GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: AC CIRCUITS
(Code: 3330901)

Diploma Programme in which this course is offered	Semester in which offered
Electrical Engineering	Third Semester

1. RATIONALE

Most of electrical power generation, transmission, distribution and utilization are in the form of alternating current. Therefore knowledge of behaviour of resistance, capacitance and inductance in AC systems is must for every electrical engineer. AC circuit course will help the students to Explain concepts of advanced courses and develop the skills that are needed by the industries.

2. COMPETENCY

The course content should be taught and implemented 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 troubleshoot electrical circuits.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
03	02	02	7	70	30	20	30	

Legends: L - Lecture; **T -** Tutorial/Teacher Guided Student Activity; **P -** Practical; **C -** Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

Note: It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **AC Fundamentals**	1a.Explain generation of alternating EMF. 1b.Define various electrical parameters 1c. Explain vector representation and mathematical operations 1d.Calculate numerical based on AC quantity	1.1 Generation of alternating EMF. 1.2 Cycle, Time period, Frequency, Amplitude, Phase and Phase difference, Average value, R.M.S. value, Form factor, Peak Factor and Power Factor 1.3 Vector representation of alternating quantities 1.4 Addition, subtraction, multiplication and division of alternating vector quantities 1.5 Simple numerical based on AC fundamentals
Unit – II **AC Series circuits**	2a. Explain behaviour of AC voltage, current and power through pure resistance, pure inductance and pure capacitance. 2b.Explain behaviour of AC voltage, current and power through RL, RC and RLC series circuit. 2c. Explain resonance in RLC series circuit. 2d. Solve numerical based on AC series circuit.	2.1 AC through pure: Resistance, Inductance, Capacitance 2.2 AC through RL, RC, LC, RLC series circuit 2.3 Resonance in RLC series circuits 2.4 Numerical based on AC series circuits and series resonance.
Unit – III **AC Parallel circuits**	3a. Explain behaviour of AC voltage, current and power through RL, RC and RLC parallel circuit. 3b. Explain resonance in RLC parallel circuit. 3c. Solve numerical based on AC parallel circuit	3.1 Solution of AC RL, RC, LC and RLC parallel circuits using phasor method. 3.2 Solution of AC RL, RC, LC and RLC parallel circuits using admittance method. 3.3 Combination of AC series and parallel circuit 3.4 Resonance in parallel AC circuits 3.5 Numerical based on AC parallel circuits and parallel resonance.
Unit – IV **Poly phase circuits**	4a. Explain generation of three phase alternating voltage. 4b.Compare single phase and polyphase circuits. 4c. Explain three phase star and delta connection 4d. Explain concepts of line voltage, phase voltage, line current and phase currents in 3 phase AC star and delta connected circuits. 4e. Explain 6-phase AC circuit.	4.1 Generation of three phase alternating voltage. 4.2 Advantages and disadvantages of Poly phase circuits. 4.3 3 phase star connection 4.4 3 phase delta connection 4.5 Derive relationship between line voltage and phase voltage, line current and phase current in 3 phase star and delta connection. 4.6 Derive the equations of power in 3 phase star and delta connection. 4.7 Explain basic concepts of 6-phase circuits.

Unit	Major Learning Outcomes	Topics and Sub-topics
	4f. Solve numerical for poly phase circuit	4.8 Numerical for poly phase circuit
Unit – V Power in AC Circuits	5a.Explain concepts of active, reactive and apparent power as well as power factor with examples 5b. State the effects of power factor	5.1 Computation of active, reactive and apparent power using power triangle. 5.2 Illustration of lagging, leading and unity power factor 5.3 Illustration of effects of poor power factor.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	AC Fundamentals	10	06	06	04	16
II	AC Series circuits	10	06	06	06	18
III	AC Parallel circuits	08	04	05	05	14
IV	Poly phase circuits	08	05	05	04	14
V	Power in AC Circuits	06	04	02	02	08
Total		**42**	**25**	**24**	**21**	**70**

Legends: R = Remember; U = Explain; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency. Following is the list of experiments for guidance.

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	I	Use CRO to measure peak value, RMS value and frequency of alternating quantity.	2
2	II	Measure active power through resistor	2
3	II	Measure of inductance and resistance of choke coil	2
4	II	Measure voltage, current, power and power factor for RL series circuit to draw relevant phasor diagram.	2
5	II	Measure voltage, current, power and power factor for RC series circuit to draw relevant phasor diagram.	2
6	II	Measure voltage, current, power and power factor for RLC series circuit to draw relevant phasor diagram.	2
7	III	Measure voltage, current, power and power factor for RL parallel circuit to draw relevant phasor diagram.	2
8	III	Measure voltage, current, power and power factor for RC parallel circuit to draw relevant phasor diagram.	2
9	III	Measure voltage, current, power and power factor for RLC	2

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
		parallel circuit to draw relevant phasor diagram.	
10	III	Measure voltage, current, power and power factor for combined series-parallel circuits	4
11	III	Identify of electrical components (R, L, C) using high frequency generator.	2
12	IV	Test voltage and current relation for 3 phase star and delta connections.	2
13	V	Measure active and reactive power of poly phase circuits.	2
14	III	Measure resonance frequency and resonant impedance in RLC series circuit.	2
		Total	**30**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i. Preparing journals based on experiments performed in laboratory

ii. Assignments for solving numerical

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
1	Electrical Technology Vol-1	Theraja, B. L.	S. Chand, New Delhi, 2011
2	Principles of Electrical Engineering	Gupta, B. R.	S. K. Kataria & Sons, New Delhi, 2011
3	Basic Electrical Engineering	Rao, Uma. K.	Pearson Education, New Delhi, 2011
4	Basic Electrical Engineering	Murthy, R. S.	Pearson Education, New Delhi, 2011
5	A Course in Electrical Technology Vol. I	Gupta, J. B.	S. K. Kataria & Sons, New Delhi, 2011
6	Fundamentals of Electrical Engineering	Singh, Tarlok	S. K. Kataria & Sons, New Delhi, 2011
7	Basic Electrical and Electronics Engineering	Singh, Ravish. R.	Tata Mc Graw Hill Education Pvt.Ltd., New Delhi, 2011.

B. List of Major Equipment/Materials with Broad Specifications

i. Ammeter: 0A-1A/0A-5A/0A-10A

ii. Voltmeter: 0V-50V/0V-150V/0V-300V/0V-500V

iii. Wattmeter: 0-1000W(5A/10A,300V/600V)

iv. Multimeter: *$5^{1/2}$ digits resolutions with all basics measurement facility like DC Voltage: 200 mV ~ 1000 V, DC Current: 200 μA ~ 10 A, AC Voltage: True-RMS,*

200 mV ~ 750 V, AC Current: True-RMS, 20 mA ~ 10 A, 2-Wire, 4-Wire Resistance: 200 Ω ~ 100 MΩ, Capacitance Measurement: 2 nF ~ 10000μF, Frequency Measurement: 20 Hz ~ 1 MHz etc., 0.015% DC Voltage Accuracy.

v. CRO: *30 MHz Bandwidth, 2 channel, 20 ns sampling time*

vi. Function generator: *10 HZ to 10MHZ , 10 Vpp , rise & fall time =20ns, manual / external triggering*

vii. RF ammeter:

viii. Choke coil: 0- 80 mH, variable choke coil

ix. Single phase variac : 0-300V/ 1KVA

C List of Software/Learning Websites

i. Electronic Work bench or Circuit maker

ii. www. kpsec.freeuk.com

iii. www.howstuffworks.com/

9. INSTRUCTION STRATEGY :

i. Numerical based on AC series circuits and series resonance
ii. Use Power point presentation
iii. Use Over-head projector
iv. Use case study
v. Field visit

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- Shri R.L. Patel, Sr. Lecturer, Electrical engineering Department, Govt. Polytechnic, Jamnagar
- Shri M. J. Aghara, Sr. Lecturer, Electrical engineering Department, Govt. Polytechnic, Rajkot
- Shri A.A. Amin, Sr. Lecturer, Electrical engineering Department, Govt. Polytechnic, Vadnagar
- Ms V.R. Kotdawala, Sr. Lecturer, Electrical Engineering Department, Govt. Polytechnic, Himmatnagar.

Coordinator and Faculty Members from NITTTR Bhopal