Diploma: Electrical Engineering
Semester-III

L-3 T-1 P-2 C-4

ELE030: Basic Electronics

Course Objectives:

- Identify different diodes on their construction, characteristics and applications.
- Prepare different types of rectifier and filter circuits.
- To learn different configurations of Bipolar Junction Transistor circuits.
- Explain the constructional and characteristic difference of different types of FET's.
- Identify different types of MOSFET biasing circuit and learn various types of oscillator circuits.

Course Outcomes (COs):

- Understand the concept of semiconductor physics.
- Apply the concepts of basic electronic devices to design various rectifiers circuits.
- Analyze operation of diodes, transistors in order to design basic circuits.
- Analyze the operation of field - effect transistors.
- Analyze various types of oscillators.

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	PSo3	PSO4
CO1	3	2	-	1	1	1	2	-	1	-	2	1	1
CO2	3	2	-	1	1	2	-	-	2	-	2	2	1
CO3	3	2	-	-	1	2	-	-	2	-	2	2	1
CO4	3	2	2	1	1	1	1	1	2	2	2	2	1
CO5	3	1	-	2	1	1	-	-	2	2	2	2	1

High-3 Medium-2 Low-1

Unit-I **9 Hours**

Semiconductor Physics PN Junction Diode:

Germanium& Silicon Intrinsic Semiconductor, Extrinsic P type & N Type Semiconductor, Effect of Temperature on Semiconductor. Germanium Diode, Silicon Diode, Their Construction, Working Under no Bias Forward Bias & Reverse Bias Condition. Forward & Reverse Characteristics. Important Specifications (Ratings) of a PN Junction Diode. Diode Applications: Diode as a Switch. Zener Diode: Construction, Characteristics, Various Specifications (Ratings). Application in a Simple Voltage Regulator Circuit.

Unit-II **9 Hours**

Diode Applications

Rectifiers & Filters: Half Wave Rectifier (HWR), Full Wave Rectifier (FWR) - Centre Tap Transformer and Bridge Type. Their Comparison on the Basis of Circuit Operation, Waveforms, Average(dc) Value of Rectifier Output, Ripple Factor, Ripple Frequency, Transformer Utilization Factor, Rectification Efficiency, Advantages and Disadvantages.
Clipping & Clamping Circuits: Types and Applications.

Unit-III **9 Hours**

Bipolar Junction Transistor (BJT):

Construction, Working Principle of PNP and NPN Transistors, Characteristics of CB, CE and CC Configurations. DC and AC Current Gains α, β, γ. Requirement of Biasing, Different Types of Biasing Circuits Fixed, Bias Circuit with Emitter Resistor, Collector to Base Biasing Circuit, Voltage Divider Biasing Circuit and Emitter Bias Circuit. Thermal Stability Factor. Comparison of

Each on the Basis of Thermal Stability. Transistor Specifications. Transistor Testing. Applications of BJT.

Unit-IV **9 Hours**

Field - Effect Transistors:

Introduction, Construction & Characteristics of Junction Field Effect Transistor (JFET).Transfer Characteristics. Their Important Specifications (Parameters) Mentioned in Manufacturer's Data Sheets. Metal Oxide Semiconductor Field Effect Transistor (MOSFET).Depletion Type, Enhancement-Type MOSFET's. Their Construction, Characteristics & Parameters. Vertical MOSFET (VMOS) & Complementary MOSFET (CMOS). JFET Voltage Variable Resistor (VVR) and CMOS Inverter Switch Applications.

Unit-V **9 Hours**

Feedback and Oscillator Circuits:

Concept of Negative & Positive Feedback. Types of Negative Feedback Amplifier Circuits. Principle of Oscillator, Barkhausen Circuit Criteria for Oscillation.

Types of Oscillators: Phase Shift Oscillator, Resonance – Circuit LC Oscillator, Wein Bridge Oscillator, Colpitts Oscillator, Hartley Oscillator, Crystal Oscillator, RC Phase shift, Wien Bridge, Hartley and Colpitts Oscillator Circuits.

Suggested List of Experiment:

1. To plot the V-I Characteristics of a – (a) Silicon Diode (b) Germanium Diode
2. To verify the V-I Characteristics of Zener Diode.
3. To verify the Action of Diode as a Positive Clipper and Negative Clipper.
4. To verify the action of diode as a Positive Clamper and Negative Clamper.
5. To Obtain the Input and Output Transistor Characteristics for CB Configuration.
6. To Obtain the Input and Output Transistor Characteristics for CE Configuration.
7. To Obtain the Input and Output Transistor Characteristics for CC Configuration.
8. To Verify the Operation of FET as a Switch.
9. To Verify the V-I Characteristics of UJT.
10. To Setup the Circuit and Verify the Waveforms of HW Rectifier.
11. To Setup the Circuit and Verify the Waveforms of FW Rectifier.
12. To Setup the Circuit and Verify the Waveforms of Bridge Rectifier.
13. To Setup a RC Phase Shift Oscillator and Analyze its Operation.
14. To Analyze the Performance of a Class A Amplifier.
15. To Verify the Action of UJT as a Relaxation Oscillator.
16. To Setup a RC Phase Shift Oscillator and Analyze its Operation.

Reference(s)

- Electronics Principles by Malvino
- Electronic Devices &CKTs by Mottershead
- Integrated Electronics by Millian&Halikyas
- Electronic Devices & Circuits By Robert Boylestad
- Electronic Devices and Circuits by Millman&Halkias
- Electronic Devices and Circuits by Mathur&Chadha
- Solid State Devices by Streetman
- Basic Electronics by V.K. Mehta
- Electronic Principles,7th Edition by Albert Paul Malvino, (Tata McGraw - Hill Publishing Company Ltd).

Total: 75 Hours

List of e-Learning Resources:

1. https://www.youtube.com/playlist?list=PLzJaFd3A7DZsA8xZg3tgoshboIIBY98cB
2. https://www.youtube.com/watch?v=w8Dq8blTmSA&list=PL6A5175DB9EF79D22

Diploma Electrical Engineering
Semester-III

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

Fundamental of Electrical & E Engineering

Course Objectives

- To provide strong foundation in basic science and mathematics necessary to formulate, solve and analyze electrical and electronics problems.
- Understand the basic concepts of magnetic circuits, AC & DC circuits.
- Explain the working principle, construction, applications of DC & AC machines.

Course Outcomes (COs)

CO1: Understand the basic elementary concepts of electrical engineering.
CO2: Analysis of Single Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.
CO3: Analysis of Three Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.
CO4: Analyze the performance of transformers under all load conditions and draw the equivalent circuit of transformer.
CO5: Explain the concepts of electromechanical energy conversion, Principle of operation of DC and AC Machine and classify various.

Articulation Matrix

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

High-3 Medium-2 Low-1

Course Content: UNIT I Overview of Electronic Components & Signals: Passive Active Components: Resistances, Capacitors, Inductors, Diodes, Transistors, FET, MOS and CMOS and their Applications. Signals: DC/AC, voltage/current, periodic/non-periodic signals, average, rms, peak values, different types of signal waveforms, Ideal/non-ideal voltage/current sources, independent/dependent voltage current sources. UNIT II Overview of Analog Circuits: First Year Curriculum Structure Common to All Branches 42 Operational Amplifiers-Ideal Op-Amp, Practical op amp, Open loop and closed loop configurations, Application of Op-Amp as amplifier, adder, differentiator and integrator. UNIT III Overview of Digital Electronics: Introduction to Boolean Algebra, Electronic Implementation of Boolean Operations, Gates-Functional Block Approach, Storage elements-Flip Flops-A Functional block approach, Counters: Ripple, Up/down and decade, Introduction to digital IC Gates (of TTL Type). Unit IV Electric and Magnetic Circuits: EMF, Current, Potential Difference, Power and Energy; M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor and BH curve; Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Analogy between electric and magnetic circuits. Unit V A.C. Circuits: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; Voltage and Current relationship in Star and Delta connections; A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, R-L-C series and parallel circuits; Power in A. C. Circuits, power triangle. Unit

VI Transformer and Machines: General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and Working principle of motors; Basic equations and characteristic of motors.

Unit I Elementary Concepts: **9 Hours**

Concept of Potential difference. Current and resistance. Ohm's law, effect of temperature on resistance, resistance temperature coefficient, insulation resistance. SI units of work Power and Energy. Conversion of energy from one form to another in electrical and thermal systems.

Unit II 1- Phase AC Circuits : **9 Hours**

Generation of Sinusoidal AC Voltage, Definition of Average Value, R.M.S. Value, Form Factor and Peak Factor of AC Quantity , Concept of Phasor, Concept of Power Factor, Concept of Impedance and Admittance, Active, Reactive and Apparent Power, Analysis of RL, RC, RLC Series & Parallel Circuit.

Unit III3-phase AC Circuits: **9 Hours**

Necessity and Advantages of Three Phase Systems, Meaning of Phase Sequence, Balanced and Unbalanced Supply and Loads. Relationship between Line and Phase Values for Balanced Star and Delta Connections. Power in Balanced & Unbalanced Three Phase System and their Measurements

Unit IVTransformers- **9 Hours**

Review of Laws of Electromagnetism, mmf, Flux, and their Relation, Analysis of Magnetic Circuits. Single-Phase Transformer, Basic Concepts and Construction Features, Voltage, Current and Impedance Transformation, Equivalent Circuits, Phasor Diagram, Voltage Regulation, Losses and Efficiency, OC and SC Test.

Unit V Rotating Electric Machines- **9 Hours**

Constructional Details of DC Machine, Induction Machine and Synchronous Machine, Working Principle of DC Machine and Induction Machine, Emf Equation of DC Machine and Induction Machine, Classification of DC and AC Machine.

List of Experiment:

1. The Study of R-L-C Series Circuit and Draw its Phasor Diagram.
2. Perform Experiment to Measure Active and Reactive Power Consumed by Single Phase Inductive Load While Connected to Single Phase AC Supply.
3. Performing Experiment to Measure Line Voltage, Line Current, Phase Voltage, Phase Current and Total Power Consumed by the Balanced 3- Phase Resistive Load.
4. To Verify the Voltage and Current Relations in Star Connected Systems.
5. To Verify the Voltage and Current Relations in Delta Connected Systems.
6. To Perform O.C. Test on 1-Ph Transformer and Determine Equivalent Circuit Parameters.
7. To Perform S.C. Test on 1-Ph Transformer and Determine Equivalent Circuit Parameters.
8. Study of Construction and Working Principle of 3-Phase Induction Motor.
9. Study of Construction and Working Principle of DC Motor.
10. Study of Construction and Working Principle of DC Generator.

Total: 60 Hours

References:

1. D.P. Kothari & I.J. Nagrath, Basic Electrical Engineering, Tata McGraw Hill, Latest Edition.
2. S.N. Singh , Basic Electrical Engineering, P.H.I.,2013
4. Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall,2014

5. M.S. Sukhija, T. K. Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press,2012
6. C.L. Wadhwa, Basic Electrical Engineering. New Age International.

List of e-Learning Resources:

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

Diploma: Electrical Engineering

Semester-III

L-2 T-1 P-0 C-3

PCDEE0200A Communication Engineering

Course Objectives:

- To understand the fundamental characteristics of signals and systems
- To understand the basics of communication system and analog modulation techniques
- To analyze the concept of Frequency modulation and Pulse Modulation techniques
- To create deeper understanding of various aspects in the design of communication & multiple access systems for satellite communication and design of Earth station and satellite link

Course Outcomes (Cos):

- Understand the Fourier transform techniques, probability & stochastic theories
- Understand the need of modulation in transferring a signal through either wireless or wired communication systems
- Apply analog modulation techniques and receiver fundamentals in analog communication
- Analyze and understand the performance of communication systems in the presence of noise and interference
- Evaluate appropriate multiple access technique for a given satellite communication application. And analyze the overview of cellular communication

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	PSO3
CO1	3	2	1	1	1	-	1	1	2	3	-	1
CO2	3	1	1	2	1	-	2	-	1	1	2	2
CO3	3	1	1	-	-	-	1	1	2	3	1	2
CO4	2	2	1	-	-	-	-	-	2	2	1	1
CO5	3	2	3	1	-	1	-	-	1	2	2	1

High-3 Medium-2 Low-1

Unit I:-Signal Processing — 12 Hours

Types of signal, deterministic & random, periodic &non Periodic, analog & discrete, energy & power signals, Representation of sinusoid in different forms & their conversion. Fourier series, Fourier Transform and its properties. Probability and random variables: Overview of probability, concept of Random variable.

Unit II: Analog Modulation Techniques — 12 Hours

Block schematic of a typical Communication system.Need of modulation in a communication system, Types of modulation, Amplitude (Linear) Modulation: AM, DSB, SSB. Methods of generation and detection. Angle (Non-Linear) Modulation: Frequency and Phase modulation. Relationship between phase & freq. modulation, FM wave & its spectrum, methods of generation & detection of FM, pre-emphasis & de- emphasis.

Unit III: Transmitter and Receiver — 12 Hours

Classification of radio transmitters, Block diagram of AM transmitter, Armstrong FM transmitter, Simple FM transmitter using Reactance modulator. Classification of radio receivers, TRF receivers, Super heterodyne receivers, Tracking and alignment of receivers, Intermediate frequency, AGC, AFC, SSB receiver.

Unit IV: Pulse and Digital Modulation Techniques — 12 Hours

Nyquist sampling theorem, TDM, Pulse modulations & PCM, Quantization error, Necessity of nonlinear quantizer, A-law, μ -law, FSK & PSK, QPSK, QAM, Source of noise,
Noise figure, Noise bandwidth, effective noise temperature, Performance of AM, FM & digital system in presence of noise.

Unit V: Cellular Mobile System and Satellite System **12 Hours**

Introduction to cellular mobile system, A basic cellular system, operation of cellular System, concept of frequency reuse channels, co-channel interference, hand off mechanism, Digital Cellular Systems: GSM and CDMA. Satellite system block diagram, satellite freq. bands, Satellite multiple access Format like TDMA, FDMA, Satellite link design.

Total: 60 Hours

Reference(s)

1. Simon Haykins,(2001) Communication system, John Wiley.
2. Taub and Schilling,(2007) Principles of Communication Systems , Tata McGraw Hill.
3. Singh &Sapre(2017), Communication System, TMH.
4. B.P. Lathi, Modern(2011), Digital and Analog communication system.
5. Wayne Tomasi(2003), Electronic Communication system.
6. Schaum outline Series(1993), Analog and digital communication
7. John G. Prokis,MasoudSalehi, Gerhard Bauch(2004), Contemporary communication sytems using MATLAB, Cengage learning.
8. D.Roddy(2009),"Satellite Communication (4/e)", McGraw-Hill.

List of e-Learning Resources:

3. https://www.youtube.com/watch?v=TPm0XSPxld8&list=PL7748E9BEC4ED83CA
4. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/

Subject Expert **Academic Coordinator** **HoD** **Appointed Senior Faculty by DoAA**

Mandsaur University

Diploma: Electrical Engineering

Semester-III

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

PCDEE0300A 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. Createcounters and registerscircuits.

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
CO1	3	-	1	1	-	-	1	-	2	3	1	1
CO2	3	1	2	-	-	-	1	-	3	3	1	2
CO3	3	2	2	2	-	-	1	-	3	3	1	1
CO4	3	2	2	1	-	-	1	-	3	3	1	1
CO5	2	2	3	1	-	-	1	-	3	3	2	1

High-3 Medium-2 Low-1

Unit-I Number System, Codes &Basic Logic Gates — 9 Hours

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 Boolean Algebra & Simplification of Boolean Functions — 9 Hours

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 Combinational Logic Circuits — 9 Hours

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

Mandsaur University

Diploma: Electrical Engineering

Unit-IV Sequential Logic Circuits **9 Hours**

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 Counters and of Registers **9 Hours**

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

Total: 45 Hours

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.

Total: 75 Hours

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

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

Subject Expert **Academic Coordinator** **HoD** **Appointed Senior Faculty by DoAA**

Diploma Electrical Engineering

Semester-III

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

PCDEE0400A Electrical Machine-I

Course Objectives

This course will expose students to –

- To define basics of transformer, tests performed on transformers and fundamental concepts of transformer.
- To understand the various applications of transformers.
- To define basics of three phase induction motor, tests performed and fundamental concepts of transformer.
- To develop the concepts about many effects on the performance of three phase induction motor.
- To define basics fundamental of single phase induction motor.

Course Outcomes (COs)

1. Understand the circuit, phasor diagrams, performing of tests for losses and efficiency of transformer.
2. Apply the winding connections and suitable three phase transformers for particular applications.
3. Analyze the speed characteristics with torque and power, performing of tests for losses and efficiency of three phase induction motor.
4. Analyze the methods of starting of induction motors with high starting torque and small armature resistance and speed control of the same.
5. Analyze the starting and working of different types of single phase induction motors.

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	PSO3
CO1	3	2	1	1	-	-	1	-	1	2	1	1
CO2	3	2	1	-	-	1	-	-	-	1	-	-
CO3	2	3	1	-	-	1	1	-	1	1	1	1
CO4	2	3	2	-	1	1	-	-	-	-	1	-
CO5	3	2	1	-	-	1	-	-	1	-	-	1

High-3 Medium-2 Low-1

UNIT I: Transformer-I **9 Hours**

Working principle, e.m.f. equation, construction, phasor diagrams, equivalent circuit, voltage regulation, losses and efficiency, tests: open circuit and short circuit, condition for maximum efficiency, power and distribution transformer, all-day efficiency, autotransformer: working, advantages

UNIT II: Transformer-II **9 Hours**

Three phase transformer: Different types of winding connections; parallel operation of three phase transformers: application, advantages, requirement and load sharing; cooling, conservator and breather

UNIT III: Three Phase Induction Motor- I **9 Hours**

Working principle, construction, comparison of slip ring and squirrel cage motors, concept of slip, phasor diagram and equivalent circuit, power flow diagram, torque speed and power-speed characteristics, losses and efficiency, no load and block rotor test

UNIT IV: Three Phase Induction Motor- II **9 Hours**

Starting methods of induction motors, Cogging & Crawling, double cage & deep bar indication motor, impact of unbalanced supply and harmonics on performance, speed control, braking, and induction generator. Applications

UNIT V: Single Phase Motors **9 Hours**

Single phase induction motor; double revolving field theory, equivalent circuit, starting methods and types of single phase induction motors: their working principle and applications

Total: 45 Hours

PRACTICAL

1. To Study Constructional Features of Single Phase Transformer.
2. To perform Open Circuit test on single phase transformer.
3. To perform Short Circuit test on single phase transformer.
4. To Perform Polarity Test on Two Single Phase Identical Transformers.
5. To Perform Parallel Operation on Two Single Phase Identical Transformers.
6. To Study Constructional Features of Induction Motor.
7. To Perform Starting of Single Phase Induction Motor.
8. To perform no-load test on single phase induction motor.
9. To Perform Starting of Three Phase Induction Motor by Star-Delta Starter.
10. To perform blocked rotor test on single phase induction motor.

Total: 60 Hours

Reference(s)

1. M. G. Say, Alternating Current Machines', (5th Ed.) ELBS, 1986.
2. V. Del Toro, "Electrical Machines & Power Systems", 1985, Prentice-Hall, Inc., Englewood
3. Cliffs.
4. V. Del Toro, "Electromechanical Devices for Energy Conversion & Control Systems", PHIPvt. Ltd.,1975.
5. Electrical Machines by Dr.P.S.Bimbhra (Khanna).
6. Electrical Machines by Ashfaq Hussain. (DhanpatRai).
7. Electrical Machines by Nagrath and Kothari (TMH).
8. A.C. Machines by Langsdorf (McGraw-Hill)

List of e-Learning Resources:

5. https://nptel.ac.in/
6. https://www.coursera.org/

Subject Expert	**Academic Coordinator**	**HoD**	**Appointed Senior Faculty by DoAA**

Diploma- Electrical Engineering

Semester-III

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

PCDEE0500A Circuit Theory

Course Objectives

This course will expose students to –

- To learn basic techniques for the design of AC & DC circuits and fundamental concepts for measurement of electrical quantities like current, voltage, power etc..
- To understand use of network theorem to reduce complex electrical circuit into simple one.
- To define and understand transient response analysis of series RL, RC and RLC circuits.
- To develop the basic concept of complex frequency and transfer function.
- To learn basic characterization of two port networks in terms of Z, Y, h and ABCD Parameters.

Course Outcomes (COs)

- Understand the concepts of circuit analysis and its laws.
- Identify the different network theorems to reduce complex electrical circuit.
- Design and apply linearity and superposition concepts to analyze RL, RC, and RLC circuits in time and frequency domains.
- Analyze the network function of circuits.
- Examine and analysis of basic characterization of two port networks in terms of Z, Y, h and ABCD parameters.

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	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	1
CO2	1	3	2	-	-	-	-	-	-	-	-	
CO3	1	2	3	1	-	-	-	-	-	1	-	-
CO4	1	1	3	2	-	-	-	-	-	1	1	1
CO5	1	1	2	2	-	-	-	-	-	2	1	1

High-3 Medium-2 Low-1

Unit I Basic Circuits Analysis **09 Hours**

Introduction to circuit elements and their characteristics. Electrical Sources and their conversion. Ohm's Law, Kirchhoff's Laws for DC and AC Circuits. Resistors in Series and Parallel. Mesh Current and Node Voltage Method of Analysis for D.C and A.C. Circuits.

Unit II Network Reduction and Network Theorems for DC and AC Circuits **09 Hours**

Network Reduction: Voltage and Current Division. Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem and Reciprocity Theorem.

Unit III Transient Response Analysis **09 Hours**

Transient Response analysis of series RL, RC and RLC Circuits.

Unit IV Transfer Function **09 Hours**

Concept of Complex Frequency, Network & Transfer Functions for One Port & Two Ports network, Poles and Zeros of a transfer function.

Unit V Two Port Networks **09 Hours**

Characterization of Two Port Networks in Terms of Z,Y, h and ABCD Parameters. Relationship between Parameters, Interconnection of Two Ports Networks

Total: 45 Hours

PRACTICALS: -

1. To Verify Kirchhoff's Law.
2. To Verify Thevenin's Theorem.
3. To Verify Superposition Theorem.
4. To Verify Reciprocity Theorem.
5. To Verify Maximum Power Transfer Theorem.
6. To Verify Millman's Theorem.
7. To Determine Open Circuit and Short Circuit Parameters of a Two Port Network.
8. To Determine A,B, C, D Parameters of a Two Port Network
9. To Determine h Parameters of a Two Port Network
10. To Study 1-Phase & 3-Phase Networks.

Total: 75 Hours

Reference(s)

1. M.E. Van Valkenburg, Network Analysis, Pearson
2. William H Hayt& Jack E. Kemmerly, Steven M Durbin; Engineering Circuit Analysis; McGrawHill
3. Richard C Dorf, James A Svoboda, Introduction to Electric Circuits, Wiley India, 2015
4. Charles K. Alexander & Matthew N.O. Sadiku: Electrical Circuits; McGrawHill
5. J David Irwin, Robert M Nelms, Engineering Circuit Analysis, Wiley India,2015

List of e-Learning Resources:

7. https://nptel.ac.in/
8. https://www.coursera.org/

Subject Expert	**Academic Coordinator**	**HoD**	**Appointed Senior Faculty by DoAA**

Diploma: Electrical Engineering
Semester-III

L-0 T-0 P-4 C-2

PCDEE0600A Electrical Wiring & Winding

Course Objectives:

- To master fundamental principles of electrical wiring and winding techniques.
- To understand safety protocols and regulations in electrical installations.
- To develop skills in interpreting electrical diagrams and blueprints accurately.
- To gain proficiency in executing proper wiring and winding procedures.
- To apply knowledge to troubleshoot and maintain electrical systems effectively.

Course Outcomes:

1. Understand the knowledge about tools, equipment's and instruments required for different types of wiring systems and testing.
2. Apply the skills in house wiring.
3. Analyze skills in Industrial wiring.
4. Evaluate the various types of wiring systems & to select suitable.
5. Create domestic wiring procedures practically and winding and develop the mini projects with report

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	PSo3
CO1	3	3	3	3	1	1	1	1	1	3	2	3
CO2	3	3	3	3	1	1	1	-	-	3	2	3
CO3	3	3	3	3	1	1	1	-	1	3	2	3
CO4	3	3	3	3	1	1	1	1	-	3	2	3
CO5	3	3	3	3	1	1	1	-	2	3	2	3

High-3 Medium-2 Low-1

PRACTICAL:

1. Introduction of tools, electrical materials, symbols and devices etc.
2. To study about the trouble shooting of electrical equipments like fan, iron box, mixer-grinder etc.
3. To measure the electrical quantities – voltage, current, power and to calculate power factor for RLC circuit.
4. To draw connection of instrument circuit: Ammeter, voltmeter, wattmeter, energy meter.
5. To implement residential house wiring using switches, fuse, indicator, lamp and energy meter.
6. To draw different types of wiring: (i) Staircase wiring (ii) Corridor wiring.
7. To draw different types of wiring: (i) Sodium vapour lamp (ii) Fluorescent lamp wiring.
8. Assembly of choke or small transformer.
9. To study various electrical gadgets of Induction motor, transformer, CFL, LED, PV cell.
10. To draw connection of instrument circuit: Power factor meter, frequency meter, synchroscope.
11. To implement residential house wiring using switches, fuse, indicator, lamp and energy meter.
12. To measure the energy consumed in a single phase circuit and 3 phase circuit.
13. To draw and calculate DC machine winding: Simplex lap, simplex wave, multiplex lap, multiplex wave winding.

14. To draw and calculate AC machine winding: Single layer, double layer winding.
15. To control one lamp by two 2-way switches.
16. To design and fabricate single phase transformer.
17. To control lamps by two separate switches (house wiring).

Total: 60 Hours

List of E-learning Recourses:

1. https://www.electricaltechnology.org/2012/11/how-to-control-each-lamp-by-separately.html
2. https://matthews.sites.wfu.edu/courses/p230/switches/SwitchesTut.html
3. https://www.electronicshub.org/2-way-switch-wiring/

Subject Expert	**Academic Coordinator**	**HoD**	**Appointed Senior Faculty by DoAA**

Diploma - Electrical Engineering
Semester-V

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

PEDEE0102A 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:

1. Understand the illumination systems for various applications
2. Apply the electric heating methods
3. 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	PSO1	PSO2	PSO3
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 9 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 9 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 9 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 **9 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 **9 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: 45 Hours

PRACTICALS

1. Identify the different lighting accessories required for various types of lamps.
2. Identify the different lighting accessories required for various types of lamp fittings.
3. Measure illumination at different places in college using lux meter.
4. Identify the different components required for various types heating furnaces.
5. Observe construction and working of various heating furnaces by watching video programmes.
6. Identify the different accessories and safety devices required for various types of welding system.
7. Prepare a report of specification of various electrical welding machines available in college workshop.
8. Visit a small manufacturing unit to observe various electrical drives and prepare a technical report.
9. Prepare a comparative chart of two different manufacturing companies in India for any two Lift/Elevator with technical data.
10. Visit a railway loco shed to observe various components and working of electric locomotive and prepare a technical report.
11. Prepare a report /chart on various types of traction systems.
12. Prepare a report/chart on speed time curves.
13. Improve the power factor of available inductive load using static capacitor.
14. Prepare a report based on comparative study of various tariff structure of Madhya Pradesh.
15. Prepare Energy Bill based on energy consumption of residence/ Institute.

Total 75 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

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Subject Expert	**Academic Coordinator**	**HoD**	**Appointed Senior Faculty by DoAA**