Lok Jagruti Kendra University
University with a Difference

Diploma in Mechanical Engineering

LJ Polytechnic

Subject Code:025060202 Fundamentals of Electrical and Electronics Engineering

Programme / Branch Name	Diploma in Mechanical Engineering					
Course Name	Fundamentals of Electrical and Electronics Engineering				**Course Code**	025060202
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. TEACHING AND EVALUATION SCHEME

Teaching Hours / Week / Credits				Evaluation Scheme			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**Total Marks**
3	0	2	4	50	50	50	150

Legends: L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. PREREQUISITE

- ✓ Physics and Mathematics (Pre-university level)
- ✓ Measure basic electrical quantities/parameters
- ✓ Use major electrical/electronic machines//instrument/equipment

3. RATIONALE

This subject provides an exceptional appearance to the entire extent of topics like Electricity Fundamentals, Network Theory, Electro-magnetism, Electrical Machines, Transformers, Measuring Instruments, Power Systems, Semiconductor Devices, Digital Electronics, and Integrated Circuits. With the help of this subject, the students will learn the fundamentals of Electrical engineering and Electronic engineering. Also, they will go to experience the Practical implementation of fundamental theory concepts along with the learning process of different applications of generally used electrical machinery.

4. OBJECTIVES

- ✓ Impart a basic knowledge of electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and societal context.
- ✓ Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
- ✓ To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.
- ✓ Highlight the importance of transformers in the transmission and distribution of electric power.
- ✓ This course provides the student with the fundamental skills to understand the basic of semiconductor and components like a diode, transistor
- ✓ It will build mathematical and numerical background for the design of electronics circuits & component value.

5. CONTENTS

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1	**Electronic and Electric Components, Signals**	1.1. Basic of Electronics and Electrical Devices 1.2. Active Components: Voltage and Current Source 1.3. Passive Components: Resistor, Capacitor, Inductor. 1.4. Symbols of Various Electronic and Electrical Components 1.5. Series and Parallel Resistor, Capacitor and Inductor Circuits 1.6. Definitions Of: Amplitude, Frequency, Phase, Wavelength 1.7. Definitions Of: Signal, Waveform, Spectrum, Time and Frequency Domain Representation 1.8. Test Signals: Unit Step, Unit Impulse, And Unit Ramp 1.9. Types of Signals: Sinusoidal, Triangular, and Saw Tooth, Square	• State the Difference Between Active and Passive Electronic Components • Know About Semiconductor and Its Types • State Different Terminologies Used in Signal. • Explain the Signal Parameters and Its Types	20	10
2	**Electric And Magnetic Circuits**	2.1. Concepts of EMF, Current, Potential Difference, work, Power and Energy 2.2. Define terms M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor, etc. 2.3. Comparison of magnetic and electric circuit 2.4. Faraday's laws of electromagnetic induction 2.5. Dynamically induced emf. Statically induced EMF. -(a) Self-induced EMF (b) Mutually induced emf 2.6. Equations of self & mutual inductance	• Explain Concepts of Electric Parameters. • Determine Current, Voltage And Resistance in An Electric Circuit Using Ohm's Law. • Explain the Terms Related to Electric and Magnetic Circuits • Apply Faraday's Laws • Differentiate Statically And • Dynamically Induced EMF	20	8

3	**A.C. Circuits**	3.1. A.C. circuit parameter: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, current, RMS value, Average value, Form Factor & Peak Factor, impedance, phase angle, and power factor. 3.2. Vector representation of emf and current. Mathematical representation of an alternating emf and current 3.3. Power in A. C. Circuits. Concept of the power triangle 3.4. Voltage and Current relationship in Star and Delta connections 3.5. A.C. through R-L series, R-C series, and R-LC series & parallel circuit	• Explain the Various Basic Parameters of AC Fundamentals • Derive the Relationship Current and Voltage in Star and Delta Connection.	20	8
4	**Transformer and Electrical Machines**	4.1. Transformer Types: Core and Shell Type. 4.2. General Construction of Different Types of Transformer, Emf Equation, and Transformation Ratio 4.3. Auto Transformer 4.4. Types of DC Generator, EMF Equation, Application 4.5. Types of DC Motor, Back Emf, Torque Equation and Applications of Dc Motor with Sketches Diagram 4.6. Types: Single Phase and Three Phase Induction Motor- Specification, construction, working and starting method, connection diagram, and application	• Explain Working Principle and Schematic Line Diagram of Single-Phase Transformer • Explain Working of Autotransformer with Its Sketches • Construction and Working Principle of Dc Machine (Generator) • Working Principle of DC Motor • Working Principle of Ac Motors	20	8

5	**Semiconductor Devices and Its Applications**	5.1. P-N Junction Diode Working 5.2. Zener Diode, Zener Diode as Voltage 5.3. Transistor – Types NPN and PNP 5.4. Working of Transistor, Configuration of Transistor, Transistor as a Switch 5.5. Oscillator: Working Principle, Amplifier with Positive Feedback as Oscillator 5.6. Damped and Sustained Oscillator 5.7. Requirement and Uses of Oscillator	• Describe the Working and Applications Of P-N Junction Diode. • Describe the Working and Applications of Zener Diode • Transistor - PNP and NPN, Configuration Types • Oscillation Concept, Working, Types, and Applications	20	8
				Total Hours	42

6. LIST OF PRACTICAL / EXERCISE

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills so that students can acquire the competencies/Programme outcomes. Following is the list of practical exercises for guidance.

Sr. No	Practical / Exercises	Key Competency	Hours
1	To verify the relationship between electric current and potential difference.	Voltage, current, and resistance relation	2
2	Use a digital multimeter for the measurement of voltage, resistance, and current.	Uses of multimeter	2
3	Study of different electronics components	Types of Components	2
4	To measure voltage, current & power in the 1-phase circuit. (with resistive load)	Different types of load	2
5	Operate all controls of the CRO front panel.	CRO working	2
6	Study and use of Oscilloscope, the signal generator to view waveforms and measure amplitude and frequency.	Operating of CRO	2
7	Measure the voltage and frequency of any given signal using an oscilloscope.	Operating of CRO	2
8	Measure parameters of various signals	Operating of CRO	2
9	Identify, find value and test different types of resistors.	Resistor colour code	2
10	Identify, find value and test different types of capacitors.	Capacitor colour code, types	2
11	Identify, find value and test different types of Inductors.	Inductor coding, types	2
12	Measure voltage, current, and power in the R-L series circuit.	RLC series circuit	2
13	Study the AC circuit with resistor, inductor, and capacitor at a constant frequency.	Types and terminal of components	2

14	To study the different parts of DC Machines.	DC machine construction	2
15	Connect the 1-phase transformer and measure input & output quantities.	1-Phase transformer working	2
16	Study the electric Earthing circuit in the institution.	Earthing and its types	2
17	Identify switches, switch fuse and fuse switch units, MCB, MCCB & ELCB.	Short circuit protection devices	2
19	To study p-n junction in forwarding bias	Working of PN diode	2
		Total Hours	38

7. SUGGESTED SPECIFICATION TABLE FOR EVALUATION SCHEME

Unit No.	Unit Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Electronic and Electric Components, Signals	10	20	40	20	0	10	10
2	A.C. Circuits	8	20	40	15	10	10	5
3	Transformer and Electrical Machines	8	20	25	20	10	10	15
4	Electric and Magnetic Circuits	9	20	30	15	10	10	15
5	Semiconductor Devices and Its Applications	9	30	30	10	0	20	10

Legends: R - Remembering; U - Understanding; App – Applying; C – Creating; E- Evaluating; An- Analyzing

8. TEXTBOOKS

1) Electrical Technology by, B. L Theraja, A. K. Theraja, S CHAND Volume 1 and Volume 2.
2) Electronic Devices and Circuit Theory by, Robert L. Boylestad, Pearson, latest edition

9. REFERENCE BOOKS

1) Electrical Machine by Bhattacharya S.K, Tata McGraw Hill; New Delhi, 2010
2) Basic electronics by V. K. Mehta, S. Chand Publication

10. OPEN SOURCES (Website, Video, Movie)

1) http://www.animations.physics.unsw.edu.au//jw/AC.html
2) http://en.wikipedia.org/wiki/Transformer
3) http://www.alpharubicon.com/altenergy/understandingAC.htm