Mandsaur University

Diploma - Electrical Engineering
Semester-V

L-4 T-0 P-0 C-4

ELE150: Utilization of Electrical Energy

Course Objectives:

The students should be able to:
Comprehensive idea of utilization of electrical power in illumination, electric heating, electric welding and electric traction, refrigeration, air-conditioning, vacuum cleaner, electric water heater etc.

Course Outcomes:

At the completion of this course, students will be able to:

1. Design illumination systems for various applications
2. Understand and Apply the electric heating methods
3. Understand and Apply the electric welding methods
4. Apply to figure-out the different schemes of traction systems and its main components
5. Analyze the working of various domestic electrical appliances

Articulation Matrix

(Program Articulation Matrix is formed by the strength of correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	2	2	-	-	-	2	1	2	2	2	2	-
CO2	3	3	2	-	-	-	2	1	1	1	2	2	-
CO3	3	3	2	-	-	-	2	1	1	1	2	2	-
CO4	2	3	2	2	-	-	1	2	2	2	3	3	-
CO5	3	2	3	2	-	-	3	2	3	3	2	2	-

High-3 Medium-2 Low-1

Unit-I: Illumination

14 Hrs

Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light, definition: Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux, laws of illumination – simple numerical, lighting calculations: solid angle, inverse square and cosine laws, main requirements of proper lighting: absence of glare, contrast and shadow, general ideas about street lighting, flood lighting, monument lighting and decorative lighting, light characteristics etc.

Unit-II: Heating

12 Hrs

Advantages of electrical heating, heating methods: resistance heating - direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating appliances, induction heating - principle of core type and coreless induction furnace, electric arc heating - direct and indirect arc heating, construction, working and applications of arc furnace, dielectric heating, applications in various industrial fields, infra-red heating and its applications, microwave heating.

Unit-III: Welding **12 Hrs**

Advantages of electric welding, welding method, principles of resistance welding, types – spot, projection seam and butt welding, principle of arc production, electric arc welding, characteristics of arc, carbon arc, metal arc, hydrogen arc methods and their applications, power supply requirement, advantages of using coated electrodes, comparison between AC and DC arc welding, welding of aluminum and copper.

Unit-IV: Traction **11 Hrs**

Special features of traction motors, selection of traction motor; different system of electric traction and their advantages and limitations, mechanics of train movement: simplified speed time curves for different services, average and schedule speed, tractive effort, specific energy consumption, factors affecting specific energy consumption.

Unit-V: Domestic Electrical Appliances **11 Hrs**

Working of various domestic electrical appliances: electric iron, electric toaster, electric water heater, microwave oven, fans (ceiling and table fan), washing machine, grinder/ mixer/ juicer, vacuum cleaner, air conditioner, concept of star system for energy conservation.

Total: 60 Hours

Reference Books:

1. Open Shaw,Taylor, Utilization of electrical energy., Orient Longmans, 1962.
2. H. Pratap, Art and Science of Utilization of Electrical Energy.
3. Gupta, J.B., Utilization of Elect. Energy, Katariya and sons, New Delhi.
4. Garg, G.C., Utilization of Elect. Power and Elect. Traction.
5. N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect. Traction, New Age International.
6. Hancok N N, Electric Power Utilisation, Wheeler Pub.

List of e-Learning Resources:

1. http://202.45.146.138/elibrary/pages/view.php?ref=3851&k=
2. https://nptel.ac.in/courses/108105060

Diploma Electrical Engineering

Semester-V

L-4 T-0 P-0 C-4

ELE161: Testing and Maintenance of Electrical Machines

Course Objectives

This course will expose students to –

- Understand the safety measures for various electrical equipments.
- Understand the working and types relays and circuit breakers.
- Define basics of different types of electrical installations
- Develop the different types of earthing
- Analyze trouble shooting for various electrical equipments and machines.

Course Outcomes (COs)

1. Understand the circuit Electrical accidents and safety measures.
2. Apply the testing and maintenance of relays and circuit breakers.
3. Classify the different Installation for various electrical equipments.
4. Analyze the methods of Earthing for different equipments.
5. Analyze Trouble shooting chart for various electrical equipment, machines and domestic appliances

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	1	-	-	-	-	1	-	2	-
CO3	2	3	1	1	-	-	-	-	-	1	1	1	-
CO4	3	2	2	1	1	1	-	-	-	1	1	2	1
CO5	2	3	2	-	-	-	-	-	-	-	-	-	1

High-3 Medium-2 Low-1

UNIT I: **12 Hours**

Electrical accidents and safety measures - Electrical accidents, safety regulations, treatment of shock, fire extinguishers.

UNIT II: **12 Hours**

Testing and maintenance of relays and circuit breakers - Testing of relays factory test, commissioning test and preventive periodic maintenance test. Testing of circuit breakers, voltage test, and preventive maintenance of circuit breaker. Hot line maintenance - meaning and advantages, special types of non-conducting materials used for tools for hot line maintenance.

UNIT III: **12 Hours**

Installation - Types of heavy electrical equipment, unloading accessories precautions for unloading, installation of small and large machines of both static and rotating type. Installation of pole mounted transformer.

UNIT IV: **12 Hours**

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 V: **12 Hours**

Trouble Shooting -Normal performance of equipment, trouble shooting internal and external faults, instruments and accessories for trouble shooting, trouble shooting charts.

Total: 60 Hours

Reference(s)

1. B. L. Theraja Electrical Technology Vol I to IV S. Chand & Co., New Delhi.
2. B. V. S. Rao Operation & Maintenance of Electrical Machines Vol –I.
3. B. V. S. Rao Operation & Maintenance of Electrical Machines Vol.-II Media Promoters & Publisher Ltd. Mumbai.
4. C.J. Hubert Preventive Maintenance Hand Books & Journals.

List of e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/

Mandsaur University

MANDSAUR UNIVERSITY
MAKING FUTURE READY

Diploma Electrical Engineering
Semester-V

L-4 T-0 P-0 C-4

ELE162: Energy Conservation & Audit

Course Objectives:

- Identify the energy losses and wastage.
- Suggest the energy conservation techniques in various sectors.
- Find the opportunity for saving in energy consumption through tariff structure.
- Prepare energy audit report.

Course Outcomes:

The students will be able to

- Identify the demand supply gap of energy in Indian scenario.
- Carry out energy audit of an industry/Organization.
- Select appropriate energy conservation method to reduce the wastage of energy
- Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream.

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	-	2	-	-	-	-	1	-	1	-
CO2	3	2	1	-	-	-	1	-	-	-	-	-	-
CO3	2	1	3	-	1	-	-	-	-	1	1	-	-
CO4	2	2	1	-	-	-	1	-	1	-	-	-	-
CO5	1	2	2	-	-	-	-	-	-	-	-	1	-

High-3 Medium-2 Low-1

Unit-I Energy Conservation in Lighting system **12 Hours**

Introduction to Energy Conservation - Present energy scenario, Meaning of term Energy Conservation, Need of energy conservation, , Energy Conservation Act – 2003, Functions of Government Organization (NPC, MNRE, BEE, MEDA).

Energy Conservation in Lighting System - Basic terms used in lighting system (Illumination), Recommended Luminance levels, Procedure for assessing existing Lighting system in a facility. Energy Conservation techniques in lighting system - By replacing Lamp sources, Using energy efficient luminaries, Using light controlled gears, By installation of separate transformer / servo stabilizer for Lighting, Periodic survey and adequate maintenance programs, Energy Conservation techniques in fans, Electronic regulators.

Unit-II Energy Conservation techniques in Electrical Motors **12 Hours**

Construction, Power flow and working of Induction motor. Factors governing the selection of Induction motor. Need for energy conservation in Induction motor. Various energy conservation

techniques in Induction motor - improving power quality, motor survey, matching motor, minimizing the idle, Redundant running of motor, operating in star mode, rewinding of motor, improving mechanical power and transmission Efficiency. Energy Efficient motors - Comparison with conventional Induction motor

Unit-III Energy Conservation techniques in transformer **12 Hours**

Need of energy conservation in transformer. Methods (related to material, design) to improve the performance of transformer.

Energy conservation techniques related to transformer - Loading sharing, Parallel operation, Isolating techniques. Energy efficient transformers - Amorphous transformers, Epoxy Resin cast transformer (Dry type of transformer), Periodic maintenance.

Unit-IV Tariff And Energy Conservation Equipments **12 Hours**

Tariff - Types of tariff structure, Terms involved in tariff, Specific tariff: - Time-off-day tariff, Peak-off-day tariff, Power factor tariff, Maximum Demand tariff, Load factor tariff. Application of tariff system to reduce energy bill, Simple numerical based on power factor and load factor tariff.

Energy conservation equipments - Energy conservation equipment related to Lighting system - Centralized Control Equipment (Microprocessor based), Occupancy sensors/Motion Detectors, Control gears: Dimmers, Regulators, and Stabilizers). Energy conservation equipment related to electrical motors - Construction, working and advantages of each energy conservation Equipment listed below - Soft starter: For induction motors, Power Factor Controller, Static capacitor, Automatic star delta starter, Variable Frequency Drives.

Unit-V Energy Audit **12 Hours**

Energy flow diagrams and its significance, Energy audit instruments and their use, Prepare questionnaire for energy audit projects, ABC analysis and its advantages referred to energy audit projects, Energy Audit procedure (walk through audit and detailed audit), Calculation of simple payback period (Simple numerical)

Total 60 Hours

Reference Books:

1. S. Sivanagraju, M. Balasubba Reddy, D. Srilatha - Generation And Utilization Of Electrical Energy, Pearson, New Delhi
2. P. H. Henderson, India - The Energy Sector, University Press
3. W. C. Turner, Energy Management Handbook, Wiley Press
4. B. G. Desai, J. S. Rana, A. V. Dinesh, R. Paraman - Efficient Use And Management Of Electricity In Industry, Devki Energy Consultancy PVT. Ltd.

List of e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/

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L-4 T-0 P-0 C-4

ELE163: Electrical Installation

Course Objective:
This course is about the installation of electrical equipment used in electrical power system such as transmission and distribution lines and cables.

Course Outcomes:
After learning the course, the students will be able to understand installation of various electrical equipment in different electrical systems, including:

- Procedure of installation of different types of earthing for different types of systems.
- Installation of different types of lines and underground cables.
- Familiar about electrical safety regulations and rules during Installation.

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	1	-	-	-	-	1	-	2	-
CO3	2	3	1	1	-	-	-	-	-	1	1	1	-
CO4	3	2	2	1	1	1	-	-	-	1	1	2	1
CO5	2	3	2	-	-	-	-	-	-	-	-	-	1

High-3 Medium-2 Low-1

Unit-I Installation of Transmission and Distribution Lines: **18 Hours**

Erection of steel structures, connecting of jumpers, joints and dead ends; crossing of roads, streets, power/telecommunication lines and railway crossings, clearances; earthing of transmission lines and guarding, spacing and configuration of conductors: arrangement for suspension and strain insulators, anti-climbing devices and danger plates; sizes of conductor, earth wire, Laying of service lines.

Unit-II Laying of Underground Cables: **18 Hours**

Inspection, storage, transportation and handling of cables, cable laying depths and clearances from other services such as: water, sewerage, gas, heating and other mains, excavation of trenches, direct cable laying (including laying of cable from the drum, laying cable in the trench, taking all measurements and making as installed drawings, back filling of trenches with earth or sand, laying protective layer of bricks etc), laying of cables into pipes and conduits and within buildings, cable filling compounds, epoxy resins and hardeners, cable jointing and terminations. **12 Hours**

Unit-III:

Elementary idea regarding, inspection and handling of transformers; pole mounted substations, plinth mounted substations, grid substation, busbars, isolation, CT and PT, lightning arrestors, control and relay panels, HT/LT circuit breakers, LT switches, installation of transformers. Earthing system, fencing of yard, equipment foundations and trenches.

Unit-IV : **12 Hours**

Testing of various electrical equipment such as electrical motor, transformers cables and generator and motor control centers, medium voltage distribution panels, power control centres, motor control centers, lighting arrangement, storage, pre-installation checks, connecting and starting.

Total: 60 Hours

Reference Books:

1. Bill Atkinson, Roger Lovegrove, Gary Gundry: "Electrical Installation Designs".
2. V.K. Jain, Amitabh Bajaj, "A Text Book of Design of Electrical Installations".
3. Brian Scaddan "Electrical Installation Work, 8th edition" Routledge.

List of e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/

Mandsaur University

Diploma - Electrical Engineering

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Control Systems (ELE170)

Course Objectives

This course will expose students to –

- Learn Principles and applications of control systems in every day life.
- Understand the time domain analysis of different order control system.
- Define and understand the basic criterion of stability.
- Develop the concepts about frequency domain analysis.
- Learn the designing of compensation networks.

Course Outcomes (COs)

CO.1 Understand the concepts of open loop and closed loop control systems
CO.2 Identify the different physical systems and determine the transfer function.
CO.3 Design the system for different inputs and analyze time domain first and second order systems.
CO.4 Analyze the stability criterion for time domain systems.
CO.5 Examine the frequency response analysis of the control system.

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	-	-	-	-	-	-	-	-	1	-
CO2	1	3	2	-	-	-	-	-	-	-	-		
CO3	1	1	3	1	-	-	-	-	-	1	-	-	-
CO4	1	2	3	2	-	-	-	-	-	1	1	1	1
CO5	1	2	2	1	-	-	-	-	-	2	1	1	1

High-3 Medium-2 Low-1

Unit I — 09 Hours

Introduction: Elements of control systems, concept of open loop and closed loop systems, Examples and application of open loop and closed loop systems, brief idea of various control systems used in everyday life.

Unit II — 09 Hours

Mathematical Modeling of Physical Systems: Representation of physical system (Electro Mechanical) by differential equations, determination of transfer function by block diagram reduction techniques and signal flow graph method, Laplace transformation function, inverse Laplace transformation.

Unit III — 09 Hours

Time Response Analysis of First Order and Second Order System: Characteristic equations, response to step, ramp and parabolic inputs. Transient response analysis, steady state errors and error constants. Brief idea of proportional, derivative and integral controllers.

Unit IV — 09 Hours

Stability and Algebraic Criteria: concept of stability and necessary conditions, Routh-Hurwitz criteria and its limitations. Root Locus technique: The root locus concepts, construction of root loci.

Unit V — 09 Hours

Frequency Response Analysis: Frequency response, correlation between time and frequency responses, polar and Bode plots.

Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin.

PRACTICALS:-

1. To study about MATLAB
2. To study and verify various arithmetic operations on MATLAB.
3. Transfer function from zeros and poles.
4. To study analysis of time response of second order system.
5. Plotting root locus of a given transfer functions using a simulator.
6. Stability Analysis (Root locus, Bode, Nyquist) of Linear Time Invariant System.
7. Simulation of lag compensator.
8. Simulation of lead compensator.
9. Simulation of lead lags compensator.
10. Simulation of Nyquist plot from a transfer function.

Total: 60 Hours

Reference(s)

1. B. S. Manke, Linear Control System, Khanna Publisher.
2. Control Systems Theory and Applications - S. K. Bhattacharya, Pearson.
3. Control Systems - N. C. Jagan, BS Publications.
4. B. C. Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.
5. K. Ogata, Discrete Time Control Systems, Prentice Hall, 2/e, 1995.

List of e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/

Diploma: Electrical Engineering

Semester-V

L-2 T-1 P-2 C-4

ELE190: Digital Electronics

Course Objectives:

- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To study to simplify the mathematical expressions using Boolean functions – simple problems.
- To implement simple logical operations using combinational logic circuits
- To design sequential logic circuits.
- To study the design of various synchronous and asynchronous circuits.

Course Outcomes(COs):

1. Understand to manipulate numeric information in different forms, e.g. different bases, Signed integers, various codes such as ASCII, Gray and BCD.
2. Apply Boolean laws and theorems to manipulate simple Boolean expressions to minimize combinational functions.
3. Analyze combinational circuits such as decoders, encoders, multiplexers, demultiplexers.
4. Analyze sequential logic circuits such as flip flops.
5. Create counters and registers circuits.

Articulation Matrix

(Program Articulation Matrix is formed by the strength of correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PS03	PSO4
CO1	3	-	1	1	-	-	1	-	2	3	1	1	1
CO2	3	1	2	-	-	-	1	-	3	3	1	2	1
CO3	3	2	2	2	-	-	1	-	3	3	1	1	1
CO4	3	2	2	1	-	-	1	-	3	3	1	1	1
CO5	2	2	3	1	-	-	1	-	3	3	2	1	1

High-3 Medium-2 Low-1

Unit-I **9 Hours**

Number System, Codes &Basic Logic Gates Number systems and their inter-conversion, Binary Arithmetic (Addition, Subtraction, Multiplication and Division), Weighted, Non Weighted codes, BCD codes, Excess-3 code, Gray code, Hamming code, error detection. Complements 9's&10's, Subtraction using 1's & 2's complements, ASCII code, EBCDIC Codes. Logic gates: AND, OR, NOT, Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables.

Unit-II **9 Hours**

Boolean Algebra&Simplification of Boolean Functions:: Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Simplification of Boolean function using Boolean algebra, Theorems of Boolean algebra. Logic diagrams from Boolean expressions and vica-versa. Converting logic diagrams to universal logic, Representation of logic functions,

Unit-III **9 Hours**

Combinational Logic Circuits, Canonical and Standard Forms (Minterms&Maxterms), Sum of Minterms& Product of Maxterms, Conversion Between Canonical Forms, Simplification using Karnaugh map: Two, Three and Four variable functions, NAND and NOR implementation, Adders, Subtractors, Multiplexers and Demultiplexers, Encoders and Decoders, Code Converters, Binary Parallel Adder, Decimal Adder, Parity Checker and Magnitude Comparator. Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder.

Unit-IV **9 Hours**

Sequential Logic Circuits: Introduction of Sequential Circuits, Latches, Flip-Flops, S-R FF, J-K FF, D FF, T FF, Edge Triggered Flip Flop, Master Slave Flip Flop, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Flip-Flop Excitation Tables,

Unit-V **9 Hours**

Counters and of Registers: Asynchronous and Synchronous Counter, Counters with MOD Numbers, Down Counter, UP/DOWN Counter, Propagation Delay in Ripple Counter, Programmable Counter, Pre-settable Counter, BCD Counter, Cascading, Counter Applications, Decoding in Counter, Decoding Glitches, Ring Counter, Johnson Counter, Rotate Left & Rotate Right Counter. Definition of Register, Shift Register, Buffer Register with their timing diagrams and truth tables.

Suggested List of Experiment:

1. To study operation of all Logic Gates.
2. To study the NAND& NOR Gates as Universal Gates.
3. To prove Demorgan's theorem.
4. To study Binary to Gray code conversion & Gray to Binary code conversion.
5. To study Binary to Excess -3 code conversion.
6. To study Binary adder/ Subtractor
7. To study Encoder/Decoder (8 to 3 line Encoder,3 to 8 line Decoder)
8. To study Multiplexer / Demultiplexer (4 to 1 line Mux,1 to 4 line Demux.)
9. To study Flip –Flops (R-S,J-K & T Type Flip –Flops)
10. To study 4 bit Shift Register
11. To study 4 bit Synchronous Binary Counter.
12. To study 4 bit Binary Ripple Counter
13. To study ODD parity Generator & Even parity Generator.

Reference(s)

1. M. Mano; Digital design; Pearson Education Asia
2. Jain RP; Modern Digital Electronics; TMH
3. M. Mano; Digital Logic & Computer Design; PHI
4. Tocci ; Digital Systems Principle & Applications; Pearson Education Asia
5. Gothmann; Digital Electronics; PHI
6. R. H. Gour; Digital Electronics and Micro Computer
7. Malvino, Leech; Digital Principles and Applications
8. S. Salivahanan; Digital Circuits and Design; Vikas Publishing House PVT. LTD.
9. A.K. Maini; Digital Electronics: Principles and Integrated Circuits; Wiley India Publications

Total: 75 Hours

List of e-Learning Resources:

1. https://www.youtube.com/watch?v=eVZM7uzNlwo&list=PLeCiDjsAtogavOJvSdNbM0hs495GAORFO
2. https://www.youtube.com/watch?v=CeD2L6KbtVM&list=PL803563859BF7ED8C