Department of Civil Engineering (709)

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

Course Code:	017092201				Teaching Scheme				
Course Name:	Basic Electrical Engineering				Lecture (L)	Tutorial (T)	Practical (P)	Credit	Total Hours
Category of Course:	Engineering Science Course (ESC)				4	0	2	5	40
Prerequisite Course:	---								

Syllabus				
Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	**DC Circuits**			4 (10%)
	1.1 Electrical circuit elements (R, L and C), Voltage and current Sources	---	---	
	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 (017092201-Unit-1.2)	---	
	1.4 Charging and discharging of capacitor	Ohm's Law (017092201-Unit-1.2), KVL-KCL (017092201-Unit-1.3)	---	
02	**Network Theorems**			4 (10%)
	2.1 Thevenin and Norton Theorems	Ohm's Law (017092201-Unit-1.2), KVL-KCL (017092201-Unit-1.3)	---	
	2.2 Superposition Theorem and Source Transformation	Ohm's Law (017092201-Unit-1.2), KVL-KCL (017092201-Unit-1.3)	---	
	2.3 Nodal and Mesh Analysis	Ohm's Law (017092201-Unit-1.2), KVL-KCL (017092201-Unit-1.3)	---	
03	**Single Phase AC Circuits**			4 (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 (017092201-Unit-3.1)	---	
04	**Analysis of Single-Phase AC Circuits**			4 (10%)
	4.1 Analysis of Single-Phase AC Circuits consisting of R, L and C with Power Measurement	Ohm's Law (017092201-Unit-1.2), KVL-KCL (017092201-Unit-1.3)	---	
	4.2 Analysis of Single-Phase Series AC Circuits consisting of RL, RC and RLC with Power Measurement	Ohm's Law (017092201-Unit-1.2), KVL-KCL (017092201-Unit-1.3)	---	
	4.3 Series RLC AC Circuit at Resonance	Analysis of Single-Phase Series RLC Circuit (017092201-Unit-4.2)	---	
05	**Three Phase AC Circuits**			4 (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 (017092201-Unit-5.1)	---	
	5.3 Power Measurements in Three Phase AC Circuits	Three Phase 'STAR'AC Circuit (017092201-Unit-5.1)	---	
06	**Transformers**			4 (10%)
	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 (017092201-Unit-6.1)	---	
	6.3 Single Phase Step-Up and Step-Down Transformers	Working Principle of Transformer Operations (017092201-Unit-6.2)	---	
	6.4 Three Phase Transformers	---	---	
07	**Electrical Machines**			4 (10%)
	7.1 Three Phase Induction Motor (Generation of Rotating magnetic field)	Faraday's Law (017092201-Unit-6.1)	---	
	7.2 Single Phase Induction Motor	Faraday's Law (017092201-Unit-6.1)	---	
	7.3 DC Motors (Construction, Working & Types)	Faraday's Law (017092201-Unit-6.1)	---	

08	**Electrical Wiring**			
			---	**4 (10%)**
	8.1 Types of wires and cables	---		
	8.2 System of wiring-Domestic and industrial wiring	---	---	
	8.3 Simple control circuit in domestic installation	---	---	
09	**Safety and Protection**			
	9.1 Electric shock and first aid for electric shock and safety rules	---		**4 (10%)**
	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	**Illumination**			
	10.1 Types of lamps	---		**4 (10%)**
	10.2 Illumination schemes for domestic, industrial and commercial premises	---		
	10.3 Lumen requirements for different categories	---		

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)

<table>
<tr><td colspan="8">Proposed Theory + Practical Evaluation Scheme by Academicians
(% Weightage Category Wise and it's Marks Distribution)</td></tr>
<tr><td colspan="2">L :</td><td>4</td><td>T:</td><td colspan="2">0</td><td>P:</td><td>2</td></tr>
<tr><td colspan="8">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%</td></tr>
</table>

Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage
Theory			MCQ	32%	40
Theory	4		Theory Descriptive	8%	10
Theory			Formulas and Derivation	12%	15
Theory			Numerical	28%	35
Expected Theory %	**80%**	5	**Calculated Theory %**	**80%**	**100**
Practical			Individual Project	0%	0
Practical			Group Project	7%	35
Practical	1		Internal Practical Evaluation (IPE)	13%	65
Practical			Viva	0%	0
Practical			Seminar	0%	0
Expected Practical %	**20%**		**Calculated Practical %**	**20%**	**100**
Overall %	**100%**			**100%**	**200**

Course Outcome

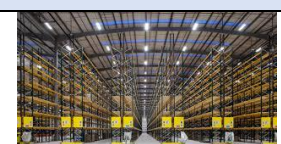|	Upon completion of the course students will be able to
CO1	Apply fundamental electrical laws and circuit theorems to electrical circuits.
CO2	Analyse single phase AC circuits.
CO3	Analyse three phase AC circuits and describe operating principle and applications of static and rotating electrical machines.
CO4	Understand the importance of safety and the precaution to be taken while working with electrical equipment's such as fuse, MCB, ELCB & Relays.

Suggested Reference Books

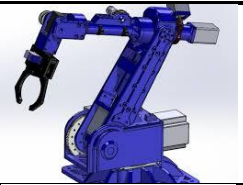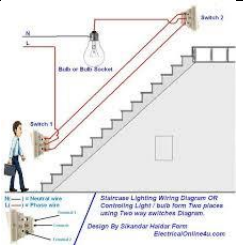|	
1	B. L. Theraja, '*Electrical Technology*', S. Chand Publication
2	J.B. Gupta, Basic Electrical Engineering, Kataria & Sons
3	"Fundamentals of Electric Circuits", McGraw Hill
4	"Electrical & Electronic Technology", Pearson Publishing
5	K.A. Krishnamurthy and M.R. Raghuveer, Electrical and Electronics Engineering for Scientists, Wiley Eastern Ltd.
6	B.L Theraja, Electrical Technology,S. Chand & Company
7	J.B Gupta, A Course in Electrical Power, S.K. Kataria & Sons
8	U. A. Patel, '*Elements of Electrical Engineering*', Atul Prakashan

List of Open Source Software/Learning website

1	http://nptel.ac.in
2	https://www.electronicshub.org/arm-tutorial/
3	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/

Practical Project/Hands on Project

Sr. No.	Project List		Linked with Unit
1	Make automatic LED based emergency light in warehouse using general purpose circuit board.		Unit 01,02
2	Design AC to DC convertor using Bridge Rectifier for Uninterrupted Power System (UPS) for intelligent Building Management System.		Unit 03, 04, 10
3	Make battery charger for Uninterrupted Power System (UPS) for intelligent Building Management System.		Unit 06

4	Design robotic arm using motor for replacement of civil manpower during construction of building.		Unit 07
5	Design control of one lamp by two switches for staircase at home.		Unit 08
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 mood light concept in smart home and building on bread board/general purpose circuit board.		Unit 10