Semester – II

Subject Name: AC. Circuit

Subject Code: 09EE2104

Diploma Branches in which this subject is offered: Electrical Engineering

Objective: This is one of the important subjects of electrical engineering. After studying this student should be understand the basic concept of A.C. circuits for highly effectively working as a skilled electrical engineer. This subject teach to students apply the principle of A.C. circuit; solve the problem of electrical industry and electric network. Basically electrical engineering dividedly power generation, transmission, distribution and utilization in form of A.C. so every electrical engineer should know basic concept of A.C. system. To solve the problem by using the knowledge of fundamental concept of series-parallel circuit and poly-phase circuits. To analyse and measure various type of powers in terms of power factor using watt meters.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, student will be able

1. To understand various parameters of AC circuit
2. To troubleshoot problems related to single phase AC series and parallel circuits.
3. To analyse series and parallel RLC circuit.
4. To analyse and understand single phase and three phase AC circuit.
5. To troubleshoot problem related three phase circuits.
6. To analyse and measure various type of powers and power factor.

Pre-requisite of course: Basic knowledge of physics and D.C. Circuits.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
2	2	2	5	50	30	20	25	25	150

Contents:

Unit	Topics	Contact hours	Weightage (%)
1	**Fundamentals of AC circuit** • Introduction • Advantage of AC system over DC system • Definition related to AC system • Generation of alternating EMF(Basic Alternator) • Equation and waveform of alternating EMF • RMS value, Mean value or Average value • Form factor, Peak factor or crest factor • Different form of alternating voltage and current • Pharos representation of alternating quantity • Phase of alternating quantity, Define: phase and phase difference • Addition and subtraction of alternating quantities • Mathematical representation of phasor • Mathematical operation of vector	06	22
2	**Analysis AC series circuit** • Introduction • Pure resistive, inductive and capacitive AC circuit and its voltage and current response. • AC circuit with series elements, R-L, R-C, L-C , R-L-C combination of AC series circuit • Impedance triangle, impedance, reactance, power triangle, active power, reactive power, apparent power, power factor and vector diagram of AC series circuit • Resonance circuit, bandwidth, quality factor in series circuit	08	28
3	**Analysis AC parallel circuit** • Introduction • Method of solving parallel circuit, Phasor algebra method, Admittance method, Complex algebra method • AC circuit with parallel elements, R-L, R-C, L-C , R-L-C combination of AC parallel circuit • Impedance triangle, impedance, reactance, power triangle, active power, reactive power, apparent power, power factor and vector diagram of AC parallel circuit • Resonance, bandwidth, quality factor in parallel circuit • Series-parallel circuit • Comparison between series and parallel resonance circuit	05	18

4	**Three phase AC circuits**	05	18
	• Introduction • Advantages of three phase system over single phase system • Generation of three phase EMF and its waveform • Phasor and complex representation of three phase supply • Term related to three phase AC system • Numbering of phase, phase sequence and polarity • Balance and unbalance load • Concept of line value and phase value • Types of three phase connection, phase and line quantity in three phase star and delta connection		
5	**AC power analysis**	04	14
	• Introduction • Complex power, power and power factor • Advantages of power factor improvement • Causes of low power factor • Disadvantages of low power factor • Various methods of improving power factor • Measurement of single phase power and three phase power, concept of maximum demand meter and tri-vector meter • Methods of measurement of power in three phase circuit, active, reactive and apparent		

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
40%	40%	10%	10%	0%	0%

Suggested List of Experiments:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	Use DSO to determine basic terminology of AC waveform.	2
2	1	Use electrical measuring instruments to measures various electrical parameters.	2
3	2	Determine inductance and resistance of inductive load and find active power flow through resistor.	2
4	2	Determine parameter of series R-L circuit, draw phasor diagram.	2
5	2	Determine parameter of series R-C circuit, draw phasor diagram.	2
6	2	Determine parameter of series R-L-C circuit, draw phasor diagram.	2
7	2	Use variable frequency supply to create resonance in given series R-L-C circuit.	2
8	3	Determine parameter of parallel R-L-C circuit, draw phasor diagram.	2
9	3	Use voltmeter, ammeter, wattmeter, power factor meter to determine voltage, current, power and power factor for RLC parallel circuit with series connection of resistor and inductor in parallel with capacitor.	2
10	3	Use variable frequency supply to create resonance in given parallel R-L-C circuit.	2
11	4	To measure phase and line quantity relationship in star and delta connection in a three phase system.	4
12	5	Determination of power in three phase balanced circuit using two watt meter and three watt meter method.	2
13	5	Determination of power in three phase unbalanced circuit using three watt meter method.	2

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

References:
1. B. L. Theraja, "*A Text Book of Electrical Technology Vol-I*", S. Chand & Co. Ltd., 2014
2. Tarlok Singh, "*Fundamental of Electrical Engineering*", S. K. Kataria & Sons, 2012
3. D.P. Kothari and I.J. Nagrath, "*Theory and Problem in Basic Electrical Engineering*", Prentice Hall India, 2012.
4. S.K. Sahdev, "*Fundamentals of Electrical Engineering & Electronics*", Dhanpat Rai & Co. LTD., 2014
5. U. A. Bakshi & V. U. Bakshi, "*Basic Electrical Engineering*", Technical Publication Pune, 2012
6. U. A. Patel, "*Elements of Electrical Engineering*", Atul Prakashan, 2016
7. R. Jadeja, T. Trivedi & A.Ved, "Elements of Electrical Engineering" Tata-McGraw-Hill, 2018
8. V.N. Mittal, "*Basic Electrical Engineering*". Tata-McGraw-Hill, 2nd edition, 2006.

Supplementary Resources:
1. http://nptel.ac.in/courses/108108076/
2. http://nptel.ac.in/downloads/108105053/
3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/
4. https://www.facstaff.bucknell.edu/mastascu/eLessonsHTML/EEIndex.html
5. http://www.electrical4u.com/nature-of-electricity/
6. http://vlab.amrita.edu/index.php