Flexible Scheme & Syllabus

2020-2021

B.Tech.

in

Electrical Engineering

(VII Semester)

Madhav Institute of Technology & Science

Gwalior-474005

Utilization of Electrical Energy: 130717

Course Objective:

- To provides an introduction to the principles of electrical drives and their applications in daily life.
- To deals with the fundamentals of illumination and its classification.
- To provides knowledge on electrical traction systems

S No.	Course Outcome (CO)	Mapping
1	**Explain** operating principles and characteristics of traction motors with respect to speed, temperature, loading condition	Skill Development
2	**Describe** different types of heating and welding techniques	Skill Development
3	**Explain** basic principles of illumination and its measurement	Skill Development
4	**Explain** basic principle of electric traction including speed–time curves of different traction services	Skill Development
5	**Describe** braking, acceleration and other related parameters of traction system, including demand side management.	Skill Development

Unit – I Electric Drives
Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

Unit-II Electric Heating & Electric Welding
Advantages and methods of electric heating, resistance heating, induction heating, and dielectric heating. Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

Unit – III Illumination
Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light. Discharge lamps, MV and SV lamps comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

Unit –IV Electric Traction – I
System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking – plugging, rheostatic braking and regenerative braking. Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

Unit – V Electric Traction – II
Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

REFERENCE BOOKS:

1. Utilization of Electrical Energy - by E. Opens haw Taylor, University Press.
2. Art & Science of Utilization of Electrical Energy - by Par tab, Dhanpat Ravi & Sons.
3. Utilization of Electrical Power including Electric drives and Electric traction – by N.V. Suryanarayana, New Age International (P) Limited, Publishers, 1996.

4. Generation, Distribution and Utilization of Electrical Energy - by C.L. Wadhwa New Age
International (P) Limited, Publishers, 1997

DE -2 Electrical Drives: 130718

Course Objectives:

- To provide an overview of complete electrical drive systems to students, including the mechanical parts, electrical machines, and power converters and control.
- To expose the students to the basic and advanced speed control techniques using power electronic converters that are used in industry.
- Tofamiliarizethestudentswiththeconceptsbehindfourquadrantsoperationofelectricdrivesa ndslip power recovery schemes in induction motors.

S No.	Course Outcome (CO)	Mapping
1	**Describe** various components of a drive system along with modes of operation, control needs and identify stable/unstable regions	Skill Development
2	**Explain** various drives & loads, their characteristics and control methods under various operating	Skill Development
3	**Explain** performance analysis & control of dc drives	Skill Development
4	**Explain** performance analysis & control of ac drives	Skill Development
5	**Describe** working static converters for speed control of different types of drives	Skill Development
6	**Explain** the functioning of solar, battery powered and traction drives and explain energy conservation methods	Skill Development

Unit I. Basic Concepts: Elements of drive system, Requirements of electric drives. Ratings and selection of drives, Group and individual drives, constant power and constant torque drive. Dynamics of Electric drive convention and multi quadrant operation. Transient and steady state stability of Electrical drive. Control of Electrical drive, modes of operation, speed control and drive classification, closed loop control of drive.

Unit II. DC Drives: DC motor drives, DC motor and their performance, starting, braking, transient analysis and control, Ward Leonard drives, Thyristorised controlled DC drives, chopper controlled DC drives.

Unit III. Induction Motor Drives: Three phase induction motors Drives, starting, braking, transient operation, Variable frequency control from voltage and current source, rotor resistance control, static Scherbius and Kramer drives, introduction to vector control.

Unit IV. Synchronous Motor Drives: Synchronous motor drives, synchronous motor operation from fixed frequency supply, synchronous variable speed drives, self-controlled synchronous motor drives, brushless DC motor, stepper motor and switched reluctance motor drives.

Unit V. Special Drives: Solar and battery powered drives, solar powered electrical vehicles and boat, Traction Drives nature of traction load, conventional DC and AC Traction drives, Energy conservation in electric drives, Servo drives.

Recommended Books:

1. Fundamentals of Electrical Drives by G.K. Dubey, CRC Press, 2ndEd.2007
2. A first course in Electric Drives by S.K. Pillai, New Age International, 2ndEd.2007
3. Power Electronics and AC Drives by B.K. Bose, IEEE Press, Newjersey,2001

Electrical Drives Concept & Application by VedamSubrahmanyam,TataMcgrawHill, 2ndEd.2011

DE – 2 Applications of Electrical Equipment &Motors: 910205

Course Objectives: To impart knowledge on electrical appliances and their applications, safety on electrical equipment, electric motors, traction system considering economic and technology up gradation.

Unit I. Safe Working on Electrical Equipment: - Authorized Person, procedure for shutdown, testing devices for electricity, special shutdown precautions in substations and Power House, safety measures on LV & HV electrical equipment

Unit II. Utility of electrical equipment: Electrical motors, transformers, cables, and generators, motor control centers, medium voltage distribution panels, power control centers, Motor used in Electric vehicle, Electrical wiring components and accessories, Modern Appliances: Troubleshooting and Maintenance, Electrical Safety: Standards and Regulations

Unit III. Substation Equipment: Bus bar: Temperature rise test, rated short time current test, HV test,Power frequency voltage with stand test, Earthling Equipment,Isolator testing equipment,switch gear equipment: relay, CT,PT

Unit IV. Electric Motors
Drives: Introduction,Individualandgroupdrive,Factoraffectingselection of motor, Types of loads, Revised study of speed torque characteristics of DC and AC motor, Transient Characteristics, size and rating of motors, continuous & intermittent rating, Temperature rise calculation, Load Equalization, Motor enclosures

UnitV.Electric Traction Equipment: Introduction, requirements of an ideal traction system, supply systems for track-electrification, Comparison and application of different systems, Train Movement: speed time and speed distance curves, average and schedule speed, Mechanics of train movement: energy consumption Tractive effort, Factor affecting specific energy consumption, Coefficient of adhesion,Typesofmotorsusedforelectrictraction,currentcollectionsystems

Recommended Books:

1. Art and Science of Utilization of Electrical Energy by H. Pratab, Dhanpat Rai and Company, 2nd Ed., 2007.
2. Electric Power Utilization by N.N. Hanock, Wheeler publishing, 1st Ed.,1967.
3. UtilizationofElectricenergybyE.OpenshawTaylor,OrientLongman,1st Ed.,1961.
4. Generation Distribution and Utilization of Electrical Energy by C.L. Wadhwa, New Age publications, 1st Ed.,1989.

S No.	Course Outcome (CO)	Mapping
1	**Describe** various types of electrical equipment and their suitable applications.	Skill Development
2	**Describe** the various schemes of AC, DC drives, traction schemes and different braking systems	Skill Development
3	**Explain** the basics of lighting and illumination and its parameters and able to design Illumination systems for various applications.	Skill Development
4	**Gain** knowledge of the various types of arc furnaces, electrical welding, various types of heating.	Skill Development

5	**Apply** the electrical energy applications for traction and understand the power electronics technology in efficient utilization of electrical power.	Skill Development
6	**Identify** the knowledge for research opportunities in field of electric traction & utilization of Electric energy	Skill Development

Sensor Technology: 910206

Course Objective. Introduction to various types of sensors and the design of basic circuit building blocks.

Unit I. Sensors Fundamentals and Characteristics: Sensor, actuator and transducer, Signals and Systems; Sensor Classification: passive and active Sensor, absolute and relative Sensor; Units of Measurements; Sensor Characteristics: Transfer Function, Calibration, Nonlinearity, Saturation Repeatability, Dead Band ,Resolution.

Unit II. Principle of Sensing & Transduction: Mechanical and Electromechanical sensor, Resistive (potentiometric type), Strain gauge, Inductive sensor: common types- Reluctance change type, LVDT, Capacitive Sensors, Thermal Sensors, Magnetic Sensors, Proximity Sensor, Piezoelectric Effect.

Unit III. Interface Electronic Circuits: Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors.

Unit IV. Smart Sensor Technologies: Architecture of Smart Sensor: Features, Fabrication of Sensor And Smart Sensor, Integration of Micromachining and Microelectronics,Wafer bonding, LIGA process, Standard of Smart Sensor Network, Communication for smart sensors.

Unit V. Sensors in Different Application Area: Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors Neuro sensors, Biosensors, MEMS Sensors**,** Sensors for Mechanical Shock, Machinery Vibration Monitoring Sensors, Humidity Sensors, Electromagnetism in Sensing.

Recommended Books:

1. John S.Wilson “Sensor Technology” 4TH edition,Elsevier.2005
2. Jacob Fraden “Sensor Technology Design & Application”4thedition ,Springer .2010
3. Frank “Understanding Smart Sensors”2nd Ed.2002.
4. Ramon P. A. and Webster J. G., “Sensors and Signal Conditioning” 2nd 2001 Ed., John Wiley and Sons.
5. Feng Z. and Leonidas G., “Wireless Sensor Networks”, Elsevier Eastern Limited. 2007
6. Barney G., “Intelligent Instrumentation”, Prentice-Hall International Editions
7. Yamasaki H., “Intelligent Sensors”, Elsevier Eastern Limited. 1996

Course Outcomes:

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

- **CO 1.** **Explain** fundamentals of Sensors & Transducers
- **CO 2.** **Describe** physical principles of sensing
- **CO 3.** **Compare** various sensor materials and technology used in designing sensors
- **CO 4.** **Select** appropriate sensor for given application
- **CO 5.** **Recognize** the latest trends in the field of sensor

Sensor Technology (910206)

1. Glow the combinations of different colors of LEDs
2. Sense and measure temperature and humidity using DHT11

3. Identify the object and measure the distance using ultrasonic sensor
4. Display the single number using 7-segment display
5. Display thenumbers from 0000 to 9999 using 4 digit 7-segment display
6. Verify the characteristic of NTC type thermistor
7. Speed control of servo motor
8. Display the different types of the shapes and alphabets using matrix display 8 × 8 pixels
9. Identify the card details using RFID technology
10. Sense and measure the light using photosensor

Additional experiments using virtual lab platform

11. Verify the characteristic of RTD using virtual lab platform
12. Verify the characteristic of LVDT using virtual lab platform
13. Measure the weight through strain gauge using virtual lab platform

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

CO 1. **Identify**the different types of the sensors
CO 2. **Design** a project for ambient light, temperature and humidity measurement
CO 3. **Develop**a project for distance measurement
CO 4. **Create**a display to show the output of any sensor
CO 5. **Cultivate**teamwork abilities in order to operate well in groups

Sensor Technology - 910206

Skill Based Mini Project

1. Distance measurement by ultrasonic sensor
2. Displacement measurement using potentiometer
3. Development of pressure or force measurement mechanism using LVDT
4. Development of flow-level controller
5. Design a light circuit that glow on detecting any object
6. Alarm system for detection of over temperature in a rotating machine
7. Detection of any object using proximity sensor
8. Force or weight measurement using strain gauge
9. Design a signal conditioning circuit to amplify the output of thermocouple
10. Design a noise detector circuit

Theoretical

Identify the sensors and signal conditioning unit for following applications

11. Smart solar tracking system

12. Contactless liquid level controller
13. Speed checker to detect rash driving on vehicles
14. Optimum energy management system
15. Street lights that glow on detecting vehicle movement
16. Density based traffic signal system
17. Accident detection system & rescue system for ambulance
18. Contact less digital tachometer design
19. Auto metro train doors shuttling in between different stations
20. Automatic railway gate controlling
21. Automatic hand sanitizer dispenser
22. Home security system
23. Information system for weather report
24. Smart irrigation system
25. Smart water monitoring.

Electric Vehicle: 910207

Course Objectives: To impart knowledge on areas like how to choose a suitable drive scheme in developing electric vehicles depending on resources to develop basic schemes, design proper energy storage systems and usage of various protocols of communication under the umbrella of electrical vehicles.

Unit I: Background of EVs
History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles. Advantages & Disadvantages of EVs, Electric Revolution, Types of EVs (Plug-in EVs, ground vehicles, air borne, sea borne, Hybrid EVs, on-and-off road EVs), and Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics.

Unit II:Electric Drive-Trains& Propulsion
Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, Tractive effort, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives.

Unit III:Energy Storage & Management
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles,Battery based energy storage and its analysis, Fuel cell-based energy storage and its efficiency analysis, Battery Management System,Classification of different energy management strategies Comparison of different energy management strategies Implementation issues of energy strategies. Vehicle to grid (V2G) and Grid to Vehicle (G2V) fundamentals.

Unit IV Vehicle Dynamics &charging
Electric Vehicle Dynamics: Acceleration, Braking, Suspension &Ride Comfort;
Electric Vehicle charging: Introduction, Slow/ fast chargers, Swapping, Standardization, On board chargers, Public Chargers, Bulk chargers.

Unit V Sizing & Selection
Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications.

Recommended Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
3. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2005.

S No.	Course Outcome (CO)	Mapping
1	**Interpret** the environmental importance of electric vehicles and their role in society.	Skill Development
2	**Define** electric drive train topologies and propulsion mechanisms used in EVs	Skill Development
3	**Design** energy storage and management strategies for V2G and	Skill

	G2V concepts.	Development
4	**Analyze** dynamics of EVs for constant and variable tractive efforts and charging.	Skill Development
5	**Select** different components and sizes of EVs.	Skill Development
6	**Design** basic modeling of vehicle dynamics in simulink.	Skill Development