

**LOK JAGRUTI UNIVERSITY (LJU)**  
**INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**Department of Mechanical Engineering (710)**

**Bachelor of Engineering (B.E.) – Semester – II**

<b>Course Code:</b>	<b>017102292</b>
<b>Course Name:</b>	<b>Electrical and Electronics Engineering</b>
<b>Category of Course:</b>	Engineering Science Course (ESC)
<b>Prerequisite Course:</b>	---

<b>Teaching Scheme</b>				
<b>Lecture (L)</b>	<b>Tutorial (T)</b>	<b>Practical (P)</b>	<b>Credit</b>	<b>Total Hours</b>
<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>30</b>

<b>Syllabus</b>				
<b>Unit No.</b>	<b>Topic</b>	<b>Prerequisite Topic</b>	<b>Successive Topic</b>	<b>Teaching Hours</b>
<b>01</b>	<b>DC Circuits</b>			<b>3 (10%)</b>
	1.1 Electrical circuit elements (R, L and C), Voltage and current Sources	---	Electrical analogy and overall heat transfer coefficient (017103591 - Unit-2.3), Electrical analogy to simple problems and radiation shield (017103591 - Unit-8.4)	
	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 (017102292-Unit-1.2)	---	
	1.4 Charging and discharging of capacitor	Ohm's Law (017102292-Unit-1.2), KVL-KCL (017102292-Unit-1.3)	---	
<b>02</b>	<b>Network Theorems</b>			<b>3 (10%)</b>
	2.1 Thevenin and Norton Theorems	Ohm's Law (017102292-Unit-1.2), KVL-KCL (017102292-Unit-1.3)	---	
	2.2 Superposition Theorem and Source Transformation	Ohm's Law (017102292-Unit-1.2), KVL-KCL (017102292-Unit-1.3)	---	
	2.3 Nodal and Mesh Analysis	Ohm's Law (017102292-Unit-1.2), KVL-KCL (017102292-Unit-1.3)	---	
<b>03</b>	<b>Single Phase AC Circuits</b>			<b>3 (10%)</b>
	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 (017102292-Unit-3.1)	---	
<b>04</b>	<b>Analysis of Single-Phase AC Circuits</b>			<b>3 (10%)</b>
	4.1 Analysis of Single-Phase AC Circuits consisting of R, L and C with Power Measurement	Ohm's Law (017102292-Unit-1.2), KVL-KCL (017102292-Unit-1.3)	---	
	4.2 Analysis of Single-Phase Series AC Circuits consisting of RL, RC and RLC with Power Measurement	Ohm's Law (017102292-Unit-1.2), KVL-KCL (017102292-Unit-1.3)	---	
	4.3 Series RLC AC Circuit at Resonance	Analysis of Single-Phase Series RLC Circuit (017102292-Unit-4.2)	---	
<b>05</b>	<b>Three Phase AC Circuits</b>			<b>3 (10%)</b>
	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 (017102292-Unit-5.1)	---	
	5.3 Power Measurements in Three Phase AC Circuits	Three Phase 'STAR' AC Circuit (017102292-Unit-5.1)	---	
<b>06</b>	<b>Transformers</b>			<b>3 (10%)</b>
	6.1 Faraday's Law of Electromagnetic Induction	---	---	
	6.2 Working Principle of Transformer Operations (including Construction of transformer, Types, E.M.F equation)	Faraday's Law (017102292-Unit-6.1)	---	

	6.3 Single Phase Step-Up and Step-Down Transformers	Working Principle of Transformer Operations (017102292-Unit-6.2)	---	
	6.4 Three Phase Transformers	---	---	
	<b>Electrical Machines</b>			
07	7.1 Three Phase Induction Motor (Generation of Rotating magnetic field)	Faraday's Law (017102292-Unit-6.1)	Welding arc and power source characteristics (017103401 – Unit-6.3), Carbon arc welding (017103401 – Unit-6.4), Shielded metal arc welding (017103401 – Unit-6.5), Tungsten inert gas welding (017103401 – Unit-6.6), Metal inert gas welding 017103401 – Unit-6.7), Submerged arc welding (017103401 – Unit-6.8), Types of Resistance welding processes (017103401 – Unit-7.1), Merit, demerits and applications of resistance welding processes(017103401 – Unit-7.2), Numerical related to Spot welding(017103401 – Unit-7.3), Types of Solid State welding processes(017103401 – Unit-7.4), Types of Thermochemical welding processes (017103401 – Unit-7.5)	3 (10%)
	7.2 Single Phase Induction Motor	Faraday's Law (017102292-Unit-6.1)		
	7.3 DC Motors (Construction, Working & Types)	Faraday's Law (017102292-Unit-6.1)		
	<b>Electrical Wiring</b>			
08	8.1 Types of wires and cables	---	---	3 (10%)
	8.2 System of wiring-Domestic and industrial wiring	---	---	
	8.3 Simple control circuit in domestic installation	---	---	
	<b>Safety and Protection</b>			
09	9.1 Electric shock and first aid for electric shock and safety rules	---	---	3 (10%)
	9.2 Circuit Breaker: Fuses, MCB and ELCB	---	---	
	9.3 Earthing – Types of Earthing and its Importance	---	Welding arc and power source characteristics (017103401 – Unit-6.3), Carbon arc welding (017103401 – Unit-6.4), Shielded metal arc welding (017103401 – Unit-6.5), Tungsten inert gas welding (017103401 – Unit-6.6), Metal inert gas welding 017103401 – Unit-6.7), Submerged arc welding (017103401 – Unit-6.8), Types of Resistance welding processes (017103401 – Unit-7.1), Merit, demerits and applications of resistance welding processes(017103401 – Unit-7.2), Numerical related to Spot welding(017103401 – Unit-7.3), Types of Solid State welding processes(017103401 – Unit-7.4), Types of Thermochemical welding processes (017103401 – Unit-7.5)	
	9.4 Elementary Calculations for Energy Consumption	---	---	
	<b>Analog and Digital Circuits</b>			
10	10.1 Diode and Rectifiers	--	---	3 (10%)
	10.2 Digital logic gates	---	---	
	10.3 Analog to Digital conversion (ADC), Digital to Analog conversion (DAC)	---	---	

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
10	To plot input and output waveforms of the Half Wave Rectifier.	Unit-10

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)
10	Trainer Kit, DC Power Supply, Function Generator, Connecting Wires, DSO.

Proposed Theory + Practical Evaluation Scheme by Academicians (% Weightage Category Wise and it's Marks Distribution)						
<b>L :</b>	<b>3</b>	<b>T:</b>	<b>0</b>	<b>P:</b>	<b>2</b>	
<b>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%</b>						
Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage	
Theory	<b>3</b>	<b>4</b>	MCQ	30%	40	
Theory			Theory Descriptive	8%	10	
Theory			Formulas and Derivation	11%	15	
Theory			Numerical	26%	35	
<b>Expected Theory %</b>	<b>75%</b>			<b>Calculated Theory %</b>	<b>75%</b>	<b>100</b>
Practical	<b>1</b>		Individual Project	0%	0	
Practical			Group Project	9%	35	
Practical			Internal Practical Evaluation (IPE)	16%	65	
Practical			Viva	0%	0	
Practical			Seminar	0%	0	
<b>Expected Practical %</b>	<b>25%</b>		<b>Calculated Practical %</b>	<b>25%</b>	<b>100</b>	
<b>Overall %</b>	<b>100%</b>			<b>100%</b>	<b>200</b>	

Course Outcome	
	<i>Upon completion of the course students will be able to</i>
1	Apply fundamental electrical laws and circuit theorems to electrical circuits.
2	Analyze single phase AC circuits.
3	Analyze three phase AC circuits and describe operating principle and applications of static and rotating electrical machines.
4	Comprehend electrical installations, their protection and personnel safety. Also, get an insight about the basic introduction of digital electronics.
Suggested Reference Books	
1	“A Textbook of Electrical Technology”, B. L. Theraja, S. Chand Publication-Volume I
2	“Basic Electrical Engineering”, J.B. Gupta, Kataria & Sons-Volume I
3	“Fundamentals of Electric Circuits”, Charles Alexander and Matthew Sadiku, McGraw Hill
4	“Hughes electrical & electronic technology “, Edward Hughes, Harlow, Pearson Education Limited
5	‘Electrical and Electronics Engineering for Scientists “, K.A. Krishnamurthy and M.R. Raghuvver, Wiley Eastern Ltd.
6	“A Textbook of Electrical Technology”, B. L. Theraja, S. Chand Publication-Volume II
7	“A Course in Electrical Technology”, J.B. Gupta, Kataria & Sons-Volume II
8	“Elements of Electrical & Electronics Engineering “, U.A.Patel, Atul Prakashan

List of Open Source Software/Learning website	
1	<a href="http://nptel.ac.in">http://nptel.ac.in</a>
2	<a href="http://www.electrical4u.com/nature-of-electricity/">http://www.electrical4u.com/nature-of-electricity/</a>
3	<a href="http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/">http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/</a>

Practical Project/Hands on Project		
Sr. No.	Project List	Linked with Unit
1	Design automatic ignition electric circuit using bread board.	Unit 01
2	Make automatic LED based emergency light in car using general purpose circuit board.	Unit 01,02
3	Design AC to DC convertor using bridge rectifier on general purpose circuit board.	Unit 03, 04, 10
4	Make battery charger for electrical vehicle using general purpose circuit board.	Unit 06
5	Design robotic arm using stepper motor and realize circuit design using general purpose circuit board.	Unit 07
6	Calculate power consumption (KWH) and generate electric bill in INR ₹ at your own home. Calculate number of home appliances with their power rating (KW) and average time (hours) utilization.	Unit 09
7	Make vehicle head light and side light control using ADC on bread board/general purpose circuit board.	Unit 10

