Lok Jagruti Kendra University
University with a Difference

Diploma in Electrical Engineering

LJ Polytechnic

Course Code: 025070301

Electrical Circuits

Programme/ Branch Name	Diploma in Electrical Engineering					
Course Name	Electrical Circuits				**Course Code**	025070301
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

Most of electrical power generation, transmission, distribution and utilization are in the form of alternating current or DC current. Therefore it is essential for every electrical engineer to know the behavior of resistance, capacitance, inductance and related concepts in electrical systems. This course is not only a prerequisite to learn the advanced electrical courses and develop the skills but also enable the students to apply the principle of electrical circuits to troubleshoot electrical circuits in industries/Power System. This is one of the most important core engineering courses for electrical engineers and hence students should try to develop mastery over concepts of Electrical circuits for effective working as an electrical engineer.

4. Objectives

- ✓ The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency:
  - Apply the principles of AC circuits to maintain electrical systems.
  - It will build mathematical and numerical background for the design of electrical circuit & component value.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcomes	% Weightage	Hours
1	**Basics Circuit Analysis and Network Reduction Technique**	1.1. Network Terminology, Energy Sources 1.2. Ohm's law, Analysis of Series Circuits, Analysis of Parallel Circuits. 1.3. Short and Open Circuits, Voltage Division in Series Circuit of Resistors, Current Division of Parallel, Source Transformation Circuit of Resistors 1.4. Combinations of Sources, Kirchhoff's Laws, Cramer's Rule, Ac Fundamentals, Phasor Representation of an Alternating Quantity, Concept of Phase of an Alternating Quantity, Multiplication and Division of Phasors, Impedance, Power Factor, Power, Series R-L-C Circuit, A c Parallel Circuit, Star and Delta Connection of Resistances	• Classification of Electrical Networks • Linear Passive Parameters (R, Land C) • Voltage Division in Series Circuit of Resistors. • Ac Fundamentals. • Mathematical Representation of Phasor.	30	13
2	**Network Analysis and Theorem**	2.1. Loop Analysis or Mesh Analysis 2.2. Node Analysis 2.3. Superposition Theorem 2.4. Thevenin's Theorem 2.5. Norton's Theorem 2.6. Maximum Power Transfer Theorem 2.7. Reciprocity Theorem	• Supermesh • Supernode • Proof of Maximum Power Transfer Theorem • Proof of Reciprocity Theorem	15	7
3	**Resonance**	3.1. Q-factor or Figure of Merit 3.2. Series Resonance 3.3. Parallel Resonance	• Reactance curves, Variation of Impedance, Admittance and Current with Frequency, Q-factor of Series	15	7

			• The Impedance of Parallel Resonant Circuit near Resonance, Effect of Generator Resistance on Bandwidth and Selectivity		
4	**Coupled Circuit**	4.1. Magnetically Coupled Circuit 4.2. Dot Conventions 4.3. Inductive Coupling in Series 4.4. Inductive Coupling in Parallel 4.5. Energy in a Pair of Coupled Coils 4.6. Conductively Coupled Equivalent Circuit 4.7. Linear Transformer 4.8. Ideal Transformer	• Self Inductance, Mutual Inductance, Coefficient of Coupling or Magnetic Coupling Coefficient (k) • Series Aiding, Series Opposing • Parallel Aiding, Parallel Opposing • Single Tuned Circuit, Double Tuned Circuit	15	7
5	**Analysis of Three Phase Circuit**	5.1. Advantages of Three Phase System 5.2. Generation of Three Phase Voltage System 5.3. Important Definitions Related to Three Phase System 5.4. Three Phase Supply Connections 5.5. Concept of Line Voltages and Line Currents 5.6. Concept of Phase Voltages and Phase Currents 5.7. Relations for Star Connected Load 5.8. Relations for Delta Connected Load 5.9. Power Triangle for Three Phase Load	• Star Connection, Delta Connection • Balanced Load • Unbalanced Three Wire Star Connected Load • Unbalanced Four Wire Star Connected Load • Unbalanced Delta Connected Load	25	9
				Total Hours	**20**

6. List of Practicals / Exercises

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 measure voltage, current in a given linear circuit.	Linear Circuit	2
2	To Connect resistance in series to get required effective resistance and verify.	Resistance In Series	2
3	To connect resistance in parallel to get required effective resistance and verify.	Resistance In Parallel	2
4	To connect resistance in parallel and series to get required effective resistance and verify.	Resistance In Parallel And Series	2
5	To measure Current In Particular Branch Of Given Electrical Circuit Using Kirchhoff's Current Law.	Kirchhoff's Current Law.	2
6	To measure voltage drop in a close loop of the given electric circuit using Kirchhoff's voltage low.	Kirchhoff's Voltage Low	2
7	To measure current in particular branch of a given electric circuit having two input sources using superposition theorem.	Superposition Theorem.	2
8	To measure active power through resistor	Active Power	2
9	To measure voltage, current, power and power factor in RLC series circuit	RLC Series Circuit	2
10	To test voltage and current relation for 3 phase star and delta connection.	Star And Delta Connection	2
		Total Hours	**56**

7. Suggested Specification Table with Hours

Unit No.	Chapter Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Basics Circuit Analysis and Network Reduction Technique	13	20	20	20	10	10	20
2	Network Analysis and Theorem	7	10	30	20	10	10	20
3	Resonance	7	20	20	20	15	10	5
4	Coupled Circuit	7	20	20	15	20	10	15
5	Analysis of Three Phase Circuit	9	20	20	20	0	10	30

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

8. Textbooks

1) Circuit Theory-by-U.A. Bakshi and A.V. Bakshi, Technical Publication, latest edition
2) A Textbook of Electrical Technology Volume-I In SI Unit, S.Chand Publication latest edition

9. Reference Books

1) Circuit Theory-by-U.A. Bakshi and A.V. Bakshi, Technical Publication, latest edition
2) A Textbook of Electrical Technology Volume-I In SI Unit, S.Chand Publication latest edition

10. Open Sources (Website, Video, Movie)

1) https://www.electrical4u.com/
2) https://circuitglobe.com/what-is-an-ac-circuit.html
3) https://circuitglobe.com/dc-circuit.html