LOK JAGRUTI UNIVERSITY (LJU)

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication (707)

Bachelor of Engineering (B.E.) – Semester – I

Course Code:	**017072101**
Course Name:	**Basic Electrical Engineering**
Category of Course:	Engineering Science Course (ESC)
Prerequisite Course:	---

Teaching Scheme				
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**Total Hours**
3	**0**	**2**	**4**	**30**

Syllabus

Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	**DC Circuits**			**3 (10%)**
	1.1 Electrical circuit elements (R, L and C), Voltage and current Sources	---	Circuit Elements (017073301– Unit-1.1) Ideal and Practical Energy Source (017073301– Unit-1.2)	
	1.2 Ohm's law, Series and parallel resistive circuit with voltage & current divider rules	---	---	
	1.3 Kirchhoff's current and voltage laws	Ohm's Law (017072101-Unit-1.2)		
	1.4 Charging and discharging of capacitor	Ohm's Law (017072101-Unit-1.2), KVL-KCL (017072101-Unit-1.3)	First Order Differential Equations (017073301– Unit-4.1)	
02	Network Theorems			**3 (10%)**
	2.1 Thevenin and Norton Theorems	Ohm's Law (017072101-Unit-1.2), KVL-KCL (017072101-Unit-1.3)	Thevenin Theorem (017073301– Unit-3.1) Norton Theorem (017073301– Unit-3.2)	
	2.2 Superposition Theorem and Source Transformation	Ohm's Law (017072101-Unit-1.2), KVL-KCL (017072101-Unit-1.3)	Superposition Theorem (017073301– Unit-3.3)	
	2.3 Nodal and Mesh Analysis	Ohm's Law (017072101-Unit-1.2), KVL-KCL (017072101-Unit-1.3)	Mesh and Supermesh Analysis of Resistive Circuit with Independent and Dependent Electrical Sources (017073301– Unit-2.1)	
03	**Single Phase AC Circuits**			**3 (10%)**
	3.1 Generation of Single Phase, Representation of Sinusoidal Waveforms	---	---	
	3.2 RMS, Average Values and Peak Values, Form Factor and Peak Factor	---	---	
	3.3 Phasor Representation of AC Quantities	Generation of Single Phase (017072101-Unit-3.1)	---	
04	**Analysis of Single-Phase AC Circuits**			**3 (10%)**
	4.1 Analysis of Single-Phase AC Circuits consisting of R, L and C with Power Measurement	Ohm's Law (017072101-Unit-1.2), KVL-KCL (017072101-Unit-1.3)	---	
	4.2 Analysis of Single-Phase Series AC Circuits consisting of RL, RC and RLC with Power Measurement	Ohm's Law (017072101-Unit-1.2), KVL-KCL (017072101-Unit-1.3)	---	
	4.3 Series RLC AC Circuit at Resonance	Analysis of Single-Phase Series RLC Circuit (017072101-Unit-4.2)	---	
05	**Three Phase AC Circuits**			**3 (10%)**
	5.1 Voltage and Current Relations in 'STAR' Three Phase AC Circuit , Generation of three phase E.M.F	---	---	
	5.2 Voltage and Current Relations in 'DELTA' Three Phase AC Circuit	Three Phase 'STAR'AC Circuit (017072101-Unit-5.1)	---	
	5.3 Power Measurements in Three Phase AC Circuits	Three Phase 'STAR'AC Circuit (017072101-Unit-5.1)	---	
06	**Transformers**			**3 (10%)**
	6.1 Faraday's Law of Electromagnetic Induction	---	---	
	6.2 Construction of transformer, Types, Working Principle of Transformer Operations, E.M.F equation	Faraday's Law (017072101-Unit-6.1)	---	
	6.3 Single Phase Step-Up and Step-Down Transformers	Working Principle of Transformer Operations (017072101-Unit-6.2)	---	
	6.4 Three Phase Transformers	---	---	

07	**Electrical Machines**			**3 (10%)**
	7.1 Three Phase Induction Motor, Generation of Rotating magnetic field	Faraday's Law (017072101-Unit-6.1)	---	
	7.2 Single Phase Induction Motor	Faraday's Law (017072101-Unit-6.1)	---	
	7.3 DC Motors-Construction, Working & Types	Faraday's Law (017072101-Unit-6.1)	---	
08	**Electrical Wiring**			**3 (10%)**
	8.1 Types of Wires	---	---	
	8.2 System of wiring-Domestic and industrial wiring	---	---	
	8.3 Simple control circuit in domestic installation	---	---	
09	**Safety and Protection**			**3 (10%)**
	9.1 Electric shock and first aid for electric shock and safety rules	---	---	
	9.2 Circuit Breaker: Fuses, MCB and ELCB	---	---	
	9.3 Earthing – Types of Earthing and its Importance	---	---	
	9.4 Elementary Calculations for Energy Consumption	---	---	
10	**Batteries, Cables and Switches**			**3 (10%)**
	10.1 Types of Batteries, Charging & Discharging of Battery	---	---	
	10.2 Types of Cables & Application	---	---	
	10.3 Types of Switches: Single Pole Single Throw Switch (SPST) Single Pole Double Throw Switch (SPDT) Double Pole Single Throw Switch (DPST) Double Pole Double Throw Switch (DPDT)	---	---	

Sr No.	Practical Title	Link to Theory Syllabus
1	Verify KVL and KCL using Development kit.	Unit-1
2	To verify the Thevenin Theorem	Unit-2
3	To verify the Superposition Theorem	Unit-2
4	Measurement of the electric power in a single-phase AC Resistive Circuit.	Unit-4,5
5	To obtain power & power factor of single-phase R – L Series circuits	Unit-4,5
6	To obtain power & power factor of single-phase R – C Series circuits	Unit-4,5
7	To obtain power & power factor of single-phase R – L - C Series circuits	Unit-4,5
8	To practice wiring connection of staircase	Unit-8
9	To demonstrate working operation of ELCB and MCB	Unit-9

Major Components/ Equipment

Sr. No.	Component/Equipment
1	DC Network Development Kit, Voltmeter, Ammeter, Connecting Wires
2	DC Network Development Kit, Voltmeter, Ammeter, Connecting Wires
3	DC Network Development Kit, Voltmeter, Ammeter, Connecting Wires
4	Ammeter (0-5 amp), Voltmeter (0-300 volt), Wattmeter (5-amp, 300-volt, 1500 watt), Multimeter, Lamp-bank (non-inductive resistance) (230V, amp), Single-phase variac
5	Ammeter (0-5 amp), Voltmeter (0-300 volt), Wattmeter (5-amp, 300-volt, 1500 watt), Multimeter, Inductive coil (50 Hz, 5 amp), Lamp-bank (non-inductive resistance) (230V,5 amp), Single-phase variac
6	Ammeter (0-5 amp), Voltmeter (0-300 volt), Wattmeter (5-amp, 300-volt, 1500 watt), Multimeter, Single-phase variac, Lamp-bank (non-inductive resistance) (230V, amp), Capacitor bank
7	Ammeter (0-5 amp), Voltmeter (0-300 volt), Wattmeter (5-amp, 300-volt, 1500 watt), Multimeter, Single-phase variac, Lamp-bank (non-inductive resistance) (230V, amp), Choke coil, Capacitor bank
8	Experimental Board, Connecting wires
9	MCB (0-6 A), ELCB (30 mA- 32 A), Ammeter (0-20 A and 0-50 mA)

Proposed Theory + Practical Evaluation Scheme by Academicians
(% Weightage Category Wise and it's Marks Distribution)

L :	3	T:	0	P:	2

Note : In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.
Each Test will be of 25 Marks.
Each Test Syllabus Weightage: Range should be 20% - 30%

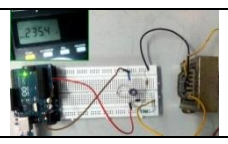
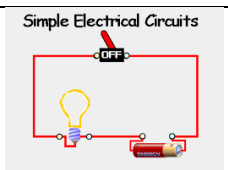
Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage
Theory	3	4	MCQ	30%	40
Theory			Theory Descriptive	8%	10
Theory			Formulas and Derivation	11%	15
Theory			Numerical	26%	35
Expected Theory %	**75%**		**Calculated Theory %**	**75%**	**100**
Practical	1		Individual Project	0%	0
Practical			Group Project	9%	35
Practical			Internal Practical Evaluation (IPE)	16%	65
Practical			Viva	0%	0
Practical			Seminar	0%	0
Expected Practical %	**25%**		**Calculated Practical %**	**25%**	**100**
Overall %	**100%**			**100%**	**200**

Course Outcome	
	Upon completion of the course students will be able to
CO1	Apply fundamental electrical laws and circuit theorems to electrical circuits.
CO2	Analyze single phase AC circuits.
CO3	Analyze three phase AC circuits and describe operating principle and applications of static and rotating electrical machines.
CO4	Comprehend electrical installations, their protection and personnel safety. Also, get an insight about the basic introduction of Batteries, Electrical Switches and Connectors.

Suggested Reference Books	
1	B. L. Theraja, 'A Textbook of Electrical Technology', S. Chand Publication-Volume I
2	J.B. Gupta, Basic Electrical Engineering, Kataria & Sons -Volume I
3	Charles Alexander and Matthew Sadiku, "Fundamentals of Electric Circuits", McGraw Hill
4	Edward Hughes, Harlow, "electrical & electronic technology", Pearson Education Limited
5	K.A. Krishnamurthy and M.R. Raghuveer, Electrical and Electronics Engineering for Scientists, Wiley Eastern Ltd.
6	U. A. Patel, '*Elements of Electrical Engineering*', Atul Prakashan.
7	V. N. Mittal and A. Mittal ,"Basic Electrical Engineering", Tata McGraw Hill (2012)

List of Open Source Software/Learning website	
1	http://nptel.ac.in
2	https://www.allaboutcircuits.com
3	https://www.electrical4u.com

Practical Project/Hands on Project

Sr. No.	Project List	Linked with Unit
1	Case Study: Verify KVL and KCL for a given premises.	Unit 01,02
2	Identify the values of various Passive Components (R, L & C) for the given Circuit Board	Unit 01,02
3	AC Voltage Measuring Device using Arduino. 	Unit 04
4	Calculation of a Number of turns and voltage level for a given center tapped Transformer.	Unit 06
5	Design Simple Electrical Circuit To ON/OFF Blub Using Switch. (One Way & Two Way). 	Unit 10
6	Make automatic LED based emergency light in car using general purpose circuit board.	All unit
7	Design automatic ignition electric circuit using bread board.	All unit
8	Electrical Safety Case Study #1	Unit 08

A 30-year-old male electrical technician was helping a company service representative test the voltage-regulating unit on a new rolling mill. While the electrical technician went to get the equipment service manual, the service representative opened the panel cover of the voltage regulator's control cabinet in preparation to trace the low-voltage (120 V) wiring in question (the wiring was not color-coded). The service representative was not using PPE.
The service representative climbed onto a nearby cabinet in order to view the wires. The technician returned and began working inside the control cabinet, near exposed, energized electrical conductors. The technician tugged at the low-voltage wires while the service representative tried to identify them from above. Suddenly, the representative heard the victim making a gurgling sound and looked down to see the victim shaking as though he were being shocked. Cardiopulmonary resuscitation (CPR) was administered to the victim about 10 minutes later. He was pronounced dead almost 2 hours later as a result of his contact with an energized electrical conductor.

Worker was performing testing on the circuit without PPE.
What should have been done before the cover was removed?

1) List the procedures and steps that should have implemented to prevent this accident.
2) What personal protective equipment should have been used?