SARDAR PATEL UNIVERSITY, BALAGHAT (M.P.)

SCHOOL OF ENGINEERING AND TECHNOLOGY

SYLLABUS

COURSE – DIPLOMA IN ENGINEERING BRANCH – ELECTRICAL ENGINEERING

SEMESTER - 6th ACADEMIC SESSION 2024-25

DEE061

ENERGY CONSERVATION AND MANAGEMENT

Course Objectives - This course aims to provide a comprehensive understanding of energy conservation and management, covering both renewable and non-renewable energy sources, their consumption patterns, and environmental impacts. Students will learn about energy auditing, waste heat recovery, and HVAC systems, as well as the role of maintenance in energy conservation. The course also explores demand side management, power factor improvement, and energy-efficient electric drives. Furthermore, students will gain insights into energy conservation practices across various sectors, co-generation benefits, and the economic analysis of energy conservation investments, equipping them with the skills necessary for effective energy management.

Unit I

Energy Scenario- Various types of renewable and non-renewable energy, energy consumption and use pattern, energy consumption and environment. Energy Management and audit-Energy Management and its objectives, energy audit, need of energy audit, types of energy audit, energy auditing instruments.

Unit II

Waste heat recovery- Sources of waste heat, advantages of waste heat 12 recovery, commercial waste heat recovery devices -Recuperators, Heat regenerators, heat pumps etc. Agricultural use of waste heat. Heating ventilation and air conditioning-Definition of Heating, ventilation and 10 air conditioning, Energy saving opportunities in Heating ventilation and air conditioning, Conducting Audit in Heating ventilation and air conditioning.

Unit III

Role of maintenance in energy conservation-Types of maintenance- breakdown, predictive & preventive, maintenance and energy conservation. Demand side management –Benefits, Demand side.

management Techniques, implementation of Demand side management program, Tariff options of Demand side management. energy efficient electric drives, use of variable speed drives. Power factor improvement-Causes of low power factor, advantages of power factor improvement, methods of power factor improvement.

Unit IV

Energy conservation in various sectors-For residential and commercial sector, in transportation , in energy intensive industries, Co-Generation, benefits, types of co-generation.

Unit V

Economic Analysis of energy conservation-Economic analysis of investment, Economic analysis techniques, Risk analysis.

Reference Books:

1. Energy Conservation and Management by S. K. Soni and Manoj Nair, Satya Prakashan, New Delhi
2. Energy management- W.R. Murphy& G.M. key, Butter worths
3. Electrical Energy utilization & conservation – Dr. S.C. Tripathi

Four books published by BEE (Bureau of Energy Efficiency) Govt. of India for job.

Course Outcomes-

CO1. Analyze energy usage patterns and identify opportunities for energy conservation in electrical systems.
CO2. Design and implement energy-efficient systems, including lighting, motors, and HVAC systems.
CO3. Understand and apply energy management principles, including energy auditing, metering, and monitoring.
CO4. Develop strategies for reducing energy consumption and costs in industrial, commercial, and residential settings.
CO5. Evaluate the economic and environmental benefits of energy conservation measures. Understand and apply relevant energy standards, codes, and regulations

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DEE062

INSTALLATION, MAINTENANCE, TESTING

Course Objectives - This course aims to provide an in-depth understanding of the installation, commissioning, and maintenance of heavy electrical equipment. Students will learn the precautions and procedures for unloading and installing various machines, including pole-mounted transformers. The course covers essential commissioning tests, mechanical alignment, and electrical testing procedures. It emphasizes the importance of earthing, insulation testing, and maintenance, along with methods to improve insulation and prevent environmental pollution. Additionally, students will explore preventive measures to control pollution resulting from electrical and electronic equipment operations, ensuring safe and efficient handling of electrical systems.

Unit I

Installation - Types of heavy Electrical equipment, unloading accessories 5 Precautions. For unloading, installation of small and large machines of both static and rotating type. Installation of pole mounted transformers

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Unit II

Commissioning - Tests required before commissioning procedure to be adopted for commissioning the electrical equipment in respect of - (a) Mechanical fixture and alignment. (b) Electrical tests. (c) Initial precautions for starting.

Unit III

Earthing- Reasons of earthing, earthing system, earth lead and its size, permissible earth resistance for different installations, improvement of earth resistance, double, earthing, earth resistance measurement, rules for earthing.

Unit IV

Insulation testing and maintenance - Instruments used for measuring 6 insulation resistance, reasons for deterioration of insulation resistance, improving insulation, resistance, drying of insulation, Measurement of internal temperature of winding, vacuum impregnation / filtering of

insulation oil, testing of insulating oil Preventive, maintenance and environmental pollution prevention.

Unit V

Preventive measures to control environmental pollution results due to production of smokes gases flow of waste material and automatic reactions in research stations, plants, electrical and electronic equipment and accessories.

Reference Books:

1. Electrical Installations work by T.G. Fanciest. E.L.B.S (Vth metric edition)
2. Electrical Installations Maintenance & fault location workbook by T.T.T.I.(W.R.) Bhopal
3. Preventive maintenance Electrical equipment by Charies J Herbert.
4. Commission of Electrical plant by RCH Richardson.
5. Operation and maintenance of Electrical Equipment's Vol. I & Vol.I by B.V.S. Rao, Asia
6. Publishing or Media Promoter Publishers Pvt. Bombay.

Course Outcomes- The student will be able to-

CO1- Interpret electrical system diagrams, blueprints, and. Install electrical systems safely and efficiently, following industry standards and regulations.

CO2-. Perform routine maintenance tasks on electrical systems, including inspection, testing, and troubleshooting.

CO3. Conduct tests on electrical systems to ensure compliance with safety standards and regulations.

CO4. Analyze and troubleshoot electrical system faults using various techniques and tools.

CO5. Understand and apply electrical safety procedures and protocols.

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LIST OF EXPERIMENTS

1. To Measure the Polarization Index and Dielectric Absorption Test.
2. To study of troubleshooting of electrical equipment based on active visit to repair-to-repair workshop –

(a) Three phase induction motor

(b) Transformer

(c) Power Cable.

3. To study of thermograph images and analysis based on these images.
4. To study the various types of earthing for electrical systems, Practice of earthing and Measurement of Earth resistance of Campus premises.
5. Design, Estimation and costing of earthing pit and earthing connection for computer lab, Electrical Machines Lab, HT substation.
6. Estimation for 11kvV feeders and substation.
7. To study single line diagram of 132 or 220 or 400 kV substation (based on actual field Visit) Symbols, Plate or Pipe earthing.
8. Project report on area electrification.
9. Maintenance of overhead line in HVDC.

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DEE 063

ELECTRIC TRACTION

Course Objectives- This course aims to provide an in-depth understanding of electric traction systems in India, covering various track electrification methods, their advantages and disadvantages, and the components of A.C. electric locomotives. Students will explore overhead equipment, current collection systems, and the mechanics of train movement, including speed-time curves, tractive effort, and traction motor power. The course also delves into train signaling, lighting systems, and battery systems, equipping students with the knowledge and skills necessary for the effective design, operation, and maintenance of electric traction systems.

Unit I

General Description of Electric Traction system in India- Electric Traction – advantage and Disadvantages, Choice of traction system in India.

Unit II

System of Track Electrification. Description of various systems - D.C., 1-Phase low A.C., 1-Phase high frequency, 3-Phase A.C. and Composite system. 25 K.V. A.C.,0 Hz System-Advantages and disadvantages.

Unit III

A.C. Electric Locomotive. Block diagram of A.C. electric locomotive Overhead equipment (O.H.E.) Pentagonal O.H.E.- catenary construction. OHE Supporting structure Current collection system, current collection gear for OHE, pole collection bow collection, pantograph collector.

Unit IV

Traction Mechanics. Speed time curve, Simplified speed time curve, Average speed and schedule speed, Tractive effort, Power of traction motor, Mechanics of train movement.

Unit V

Train signaling - System of train lighting, special requirements of train lighting, methods of obtaining unidirectional polarity and constant output. Battery System Failure of underframe generating equipment.

Reference Books:

1. Electric Traction Author A.T. Dover Publisher Pitmen& Sons
2. Electric Traction System Equipment Author D.W. Hingle Publisher Pergamon Press
3. Electric Traction Handbook Author R. Books Publisher Pitman & Sons.
4. Modern Electric Traction. Author H. Pratap Publisher Pritam Burai & Bros

Course Outcomes-

CO1- To provide basic knowledge of electric traction systems.

CO2- To analyze the various current collection schemes for electric traction systems.

CO3- To recognize the classification and applications of DC machines.

CO4-Design and develop power electronic converters for electric traction systems, including AC-DC and DC-DC converters.

CO5- Understand and implement control strategies for electric traction systems, including speed control, torque control, and position control.

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LIST OF EXPERIMENTS

1) To study & draw speed current characteristics of D.C. Series motor.
2) To study speed control of D.C. Shunt motor by:

a) Armature voltage control method.

b) Flux control method.

3) To study speed control of three phase Slip-ring Induction motor through rectifier and chopper MOSFET by

a) Static rotor resistance method.

b) Stator voltage control method.

4) To study & draw following characteristics of D.C. Series motor

a) Torque vs current characteristics.

b) Speed vs torque characteristics.

5) To study Pole and Bow as a current collector.
6) To study Pantograph as a current collector.
7) To study Metadyne control systems.
8) To study Electric Traction system and its component.

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DEE063
PROGRAMMABLE LOGIC CONTROLLER

Course Objectives -This course aims to provide a comprehensive understanding of Programmable Logic Controllers (PLCs), covering their introduction, advantages, and evolution. Students will learn about PLC hardware, timers, counters, relays, and ladder logic diagrams. The course also delves into advanced instruction and programming techniques, including comparison instructions. It covers PLC input-output modules, power supply, and special input modules. Students will explore PLC applications in industrial control systems, SCADA, and safety systems. Additionally, the course includes industrial automation and the selection of PLCs, equipping students with practical skills for implementing and managing automated systems.

Unit I

Introduction to PLC- What is PLC, Technical Definition of a PLC Advantage of Chronological Evolution of a PLC Type of PLC Block diagram PLC Hardware, Timers& Counters, Relays Ladder logic diagram PLC Connection Electrical Wiring diagram JIC Wiring Symbols, Latches, Timer, Classification of Sierpc Counters, Operation of PLC Counter Parameters.

Unit II

Advance Instruction & Programming Techniques- Introduction (a) Comparison Instruction (b) Discussions on Comparison Instruction “EQUAL” “NOTEQUAL” “LESS THEN” “LESSTHEN OR EQUAL” “GRATER THEN” “MASKED COMPARISION FOR EQUAL”.

Unit III

PLC Input-Output (I/O) Modules Power Supply Classification of Input Output Modules Input-Output System Sinking Sourcing Special Input Modules RTD Input Module Stepper Motor Control Module Thermocouple Input Module Power Supply Configuring Power Line Conditioner Reliability, Safety and Redundance Filter.

Unit IV

PLC Applications- Distributed control system, (DCS Industrial control systems, (ICS) Programmable automation controller, (PAC). Industrial safety systems SCADA.

Unit V

Industrial Automation & Selection of Programmable Logic Controllers-Introduction Utility of automation Example of some simple Automated Systems Selection of PLC.

REFERENCES

1. PLC Programming Method and Application: -John R Hackworth- Fredric D Hackworth (publication: - Pearson Education)
2. Process Dynamic and control Dyersburg Taffeta D.A. Mellichamp (publication: -Wiley publication)
3. Programmable Controllers operation and Application (publication: -PHI publication)
4. Programmable Logic Controllers and Industrial Automation an Introduction By: - Madhuchanda Mitra and Samarjit Sen Gupta (publication: -Pen ram International Publishing (India) Pvt.Ltd.
5. Programmable Logic Controllers By: -W. Bolten Programmable Logic Controllers and Industrial Automation By: - Kelvin Collins (publication: -Exposure Publishing)
6. Programmable Logic Controllers By: -Collin Simpson
7. Programmable Logic Controllers By: -Morriss Brian publication: -PHI

Course Outcomes-

CO1: -Understand the basics of PLCs, including their definitions, advantages, and hardware components.

CO2: - Gain proficiency in advanced PLC programming, focusing on comparison instructions.

CO3: - Learn about the classification, functioning, and configuration of PLC I/O modules and power supplies.

CO4: - Explore practical applications of PLCs in various industrial control systems and safety systems.

CO5: -Understand the importance of automation and criteria for selecting the appropriate PLCs for specific applications.

LIST OF EXPERIMENTS

1: Basic PLC Programming - Create and run a simple ladder logic program.
2: Timer and Counter Operations - Implement and test PLC timers and counters in a circuit.
3: Comparison Instructions - Program and demonstrate the use of comparison instructions.
4: PLC I/O Modules - Configure and test various input and output modules.
5: Motor Control - Implement and test PLC control of a stepper motor.
6: Temperature Monitoring - Set up and program a thermocouple input module.
7: Real-World Application - Develop a PLC program for an industrial application (e.g., conveyor belt system).
8: SCADA Integration - Integrate PLC with SCADA for monitoring and control.
9: Distributed Control System (DCS) - Implement a simple DCS using PLCs.
10: Selection of PLC - Evaluate and select a suitable PLC for a given application.

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DEE 064P.
MAJOR PROJECT

The objective of the course 'Project' is.

- To provide students with comprehensive experience for applying the knowledge gained so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on solutions to small industrial problems.
- Students have an opportunity to do something creative and to assimilate real life work situation in an institution.
- To adapt students for the latest developments and to handle independently new situations.
- To develop good experiences power and presentation abilities in students

Students already have a glimpse of project work as they have worked on Minor Project Work in V semester. This gives the students an opportunity to observe the work on real life projects and select some application area in which he/she will be undertaking a project. External guides from industry can also be selected for project work along with an internal guide to prepare innovative and real projects. Students also have the flexibility of extending the minor project work into Major project, if the area has a scope for that. The purpose of providing six hours per week is to orient the students' in-groups to the following objectives:

The purpose of providing six hours per week is to orient the students' in-groups to the following objectives:

- Provide general guidelines regarding execution of work.
- Impart instructions regarding write-up work and preparation of project documents.
- Sharing and solving common problems associated with execution of project work.
- Monitor and evaluate the progress of project work.

The faculty and students should work according to the following schedule:

1. Each student undertakes substantial and individual projects in an approved area of the subject and supervised by members of staff.
2. The student must submit an outline and action plan for the project execution (time schedule) and the same be approved by the faculty concerned.
3. The project development must be carried out according to the following steps and the final write-up should have the same sequence.

- Project objectives.
- Requirement gathering.
- Modelling projects should be done in any well-known modeling tools.
- Analysis of Project.
- Design of Project.
- Implementation of project.
- Testing on project.
- Quality consideration of project.
- Designing a small user manual.
- Estimating the cost of the project.
- Future scope and suggestions.

ACTION PLAN FOR PROJECT WORK AND EVALUATION SCHEME (SUGGESTIVE):

1. Project Proposal (Weeks 1-2):
    - Define the project scope, objectives, and deliverables.
    - Conduct preliminary research and literature review.
    - Develop a project timeline and identify key milestones.
2. Planning Phase (Weeks 3-4):
    - Detail the project plan, including resource allocation and budgeting.
    - Assign roles and responsibilities within the project team.
    - Finalize project methodologies and tools to be used.
3. Design and Development (Weeks 5-10):
    - Start designing the electrical circuits/systems.
    - Source and acquire necessary materials and components.
    - Begin development and assembly of the project.

4. Testing and Validation (Weeks 11-12):
    - Conduct initial testing of the electrical systems.
    - Record and analyse test results.
    - Make necessary adjustments and improvements based on testing feedback.
5. Documentation and Reporting (Weeks 13-14):
    - Prepare detailed documentation of the project, including schematics, diagrams, and test results.
    - Develop a comprehensive project report.
    - Create a presentation summarizing the project.
6. Final Presentation and Submission (Weeks 15-16):
    - Present the project findings and outcomes to stakeholders and evaluators.
    - Submit the final report and all relevant documentation.
    - Conduct a project debrief and reflection session with the team.
    -

Evaluation Scheme (Suggestive)

- Project Proposal and Planning (20%):
    - Clarity of project objectives.
    - Completeness of the project plan.
    - Feasibility and resource planning.
- Design and Development (30%):
    - Quality and innovation of the design.
    - Efficiency in the development process.
    - Handling of technical challenges.
- Testing and Validation (20%):
    - Thoroughness of testing procedures.
    - Accuracy and reliability of test results.
    - Responsiveness to feedback and adjustments.
- Documentation and Reporting (20%):
    - Completeness and clarity of documentation.
    - Quality of the final report.
    - Effectiveness of the project presentation.
- Teamwork and Contribution (10%):
    - Collaboration and communication within the team.
    - Individual contributions to the project.

Committee comprises of HOD, all project supervisors including external guide from industry (if any). The above marking scheme is suggestive, it can be changed to an alternative scheme depending on the type of project, but the alternative scheme should be prepared in advance while finalizing the topic of project before a committee and explained to the students concerned as well.

The faculty and students should work according to the following schedule:

i) Each student undertakes substantial and individual projects in an approved area of the subject and supervised by a member of staff.
ii) The student must submit an outline and action plan for the project execution (time schedule) and the same be approved by the faculty concerned.
iii) At all the steps of the project, students must submit a written report of the same.

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DEE 065P.

Industrial Training/Technical Training

Industrial Training Marks Allocation-

Marks for various components in industry should be awarded to the students in consultation with t he Training and Placement Officer (TPO) or Faculty of Institute, who must establish contact with the supervisor/authorities of the organization where students are taking training. This is to award t he marks for term work and I/C of training from Industry. During the training, students will prepa re the first draft of the training report in consultation with the section in charge. After training, the y will prepare the final draft with the help of TPO/Faculty of the institute. They will then present a seminar on their training and face a viva-voce on training in the institute.

Objective of Industrial Training

The objective of undertaking industrial training is to provide work experience so that the student's engineering knowledge is enhanced, and employment prospects are improved. Students should ta ke this course as a window to the real world of work and should try to learn as much as possible fr om real-

life experiences by involving and interacting with industry staff. Industrial training also provides a n opportunity for students to select an engineering problem and an industry guide for their major p roject in the final semester.

Learning Through Industrial Training

During industrial training, students must observe the following to enrich their learning:

- Industrial environment and work culture.
- Organizational structure and interpersonal communication.
- Machines/equipment/instruments - their working and specifications.
- Product development procedures and phases.
- Project planning, monitoring, and control.
- Quality control and assurance.
- Maintenance system.
- Costing system.
- Stores and purchase systems.
- Layout of Computer/EDP/MIS centres.
- Roles and responsibilities of different categories of personnel.
- Customer services.
- Problems related to various areas of work.

Faculty and TPO are supposed to plan industrial training in such a manner that students get expos ure to most of the above areas in the field (world of work). Students are supposed to acquire this k nowledge by:

1. Observation
2. Interaction with officials at the workplace

3. Study of literature at the workplace (e.g., user manuals, standards, maintenance schedules, etc.)
4. "Hands-on" experience
5. Undertaking/assisting project work.
6. Solving problems at the workplace
7. Presenting a seminar
8. Participating in group meetings/discussions
9. Gathering primary and secondary data/information through various sources, storage, retrie val, and analysis of the gathered data
10. Assisting officials and managers in their work
11. Undertaking short action research work
12. Consulting current technical journals and periodicals in the library
13. Discussions with peers

Guidance to Faculty/TPO for Planning and Implementing Industrial Training

The industrial training program, which is spread over a 2-week duration, must be designed in consultation with the authorities of the workplace, keeping in view the need for the contents. Some of the salient points include:

- Spelling out the objectives of the industrial training in behavioral terms and informing the same in advance to the students, authorities of the workplace, and supervising faculty mem bers.
- Discussing and preparing students for the training, for which meetings with the students m ust be planned.
- Meeting with industrial personnel and orienting them regarding the objective of the trainin g and the expectations of the program.
- Correspondence with the authorities of the workplace.
- Orientation classes for students on how to make the training the most beneficial—monitoring daily diaries, writing weekly reports, interacting with various categories of ind ustrial personnel, behaving and undertaking responsibilities, gathering information from th e workplace, ethics, etc.
- Guiding students to make individual plans (week-wise/day-wise) to undertake industrial training.
- Developing a system of maintaining training records by teachers for every batch of student for convenient retrieval.
  Inviting industrial personnel to deliver lectures on some aspects of training

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SCHEME OF STUDIES

Duration:2 weeks after the V semester in the summer break, Assessment in VI semester.

SCHEME OF EXAMINATION

Fourth assessment of industrial training is undertaken by the students, the following components.
are considered with their weight age.

(a)Teamwork

In Industry Marks allotted

1.AttendanceandGeneralDiscipline05

2.DailydiaryMaintenance05

3.Initiativeandparticipativeattitudeduringtraining05

4.AssessmentoftrainingbyIndustrialSupervisor/s05

TOTAL20

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(b)Practical/Oral Examination (Viva-Voce)

In Institution Marks allotted

1.TrainingReport10

2.Seminarandcrossquestioning(defense)20

TOTAL30

Marks for various components in industry should be awarded to students in consultation with the Training and Placement Officer (TPO) or Faculty of the Institute. The TPO/Faculty must establish contact with the supervisor/authorities of the organization where the students are undergoing training, to award marks for term work and the training from the industry.

During the training, students will prepare the first draft of the training report in consultation with the section in charge. After the training, they will prepare the final draft with the help of the TPO/Faculty of the institute. Students will then present a seminar on their training and face a viva-voce on the training in the institute.

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INDUSTRIAL TRAINING DAILY DIARY

Name of the Trainee: .....
College : .....
Industry/Workplace: .....
Week No. : .....
Department/Section : .....
Date : .....

Brief of Observations Made:

[List your observations]

Work Done:

[Detail the work completed]

Problem/Project Undertaken:

[Describe any projects or problems addressed]

Discussions Held:

[Summarize key discussions with supervisors or team members]

Literature Consulted:

[Mention any manuals, standards, or other literature referred to]