 |
| C108.4 | Remember | | |
| C108.3 | Apply | Class Presentation | 20 |
| C108.2 | Apply | Assignment | 20 |

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|--|--|----------------------|---------|
| 21MC109 | Essence of Indian Traditional Knowledge | | 2/0/0/0 |
| Nature of Course | Theory Concept | | |
| Pre Requisites | NIL | | |
| Course Objectives: | | | |
| 1 | To make understand the contribution of Indian mind in various fields. | | |
| 2 | To cultivate critical appreciation of the thought content and provide insights relevant for promoting cognitive ability, health, good governance, aesthetic appreciation and right values. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C109.1 | Relate classical Indian traditions with contemporary traditions and culture. | | [R] |
| C109.2 | Outline the thoughts of Indians in different disciplines. | | [U] |
| C109.3 | Apply the knowledge to the present context. | | [AP] |
| C109.4 | Develop a better appreciation and understanding of Indian traditions. | | [C] |
| Course Contents: | | | |
| Module 110 Hrs | | | |
| Indian Ethics: Individual and Social – Society state and Polity (Survey) - Education systems – Agriculture (Survey) – Early and Classical Architecture – Medieval and Colonial Architecture. | | | |
| Module 210 Hrs | | | |
| Astronomy in India — Martial Arts Traditions (Survey) - Indian Literatures - Indian Philosophical Systems - Indian Traditional Knowledge on Environmental Conservation | | | |
| Module 310 Hrs | | | |
| Ayurveda for Life, Health and Well-being - The Historical Evolution of Medical Tradition in Ancient India- Music in India - Classical and Folk | | | |
| Total hours | | | 30 |
| Text Books: | | | |
| 1 | Kapil Kapoor and Michel Danino, Textbook of “Knowledge Traditions and Practices of India”, Central Board of Secondary Education, 2017. | | |
| 2 | Yogesh Atal, “Indian Society: Continuity and Change”, Pearson Education India, 2016. | | |
| Reference Books: | | | |
| 1 | Douglas Osto, “An Indian Tantric Tradition and Its Modern Global Revival”, Routledge publications, 2020. | | |
| 2 | Rao C.N. Shankar, “Sociology: Principles of Sociology with an Introduction to Social Thoughts”, S Chand Publisher, 2019. | | |
| Web References: | | | |
| 1 | http://nopr.niscair.res.in/handle/123456789/43 | | |
| 2 | https://nptel.ac.in/courses/109/104/109104102/ | | |
| Assessment Methods and Levels (based on Blooms’ Taxonomy) | | | |
| Formative assessment based on Capstone Model (Max. Marks:100) | | | |
| Course Outcome | Bloom’s Level | Assessment Component | Marks |
| C109.1 | Remember | Online Quiz | 20 |
| C109.2 | Understand | Assignment | 20 |
| C109.3 | Apply | Class Presentation | 20 |
| C109.4 | Create | Survey | 40 |

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|---|---|----------------|---------|
| 21MC110 | Design And Analysis Of Algorithms | | 2/0/0/0 |
| Nature of Course | | Theory Concept | |
| Course Pre-requisites | | Nil | |
| Course Objectives: | | | |
| 1 | To understand the techniques for analyzing the computer algorithms. | | |
| 2 | To learn the paradigms for designing the algorithms. | | |
| 3 | To analyze the efficiency of various algorithm design techniques / paradigms for the same problem. | | |
| 4 | To understand the graphical algorithms for solving problems. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have ability to | | | |
| C110.1 | Illustrate the searching and sorting algorithms. | | [U] |
| C110.2 | Interpret the design principles of greedy and pattern searching algorithms with examples. | | [AP] |
| C110.3 | Explain the problem-solving methodology used in Backtracking. | | [A] |
| C110.4 | Analyze the time and space complexities of dynamic programming strategy in solving complex problems | | [A] |
| C110.5 | Employ range query and graph algorithms in real world problems. | | [AP] |
| Course Contents: | | | |
| Module - I: Sorting, Searching and String Algorithms10 Hrs Searching & Sorting, Divide and Conquer- Bubble sort, Insertion sort, Selection sort, Binary search, quick sort, merge sort - Heaps & Hashing -Binary heap, heap sort - Greedy Algorithms- Activity selection problem, Fractional knap sack - String algorithms - Naive algorithm, Rabin Karp algorithm, KMP algorithm, Z algorithm, Manachers algorithm - Tries-Making a trienode, Insert, Search and Remove operation in Tries, Huffman coding. | | | |
| Module - II: Greedy and Dynamic Programming10 Hrs Backtracking - Rat in a maze, Permutation and Combination, N Queen problem and Problems on Backtracking, Knight's Tour Problem, Subset Sum, M-Coloring Problem, Hamiltonian Cycle Problem, Sudoku Solver, Sieve of Sundaram, Prime Numbers after P with SumS. Dynamic Programming-Greedy vs Dynamic programming, Top down and bottom – up approach, Longest Common Subsequence, Longest increasing subsequence, Edit distance, 0-1 Knapsack, Coin change problem, Minimum Cost Path, Subset Sum Problem, Maximum Size Square Sub Matrix with all 1s, Longest Palindromic Subsequence. | | | |
| Module – III: Tree and Graph Algorithms 10 Hrs Range query Algorithms –Range Minimum Query (Brute Force Approach). Segment Tree, Range Minimum Query on the Constructed Segment Tree, Range Minimum Query Using Sparse Table. Graph Algorithms - Dijkstra's Algorithm, Floyd warshall Algorithm, Kruskal's Algorithm for Minimum Spanning Tree, Prim's Algorithm for Minimum Spanning Tree. | | | |
| Total Hours | | | 30 |
| Text Books: | | | |
| 1 | Anany Levitin, “Introduction to Design and Analysis of Algorithms”, Pearson Publications, 3rd Edition, 2012. | | |
| 2 | Thomas H.Cormen, Charles E.Leiserson, R.L.Rivest, “Introduction to Algorithms”, Prentice Hall of India Publications, 3rd Edition, 2009. | | |
| Reference Books: | | | |
| 1 | Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, “Computer Algorithms/ C++”, 2nd Edition, Universities Press, 2019. | | |
| 2 | Sara Baase and Allen Van Gelder, “Computer Algorithms: Introduction to Design and Analysis”, Pearson Publications, 3rd Edition, 2008. | | |
| Web References: | | | |

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| 1. | https://www.cs.usfca.edu/~galles/visualization/Algorithms.html |
| 2. | https://www.coursera.org/learn/introduction-to-algorithms |
| 3. | https://timroughgarden.org/videos.html |
| Online Resources: | |
| 1. | https://onlinecourses.nptel.ac.in/noc19_cs47/preview |
| 2. | https://www.csa.iisc.ac.in/~barman/daa18/E0225.html |
| 3. | https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms |

| Assessment Methods & Levels(based on Bloom's Taxonomy) | | | |
|--|----------------------|-----------------------------|--------------|
| Formative assessment based on Capstone Model(Max.Marks:100) | | | |
| Course Outcome | Bloom's Level | Assessment Component | Marks |
| C111.1 | Understand | Quiz | 20 |
| C111.2 | Apply | Group Discussion | 30 |
| C111.3 | Analyze | Class Presentation | 30 |
| C111.4 | Analyze | | |
| C111.5 | Apply | Assignment | 20 |



VALUE ADDED COURSES

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|--|--|------------------|---------|
| 21VA301 | Solar Energy Technology | | 2/0/0/2 |
| Nature of Course | | Theory Practical | |
| Pre requisites | | Nil | |
| Course Objectives: | | | |
| 1. To provide comprehensive knowledge on solar radiation, analysis of solar radiation data, fundamentals of the solar thermal and photovoltaic system along with storage of energy required for effective design of efficient solar energy conversion devices. | | | |
| 2. To illustrate the concept with practical examples, schematics and block diagrams wherever required | | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C301.1 | Understand the solar energy scenario and PV cells. | | [U] |
| C301.2 | Analyze the working principle of stand alone system. | | [A] |
| C301.3 | Distinguish the standalone and grid connected system | | [AP] |
| C301.4 | Apply the concepts of solar energy conversion system in practical applications. | | [AP] |
| Course Contents: | | | |
| Module 1: Solar Energy 10 Hrs | | | |
| Energy Scenario, overview of solar energy conversion devices and applications, physics of propagation of solar radiation from the sun to earth. Sun-Earth Geometry, Extra-Terrestrial and Terrestrial Radiation, Solar energy measuring instruments. Estimation of solar radiation under different climatic conditions, Estimation of total radiation. Fundamentals of solar PV cells, principles and performance analysis, modules, arrays, theoretical maximum power generation from PV cells. | | | |
| Module 2: PV system 12 Hrs | | | |
| PV standalone system components, Standalone PV-system design. Components of grid-connected PV system, solar power plant design and performance analysis. Fundamentals of solar collectors, Snails law, Bougers law, Physical significance of Transmissivity - absorptivity product. Performance anlaysis of Liquid flat plate collectors and testing. | | | |
| Module 3: Distribution system analysis 8 Hrs | | | |
| Performance analysis of Solar Air heaters and testing. Solar thermal power generation (Solar concentrators). Thermal Energy Storage (sensible, latent and thermochemical) and solar pond-Applications: Solar Refrigeration, Passive architecture, solar distillation, and emerging technologies. | | | |
| Total Hours | | | 30 Hrs |
| Text Books: | | | |
| 1. | G. N. Tiwari, Solar Energy, Fundamentals, Design, Modeling and Applications, Narosa, 2016. | | |
| 2. | S. P. Sukhatme and J. K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, 2006. | | |
| 3. | C. S. Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, Prentice Hall India, 2nd Edition, 2011. | | |

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| Suggested Readings: | |
| 1. | J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley, 2006. |
| 2. | A. Goetzberger and V. U. Hoffmann, Photovoltaic Solar Energy Generation, Springer- - verlag, 2010. |
| 3. | T. C. Kandpal and H.P. Garg, Financial Evaluation of Renewable Energy Technologies, McMillan India Ltd., 2013 |
| 4. | K. Jager, O. Isabella, A. H. M. Smets, R.A.C.M.M. Van Swaaij, and M. Zeman, Solar Energy – fundamentals, technology and systems, Delft University of Technology, 2014. |
| Web References: | |
| 1. | https://www.edx.org/course/solar-energy-delftx-et3034x-0 |
| 2. | https://www.nrel.gov/research/re-solar.html |
| 3. | https://www.azocleantech.com/article.aspx?ArticleID=1593 |
| Online Resources: | |
| 1. | https://onlinecourses.nptel.ac.in/noc20_ph14 |

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|--|---|------------------|---------|
| 21VA302 | Industry 4.0 using Industrial Internet of Things | | 2/0/0/2 |
| Nature of Course | | Theory Practical | |
| Pre requisites | | NIL | |
| Course Objectives: | | | |
| 1. To provide knowledge about Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. | | | |
| 2. To apply IoT data for business solution in various domain in secured manner. | | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C302.1 | Identify the IoT networking components with respect to OSI layer. | | [U] |
| C302.2 | Design and develop IT based sensor systems. | | [AP] |
| C302.3 | Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. | | [E] |
| C302.4 | IoT links the automation system with enterprise, planning and product lifecycle | | [AP] |
| Course Contents: | | | |
| Module 1: Introduction 10 Hrs | | | |
| Sensing and actuation, Communication, Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories. Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis. | | | |
| Module 2: Cybersecurity in Industry 4.0 12 Hrs | | | |
| Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing and Actuation, Industrial Internet Systems. | | | |
| Module 3: Industrial IoT 8 Hrs | | | |
| Layers: IIoT Sensing-IIoT Processing Introduction, Machine Learning and Data Science. Case study - I : Milk Processing and Packaging Industries. | | | |
| Total Hours | | | 30 Hrs. |
| Text Books: | | | |
| 1. | S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press. | | |
| 2. | S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. | | |
| Suggested Readings: | | | |
| 1. | Vijay Madiseti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally “Internet of Things A Hands-on-Approach” Arshdeep Bahga and Vijay Madiseti, 2014. | | |
| 2. | Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, “From Machine to Machine to Internet of Things”, Elsevier Publications, 2014. | | |
| 3. | LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From | | |

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|--------------------------|---|
| | RFID to the Next-Generation Pervasive Network, Aurbach publications, March, 2008. |
| Web References: | |
| 1. | https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3 |
| 2. | https://www.amazon.in/Introduction-IoT-Sudip-Misra-/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1 |
| Online Resources: | |
| 1. | https://onlinecourses.nptel.ac.in/noc22_cs95/preview |

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|---|---|------------------|---------|
| 21VA303 | Microgrid Technology | | 2/0/0/2 |
| Nature of Course | | Theory Practical | |
| Pre requisites | | NIL | |
| Course Objectives: | | | |
| 1. To know Advanced modeling, control, resilience and security technologies useful for the grid modernization from a unique angle of microgrid design, analysis and operation. | | | |
| 2. To develop Smart inverters, microgrid architectures, distributed energy resources modeling, microgrid hierachical control, microgrid stability, fault management, resilient microgrids through programmable networks, reliable networked microgrids, and cyber security. | | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C303.1 | Understand the concepts of microgrids, and networked microgrids;. | [U] | |
| C303.2 | Model PV power systems and standard grid-tied inverter; | [A] | |
| C303.3 | Analyze distribution grid power flow; | [A] | |
| C303.4 | Understand centralized control and distributed control in microgrids, especially primary, secondary and tertiary control; | [U] | |
| C303.5 | Conduct power flow analysis for droop-control-based microgrids and networked microgrids; | [AP] | |
| C303.6 | Understand basics of cybersecurity in microgrids and active defense strategy. | [U] | |
| Course Contents: | | | |
| Module 1: Microgrid Modelling and Analysis | | | 10 Hrs |
| Introduction - The concept of microgrids - Distributed energy resources (DERs) modelling I: PV system, MPPT, and grid-tied interface - Distributed energy resources modelling II: Microturbine, energy storage and other DERs - Microgrid inverter structures - Distribution power flow - Stability modelling and computation | | | |
| Module 2: Microgrid Control and Enhanced Microgrid Power Flow | | | 12 Hrs |
| Centralized control - Hierarchical principle: Primary, secondary and tertiary control – Distributed control - Microgrid power flow – Networked microgrid power flow - Formal analysis of microgrid dynamics - Stability margin analysis on networked microgrids. | | | |
| Module 3: Cyber Security in Microgrids | | | 8 Hrs |
| Introduction to cyber-attacks - Active detection of cyber attacks | | | |
| Total Hours | | | 30 Hrs |
| Text Books: | | | |
| 1. | P. Zhang, Networked Microgrids. Cambridge University Press, 2020. | | |
| 2. | Fusheng Li, Ruisheng Li, Fengquan Zhou, Microgrid Technology and Engineering Application, Elsevier, 2015 | | |
| Suggested Readings: | | | |
| 1. | Manuela Sechilariu, Fabrice Locment, Urban DC Microgrid: Intelligent Control and Power Flow Optimization, Butterworth-Heinemann, 2016 | | |

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| 2. | Hassan Bevrani, BrunoFrançois, Toshifumi Ise, Microgrid Dynamics and Control John Wiley Sons, 2017 |
| 3. | Gevork B. Gharehpetian, S. Mohammad Mousavi Agah, Distributed Generation Systems: Design, Operation and Grid Integration, Butterworth Heinemann, 2017 |
| Web References: | |
| 1. | https://www.sgrwin.com/basic-understanding-iec-61850/. |
| 2. | https://www.alstom.com/press-releases-news/2015/1/alstoms-substation-automation-solutions-sas-business-unveils-new-dap-io-modules-for-smart-grid-applications. |
| Online Resources: | |
| 1. | https://indianinstituteofsolarenergy.com/courses/microgrid-certification-training/ |
| 2. | https://onlinecourses.nptel.ac.in/noc20_ee84/preview |

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|--|--|------------------|---------|
| 21VA304 | FPGA-based Switched Mode Power Converters | | 2/0/0/2 |
| Nature of Course | | Theory Practical | |
| Pre requisites | | Nil | |
| Course Objectives: | | | |
| 1. | To develop skilled manpower and to facilitate academic as well as corporate research and development. | | |
| 2. | To know about latest digital control trends in power electronics industries. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C304.1 | Understand the digital control in switched mode power converters. | | [U] |
| C304.2 | Analyze frequency and time domain digital control design approaches | | [A] |
| C304.3 | Model Digital control implementation blocks. | | [AP] |
| C304.4 | Apply modeling concepts of Verilog HDL programming for the design of digital circuits. | | [AP] |
| Course Contents: | | | |
| Module 1: Introduction | | | 10 Hrs |
| Introduction to digital control in switched mode power converters - Fixed and variable frequency digital control architectures - MATLAB custom model development for simulation under digital control. | | | |
| Module 2: Modeling Techniques | | | 12 Hrs |
| Modeling techniques and model validation using MATLAB - Frequency and time domain digital control design approaches - Digital control implementation blocks and steps for FPGA based prototyping | | | |
| Module 3: Verilog HDL | | | 8 Hrs |
| Introduction to Verilog HDL and simulation using Xilinx Webpack - Digital controller implementation using fixed point arithmetic and Verilog HDL - Digital Control Implementation using STM32 and C2000 Series Microcontrollers - Hardware case studies of advanced digital control techniques . | | | |
| Total Hours | | | 30 Hrs |
| Text Books: | | | |
| 1. | S. Kapat and P. T. Krein, ""A Tutorial and Review Discussion of Modulation, Control and Tuning of High Performance DC-DC Converters based on Small-Signal and Large-Signal Approaches"" IEEE Open Journal of Power Electronics , vol. 1, pp. 339 - 371, Aug. 2020. | | |
| 2. | R. W. Erickson and D. Maksimovic, Fundamentals of Power Electronics, 3rd Ed., Springer, 2020 | | |
| Suggested Readings: | | | |
| 1. | Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2 nd edition, Pearson 2013. | | |
| 2. | Volnei A. Pedroni, "Circuit Design and Simulation with VHDL", MIT Press,2 nd edition 2010. | | |
| 3. | S.H.Gerez,"Algorithms for VLSI Design Automation", John Wiley andSons, 2011. | | |

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| Web References: | |
| 1. | https://nptel.ac.in/courses/117101058 |
| 2. | https://www.tutorialspoint.com/vlsi_design/index.htm |
| 3. | https://www.edaplayground.com/ |
| Online Resources: | |
| 1. | VLSI Classroom Training Online VLSI Course -VLSIGuru.com |

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|--|---|------------------|---------|
| 21VA305 | Phase-Locked Loop Circuit Design | | 2/0/0/2 |
| Nature of Course | | Theory Practical | |
| Pre requisites | | Nil | |
| Course Objectives: | | | |
| 1. | To expose the state-of-the-art frequency synthesis techniques used in analog/digital integer-N PLLs. | | |
| 2. | To equip students with skills to analyze, debug, and evaluate a PLL design at analytical and transistor levels both. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C305.1 | Understand the Basic concepts in PLL. | | [U] |
| C305.2 | Design of PLL building blocks for charge pump | | [A] |
| C305.3 | Design of PLL building blocks for supply regulated oscillators | | [AP] |
| C305.4 | Analyze Noise analysis in digital PLLs | | [AP] |
| Course Contents: | | | |
| Module 1: Introduction | | | 10 Hrs |
| Basic concepts in PLL, Type-I PLL - Frequency acquisition in PLLs - Phase/frequency error detectors, Charge-pump based type-II PLLs. | | | |
| Module 2: PLL building Blocks | | | 12 Hrs |
| Design of PLL building blocks: PFD - Design of PLL building blocks: Charge-pump - Design of PLL building blocks: Ring oscillators - Design of PLL building blocks: Supply regulated oscillators. | | | |
| Module 3: Digital PLLs | | | 8 Hrs |
| Introduction of Digital PLLs - Noise analysis in digital PLLs. | | | |
| Total Hours: | | | 30 Hrs. |
| Text Books: | | | |
| 1. | R.E. Best, "Phase Locked Loops Design, Simulation and Applications," McGraw-Hill Publication, 6th Edition, Revised edition 2017. | | |
| 2. | W. Egan, Phase-Lock Basics, John Wiley and Sons, 2008. | | |
| Suggested Readings: | | | |
| 1. | F. Gardner, Phaselock Techniques, John Wiley and Sons, 2005. | | |
| 2. | Dan H Wolaver, "Phase-Locked Loop Circuit Design," Prentice hall, 2001 | | |
| Web References: | | | |
| 1. | https://web.ece.ucsb.edu/~long/ece594a/PLL_intro_594a_s05 | | |
| 2. | https://ewh.ieee.org/r5/denver/sscs/Presentations/2007_05_Fischette | | |
| Online Resources: | | | |
| 1. | https://onlinecourses.nptel.ac.in/noc22_ee92/ | | |

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|--|---|-----------------------|---------|
| 21VA306 | Substation Designing | | 2/0/0/2 |
| Nature of Course | | Theory Practical | |
| Pre requisites | | Power System Analysis | |
| Course Objectives: | | | |
| 1. | To model the components (feeders, distribution transformer, regulators, capacitors, loads, distributed generation, storage, etc.) | | |
| 2. | To analyze the methods (load flow, short-circuit, etc.), specially developed for the distribution system. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C306.1 | Understand the structure of a distribution system. | | [U] |
| C306.2 | Illustrate the concept of distribution, Feeders, Substation layout. | | [U] |
| C306.3 | Analyze the role of single and three phase transformers in distribution system. | | [AP] |
| C306.4 | Analyze the load duration curve, economic aspects and power tariff calculation methods. | | [AP] |
| Course Contents: | | | |
| Module 1: Structure of a distribution system | | | 10 Hrs |
| Distribution feeder configurations and substation layouts. Nature of loads, Approximate methods of analysis, Computation of transformer and feeder loading, K Factors, voltage drop and power loss calculations, Distribution of loads and various geometric configurations. | | | |
| Module 2: Modeling of distribution system components | | | 8 Hrs |
| Overhead lines, feeders and cables - Single and three phase distribution transformers-Voltage regulators - Load models - Capacitor banks-Distributed generation. | | | |
| Module 3: Distribution system analysis | | | 12 Hrs |
| Load flow analysis: Backward/forward sweep, Load flow analysis: Direct approach, Load flow analysis: Direct approach for weakly meshed systems, Load flow analysis: Gauss Implicit Z-matrix Method. Applications of distribution system analysis. | | | |
| Total Hours | | | 30 Hrs |
| Text Books: | | | |
| 1. | B. Das, Power Distribution Automation, IET Power and Energy Series, 75, London,2016 | | |
| 2. | A. A. Sallam and O. P. Malik, Electric Distribution System, IEEE Press, Piscataway, NJ, 2011. | | |
| Suggested Readings: | | | |
| 1. | W. H. Kresting, Distribution System Modeling and Analysis, CRC Press, New York, 2002. | | |
| 2. | A. A. Sallam and O. P. Malik, Electric Distribution System, IEEE Press, Piscataway, NJ, 2011 | | |
| Web References: | | | |
| 1. | http://nptel.ac.in/video.php?subjectId=108102047 | | |
| 2. | http://textofvideo.nptel.iitm.ac.in/108102047/lec20.pdf | | |
| Online Resources: | | | |

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| 1. | https://onlinecourses.nptel.ac.in/noc19_ee61 |
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| 21VA307 | Contemporary Digital Techniques | | 2/0/0/2 |
| Nature of Course | | Theory Practical | |
| Pre requisites | | Analog and Digital Electronics | |
| Course Objectives: | | | |
| 1. | To present the engineering principles, theories and practices, which are fundamental to the successful design of a digital communication system. | | |
| 2. | To equip the methods of systematic representation, analysis and design of a digital communication. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C307.1 | Understand the concepts of microgrids, and networked microgrids. | | [U] |
| C307.2 | Model PV power systems and standard grid-tied inverter. | | [A] |
| C307.3 | Analyze distribution grid power flow. | | [A] |
| C307.4 | Understand centralized control and distributed control in microgrids, especially primary, secondary and tertiary control. | | [U] |
| C307.5 | Conduct power flow analysis for droop-control-based microgrids and networked microgrids. | | [AP] |
| C307.6 | Understand basics of cybersecurity in microgrids and active defense strategy. | | [U] |
| Course Contents: | | | |
| Module 1: Introduction | | 10 Hrs | |
| Introduction to digital communication systems - Source Coding - Characterization of Communication Signals and Systems | | | |
| Module 2: Signal representation | | 10 Hrs | |
| Representation of Memory less Modulation Methods - Nonlinear modulation methods - Optimal receivers of AWGN - Receiver for non-ideal channel - Probability of error of different modulation schemes. | | | |
| Module 3: Synchronization Techniques | | 10 Hrs | |
| Carrier phase and symbol timing synchronization techniques - Channel estimation and equalization techniques, Power Adaptation methods for colored noise channel. | | | |
| Total Hours | | | 30 Hrs |
| Text Books: | | | |
| 1. | M. Morris R. Mano, Michael D. Ciletti, "Digital Logic Design", Prentice Hall,5th Edition,2013. | | |
| 2. | Floyd, "Digital Fundamentals", Pearson education, 11th edition, 2015. | | |
| 3. | A.Anand kumar, "Fundamental of Digital Circuits", PHI Learning Private Ltd, 4th edition, 2016. | | |
| Suggested Readings: | | | |

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|--------------------------|--|
| 1. | R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 4th Edition, 2009. |
| 2. | Tocci R.J., Neal S. Widmer, "Digital Systems: Principles and Applications", Pearson Education Asia, 2014. |
| 3. | Donald P Leach, Albert Paul Malvino, Goutam Sha, "Digital Principles and Applications", Tata McGraw Hill, 7th Edition, 2010. |
| Web References: | |
| 1. | http://www.ni.com/example/14493/en/ |
| 2. | http://electronics-course.com/ |
| Online Resources: | |
| 1. | https://onlinecourses.nptel.ac.in/noc21_ee11 |

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| 21VA308 | Recent Power Electronics and Control | | 2/0/0/2 |
| Nature of Course | Theory Practical | | |
| Pre requisites | Analog and Digital Electronics | | |
| Course Objectives: | | | |
| 1. | To provide current updates in DC choppers. | | |
| 2. | To impart the concepts of PWM inverters and controllers. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C308.1 | Understand the multiphase converters and effect of source impedance. | [U] | |
| C308.2 | Examine the operation of DC-DC converter and isolated converters. | [A] | |
| C308.3 | Examine the operation of VSI, CSI, MLI and ZSI converters. | [A] | |
| C308.4 | Design the suitable controller for power converters. | [A] | |
| Course Contents: | | | |
| Module 1: Introduction | | 10 Hrs | |
| Device Physics, Application and Analysis of Switches and Single-Phase Converter - Single Phase Converter, Three Phase Converter, Multipulse Converter and Effect of Source Inductance and PWM Rectifiers. | | | |
| Module 2: DC-DC Converters | | 10 Hrs | |
| PWM Rectifiers and Power Factor Improvement Techniques and non- isolated DC- DC converters - Non- isolated and isolated DC- DC Converters and Choppers - Isolated DC- DC Converters IV and VSI and CSI, MLI and ZSI. | | | |
| Module 3: Controllers | | 10 Hrs | |
| SVM, AC to AC Converters, Cycloconverter and Matrix Converter - Linear Control in Power Electronics, Nonlinear Control in Power Electronics, Applications. | | | |
| Total Hours: | | 30 Hrs. | |
| Text Books: | | | |
| 1. | Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics - Converters, Applications and Design", John Wiley andamp; Sons edition 2011. | | |
| 2. | M.H. Rashid, "Power Electronics Circuits, devices and applications", Pearson Education, Inc. Edition 2014. | | |
| 3. | P.S. Bhimbra, "Power Electronics", Khanna Publishers edition 2018. | | |
| Suggested Readings: | | | |
| 1. | Vedam Subramanian, "Power Electronics" New age international Second edition 2018. | | |
| 2. | M.D.Singh, "Power Electronics", Tata McGraw-Hill, 2 nd Edition 2014. | | |
| 3. | Bimal K. Bose, "Modern Power Electronics andamp; AC Drives", Pearson, 2015. | | |
| Web References: | | | |
| 1. | https://www.tutorialspoint.com/power_electronics/index.htm | | |
| 2. | https://in.mathworks.com/videos/developing-dc-dc-converter-control-with- | | |

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| 3. | https://in.mathworks.com/videos/developing-dc-dc-converter-control-with-simulink-automatically-generating-controller-code-for-implementation-on-embedded-processor1535540362783.html |
| Online Resources: | |
| 1. | https://onlinecourses.nptel.ac.in/noc20_ee28 |

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| 21VA309 | Neuro-Instrumentation | | 2/0/0/2 |
| Nature of Course | | Theory Practical | |
| Pre requisites | | Nil | |
| Course Objectives: | | | |
| 1. | To provide exposure to Neuroscience and its importance in the real world | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C309.1 | Understand EEG and Event-Related Potentials (ERPs). | [U] | |
| C309.2 | Understand n to Brain-Computer Interface (BCI) and its applications. | [U] | |
| C309.3 | Apply ERPs to screen for disorders of Cognition. | [AP] | |
| C309.4 | Understand ERP stimulators and signal conditioning circuits. | [U] | |
| C309.5 | Demonstrate EEGLab and ERPLab for EEG and ERP signal processing | [AP] | |
| Course Contents: | | | |
| Module 1: Introduction | | 10 Hrs | |
| Introduction to Neurophysiology, Basic Operation of Human Brain - EEG introduction, EEG recording systems, Understanding EEG waveforms, Applications of EEG analysis - Epilepsy a classic Neurophysiological disorder, Types of Epilepsy, Role of EEG Signal Processing for Epilepsy Classification/ Screening. | | | |
| Module 2: Signal Processing | | 10 Hrs | |
| Signal Conditioning for EEG and ECG signal processing with demonstration of ECG signal processing circuits - Cortical Auditory Event Potential (CAEP), Different Event Related Potentials and their applications: MMN and P300. EEGLAB and ERPLAB Signal Processing Demo using MATLAB - Brain Computer Interface: Introduction, Applications, Existing BCI Sensors | | | |
| Module 3: Electrodes | | 10 Hrs | |
| Completing the BCI Loop in Humans without Neurosurgery: Designing Magnetic stimulators -: Invasive Techniques to acquire neurological signals, Types of implants and signal conditioning systems - Tetrodes Fabrication, Microneedle Fabrication, Implanting Tetrodes and microneedles on a rat model. | | | |
| Total Hours | | | 30 Hrs |
| Text Books: | | | |
| 1. | The Art of Electronics 3rd Edition , 2015 Horowitz and Hill. | | |
| 2. | Principles Of Neural Science, 2012 Kandel and Schwartz. | | |
| Suggested Readings: | | | |
| 1. | Samson Wright's Applied Physiology, 2008 Keele A. Cyril. | | |
| 2. | Matews G.G, Neurobiology, Second Edition, Blackwell Science,UK,2000. | | |
| Web References: | | | |
| 1. | https://www.technicalsymposium.com/alllecturenotes_biomed.html . | | |
| 2. | https://ocw.mit.edu/courses/biology/7-28-molecular-biology-spring-2005/ | | |
| Online Resources: | | | |
| 1. | https://onlinecourses.nptel.ac.in/noc20_ee95 | | |

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| 21VA160 | Agile Product Development and Web Application Design | | 2/0/0/2 |
| Nature of Course | | Theory Programming | |
| Pre requisites | | Nil | |
| Course Objectives: | | | |
| 1. | To discuss the essence of agile development methods. | | |
| 2. | Ability to understand and apply Scrum framework. | | |
| 3. | To set up and create a GitHub repository. | | |
| 4. | To impart the knowledge of web application development platforms. | | |
| 5. | To create interactive websites using HTML, CSS. | | |
| 6. | To recognize the user experience design methodologies like Java script for responsive web design. | | |
| Course Outcomes: | | | |
| Upon completion of the course, students shall have the ability to | | | |
| C160.1 | Identify the driving forces and adopt Agile approaches to software development practices. | | [AP] |
| C160.2 | Demonstrate the values and practices of Scrum and how to setup the GitHub repository. | | [U] |
| C160.3 | Find the working model and learn basic web concepts to develop Static and Dynamic web pages. | | [R] |
| C160.4 | Utilize the knowledge of HTML and CSS code to create personal and/or business websites following current professional and/or industry standards. | | [AP] |
| C160.5 | Develop dynamic web page with validation and event handling mechanisms. | | [AP] |
| Course Contents: | | | |
| Module1: | | 10 Hrs | |
| History of Traditional Software Development Model, Software Development Model and SDLC, “Waterfall Model” – An Overview, Waterfall or Sequential Based Development Model, “Real Life” – Waterfall Model, “Waterfall Model” – Advantages, “Waterfall Model” – Disadvantages, Agile Software Development – Definition, Agile Development Model, Graphical Illustration of Agile Development Model, Why use Agile?, Agile Manifesto and Principles, 12 Principles of Agile Methods, Agile Values, What is NOT an Agile software development?, Foundation of an Agile software development Method, Common Characteristics of Agile Methods, Agile Methods and Practices, When to use Agile Model?, Advantages of Agile Model, Disadvantages of Agile Model, Difference between Agile and Waterfall Model, Agile – Myths and Reality, Agile Market Insight. Introduction to SCRUM, Scrum Roles and Responsibilities, Scrum Core Practices and Artifacts, User Story, Sprint, Release Planning Meeting, Sprint Planning Meeting, Daily Scrum Meeting (Daily Stand up), Sprint Review Meeting, Retrospective, Product Backlog, Sprint Backlog, Burn-Down Chart, Velocity, Impediment Backlog. | | | |
| Definition of “Done”, Splitting User Story into Task, Why to Split User Story into Task?, Guidelines for Breaking Down a User Story into Tasks, Examples of Scrum Task Board, Planning Poker®, Planning Poker® - Process/Steps, What are Story Points?, How do We | | | |

Estimate in Story Points?, What Goes into Story Points?

Introduction to Extreme Programming, The Rules of Extreme Programming, Extreme Programming (XP) – Principles, Extreme Programming (XP) – Key Terms, Introduction to Lean Software Development, Principles of Lean Software Development, What is Kanban?

Introduction to Git - Getting a Git Repository, Recording Changes to the Repository, Viewing the Commit History, Undoing Things, Working with Remotes, Tagging, Git Aliases, Git Branching, Branches in a Nutshell, Basic Branching and Merging, Branch Management, Remote Branches, Rebasing.

Introduction to GitHub – Introduction, Set up Git, Create a repository, GitHub Flow, Contribution to Projects, Communicating on GitHub.

Linux Basic Commands - Linux Basic Commands, Linux File Permissions, Basic System Administration, Process Management, Archival.

Linux Shell Script - Shell Basics, Writing first script, Conditional statements, Loops, Command line arguments, Functions and file manipulations, Background processes, Scheduling processes -At, batch and Cron -Networking.

Module 2:

10 Hrs

HTML Basics - Understand the structure of an HTML page, New Semantic Elements in HTML 5, Learn to apply physical/logical character effects, Learn to manage document spacing. Tables - Understand the structure of an HTML table, Learn to control table format like cell spanning, cell spacing, border.

List - Numbered List, Bulleted List, Working with Links, Understand the working of hyperlinks in web pages, Learn to create hyperlinks in web pages, Add hyperlinks to list items and table contents. Image Handling - Understand the role of images in web pages, Learn to add images to web pages, Learn to use images as hyperlinks

Frames - Understand the need for frames in web pages, Learn to create and work with frames.

HTML Forms for User Input - Understand the role of forms in web pages, Understand various HTML elements used in forms, Single line text field, Text area, Check box, Radio buttons, Password fields, Pull-down menus, File selector dialog box .New Form Elements - Understand the new HTML form elements such as date, number, range, email, search and data list, Understand audio, video, article tags.

Module 3:

10 Hrs

Introduction to Cascading Style Sheets - What CSS can do, CSS Syntax, Types of CSS. Working with Text and Fonts - Text Formatting, Text Effects, Fonts.CSS Selectors - Type Selector, Universal Selector, ID Selector, Class selector.

Colors and Borders – Background, Multiple Background, Colors RGB and RGBA, HSL and HSLA, Borders, Rounded Corners, Applying Shadows in border,Implementing CSS3 in the "Real World" – Modernizr, HTML5 Shims, SASS, and Other CSS.Preprocessors , CSS Grid Systems, CSS Frameworks.

Introduction to Bootstrap – Introduction, Getting Started with Bootstrap, Bootstrap Basics, Bootstrap grid system, Bootstrap Basic Components, Bootstrap Components, Page Header, Breadcrumb, Button Groups, Dropdown, Nav and Navbars ,JavaScript Essentials - Var, Let and Const keyword, Arrow functions, default arguments, Template.Strings, String methods, Object de-structuring, Create,apply,prototype,bind method, Spread and Rest operator, Typescript Fundamentals, Types and type assertions, Creating custom object types, function types, Typescript OOPS - Classes, Interfaces, Constructor, Decorator and

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| Spread Operator, Difference == and === , Asynchronous Programming in ES6, Promise Constructor, Promise with Chain, Promise Race. | |
| <div> <div>Total Hours</div> <div>30 Hrs</div> </div> | |
| Text Books: | |
| 1. | Roman Pichler, “Agile Product Management with Scrum Creating Products that Customers Love”, Pearson Education, 1st Edition, 2010. |
| 2. | Jeff Sutherland, “Scrum the Art of Doing Twice the Work in Half the Time”, Random House Publisher, 1st Edition, 2014. |
| 3. | Scott Chacon, Ben Straub, “Pro GIT”, Apress Publisher, 3rd Edition, 2014. |
| 4. | Richard Blum, Christine Bresnahan, “Linux Command Line and Shell Scripting BIBLE”, Wiley India Pvt. Limited, 5th Edition, 2008. |
| 5. | Jennifer Niederst Robbins., “Learning Web Design, A beginner's guide to HTML, CSS, JavaScript, and Web Graphics”, O'Reilly Media, 5th Edition, 2018. |
| 6. | Jennifer Smith and the AGI Creative Team, “Web Design with HTML and CSS”, Wiley Publisher, 1st Edition, 2011. |
| 7. | Stephen Blumenthal, “JavaScript: JavaScript for Beginners - Learn JavaScript Programming with ease”, 1st Edition, 2017. |
| Suggested Readings: | |
| 1. | Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, Prentice Hall, 2nd Edition, 2014. |
| 2. | Mike Cohn, “User Stories Applied: For Agile Software”, Addison Wesley, 2 nd Edition, 2016. |
| 3. | Thomas a Powell, “HTML and CSS: The Complete Reference”, 5th Edition, Tata McGraw Hill Education Private Limited, 2010. |
| 4. | Russ Ferguson, “Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development”, Apress Publishers, 3rd Edition, 2019. |
| 5. | Deitel, Deitel, Goldberg, “Internet and World Wide Web – How to program”, 5 th Edition, Prentice Hall Publishers, 2012. |
| Web References: | |
| 1. | https://www.coursera.org/specializations/agile-development |
| 2. | https://www.edx.org/learn/agile |
| 3. | https://nptel.ac.in/courses/106/105/106105182/ |
| 4. | https://developer.mozilla.org/en-US/docs/Web/HTML |
| 5. | https://developer.mozilla.org/en-US/docs/Web/CSS |
| 6. | https://developer.mozilla.org/en-US/docs/Web/JavaScript |
| Online Resources: | |
| 1. | http://www.agilenutshell.com/ |
| 2. | https://www.atlassian.com/agile/scrum |
| 3. | https://www.youtube.com/user/AgileMikeCohn |
| 4. | https://www.coursera.org/learn/html-css-javascript-for-web-developers |
| 5. | https://online-learning.harvard.edu/subject/javascript |

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| 21VA130 | | Effective Communication Skills (MECH/MCT/AI and DS/CIVIL/CYBER/ECE/IT/EEE) | | 2/0/0/2 | |
| Nature of Course | | E (Theory skill based) | | | |
| Pre-Requisites | | Basics of English Language | | | |
| Course Objectives: | | | | | |
| 1 | | To become self-confident individuals by mastering interpersonal skills, team management skills, and leadership skills. | | | |
| 2 | | To develop effective communication skills. | | | |
| 3 | | To train students to use the language with confidence and without committing errors. | | | |
| 4 | | To improve the fluency of the students when speaking English. | | | |
| 5 | | To focus on pronunciation, dialect, intonation, interaction, practice and communication. | | | |
| Course Outcomes: | | | | | |
| Upon completion of the course, students shall have ability to | | | | | |
| C130.1 | | Remember correct usage of English grammar in speaking. | | | [U] |
| C130.2 | | Apply and improve their speaking ability in English both in terms of fluency and comprehensibility. | | | [AP] |
| C130.3 | | Understand and communicate effectively in personal and professional situations. | | | [U] |
| C130.4 | | Understand and analyze oral presentations and receive feedback on their performance. | | | [U] |
| C130.5 | | Apply reading fluency skills through extensive reading. | | | [AP] |
| Course Contents: | | | | | |
| Module I | | | | 10 Hrs | |
| Pre-Test - Vocabulary Building- Connecting Phrases- Exercises and Activities-Conversation Practices- Greetings-exchanging ideas - Asking for information - questioning techniques / answering techniques - Getting people to do things - requesting/agreeing/refusing – Activity-Common Expressions (Individual)- Talking about Favorites - Talk Show Activity - Impromptu Speaking- Personal Interest - Talking about Past Events and Future/Talking about Everyday Life (Family, Hobbies, Work, Travel and Current Events) – Activity. | | | | | |
| Module II | | | | 10 Hrs | |
| Listening- Trials of a Good Listener- Listening to Texts, Listening for Specific Purpose-Activity- 21st Century Skills– Communication with Critical Thinking and Creativity-Role Play-Activity-Personality Development- Manners and Etiquettes. Building Confidence and Developing Presentation Skills-Activity- Singing a Song (Group)- Activity. | | | | | |
| Module III | | | | 10 Hrs | |
| Story Telling- Use of Charts and Graphs-Activity -Persuasive Speech- Handling Criticism-Justifying Opinions-Conflict-Resolution-Situational Role Play Activity--News reading and Pronunciation- Activity -Satori- Intuitive Approach-Activity-Post Test. | | | | | |
| | | | | Total Hours | 30 |
| Text Books: | | | | | |
| 1 | | English and Soft skills Orient Black Swan Publishers (S. P. Dhanavel)2010 | | | |
| 2 | | Remedial English Grammar. F.T. Wood. Macmillan.2007 | | | |
| 3 | | On Writing Well. William Zinsser. Harper Resource Book. 2001 | | | |
| 4 | | Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015. | | | |
| Reference Books: | | | | | |
| 1 | | Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006. | | | |
| 2 | | Busch, B., and Oakley, B. (2017). Emotional intelligence: why it matters and how to teach it. Retrieved from https://www.theguardian.com/teacher | | | |

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| | network/2017/nov/03/emotional- intelligence-why-it-matters-and-how-to-teach-it. | |
| 3 | Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press | |
| Web References: | | |
| 1 | https://www.udemy.com/course/english-speaking-complete/ | |
| 2 | https://www.cambridgeenglish.org/exams-and-tests/linguaskill/ | |
| Online Resources: | | |
| 1 | https://www.lingoda.com/en/linguaskill-from-cambridge/ | |
| 2 | https://www.icd.org.pk/linguaskill/ | |
| Summative assessment based on Continuous and End Semester Examination | | |
| Internal Components - 10 | | |
| S.No | Components | Marks |
| 1. | Vocabulary Building | 10 |
| 2. | Conversation Practices | 10 |
| 3. | Common Expressions | 10 |
| 4. | Impromptu Speaking | 10 |
| 5. | Listening | 10 |
| 6. | 21st Century Skills | 10 |
| 7. | Presentation Skills | 10 |
| 8. | Singing a Song (Group) | 10 |
| 9. | News Reading and Pronunciation | 10 |
| 10. | Satori | 10 |
| Total | | 100 |

| No. of the CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---------------|-------------------|------|------|------|------|------|-------------------|------|------|-------|-------|-------|-----------------|-------|-------|
| C130.1 | | | | | | | | | | 3 | | | | | |
| C130.2 | | | | | | | | | | 3 | | | | | |
| C130.3 | | | | | | | | | | 3 | 3 | | | | |
| C130.4 | | | | | | | | | | 3 | | | | | |
| C130.5 | | | | | | | | | | 3 | | | | | |
| 1 | Reasonably Agreed | | | | | 2 | Moderately Agreed | | | | | 3 | Strongly Agreed | | |