Course Name : Electrical Engineering Group

Course Code : EE / EP

Semester   : Third

Subject Title : Electrical Circuits and Networks

Subject Code : 17323

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	01	02	03	100	50#	--	25@	175

NOTE:

> ➢ **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
> ➢ **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**
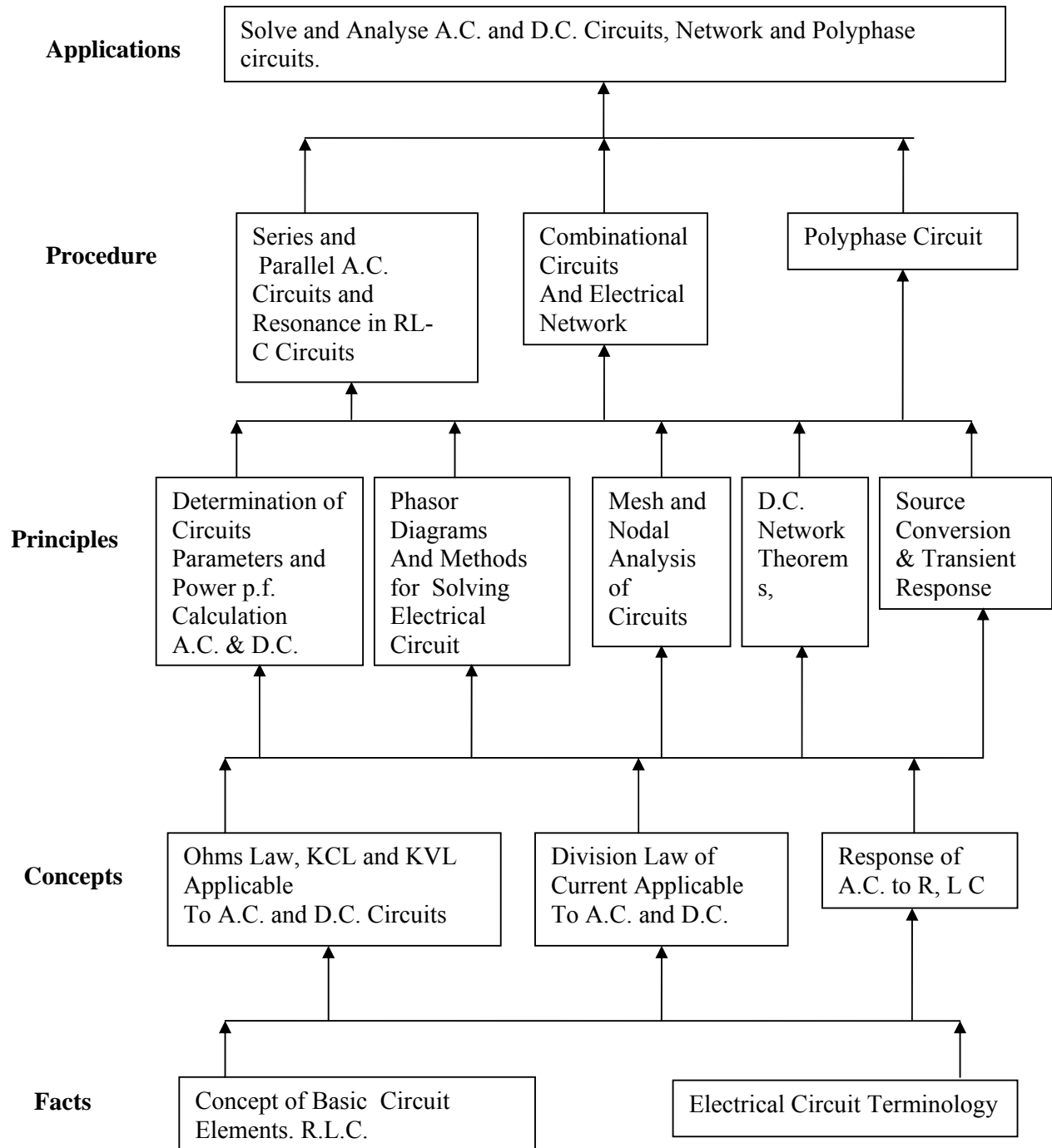
Rationale:

In order to understand electrical machines, power system, controls and measurements, knowledge of electrical circuit and network is very important. Study of electrical network lays the foundation to understand subjects of application level.

The study of this subject will facilitate student to understand concept and principles of circuits and circuit analysis. It helps also students in fault finding and troubleshooting.

General Objectives:

The student will be able to:

1) Understand basic elements of the circuit, terminology used and various quantities involved.
2) Use network theorems for solution of DC network.
3) Realize the importance of series ac circuit and parallel ac circuit.
4) Know the relations between phase and line values of various quantities in three phase ac circuit.
5) Calculate various parameters of a.c. circuits.

Learning Structure:

Applications

Solve and Analyse A.C. and D.C. Circuits, Network and Polyphase circuits.

Procedure

| Series and Parallel A.C. Circuits and Resonance in RL-C Circuits | Combinational Circuits And Electrical Network | Polyphase Circuit |

Principles

| Determination of Circuits Parameters and Power p.f. Calculation A.C. & D.C. | Phasor Diagrams And Methods for Solving Electrical Circuit | Mesh and Nodal Analysis of Circuits | D.C. Network Theorems, | Source Conversion & Transient Response |

Concepts

| Ohms Law, KCL and KVL Applicable To A.C. and D.C. Circuits | Division Law of Current Applicable To A.C. and D.C. | Response of A.C. to R, L C |

Facts

| Concept of Basic Circuit Elements. R.L.C. | Electrical Circuit Terminology |

Theory:

Note: All Network Theorems should be taught for DC supply & Superposition Theorem should be taught for both AC & DC supply.

Topic and Contents	Hours	Marks

Topic 1. Review Of Basic Concepts Of Electric Circuit:
Specific Objectives:
  ➢ Understand generation of a.c. supply and concept of phasor
  ➢ Define various terms related with a.c. supply.
  ➢ Draw sinusoidal a.c. waveform and phasor diagram.
  ➢ Calculate r.m.s., average ,instantaneous value and amplitude of a.c. supply.
Contents:
1.1 Basic Electric Circuit Elements R, L, C.
1.2 Simple one loop a.c. generator to produce sinusoidal a.c e.m.f.
1.3 Sinusoidal a.c. waveform and definitions of various terms such as frequency, time-period, cycle, amplitude, average value, r,m,s value, crest factor ,form factor .(**Simple numericals**)
1.4 Concept of phasor.
1.5 Response of pure R, L, and C to sinusoildal a.c. supplies.
1.6 Phasor representation of alternating quantity and concept of phase angle.(Simple numericals)
	06	12

Topic 2. Single Phase A.C. Series Circuits :
Specific Objectives:
  ➢ Calculate current, reactance and impedance of series a.c. circuit.
  ➢ Draw phasor diagram of series a.c. circuit.
  ➢ Calculate various powers, and p.f. of series a.c. circuit.
Contents:
2.1 Series a.c. circuits R-L, R-C and R-L-C circuits.
Impedance, reactance, phasor diagram, impedance triangle, power factor, active(real) power, apparent power , reactive power, power triangle
(Derivations and Numericals).
2.2 Series Resonance, quality factor **(Derivations and Numericals).**
2.3 Solution for AC Series circuit by using complex algebra.
	12	20

Topic 3. Single Phase A.C. Parallel Circuits:
Specific Objectives: The students will be able to :
  ➢ Calculate current, reactance and impedance of parallel a.c.circuit.
  ➢ Draw phasor diagram of parallel a.c.circuit.
  ➢ Calculate various powers, and p.f. of parallel a.c. circuit.
Contents:
3.1 Parallel AC circuits
  ➢ Resistance in parallel with pure inductance.
  ➢ Resistance in parallel with capacitance.
  ➢ Series combination of resistance and inductance in parallel with capacitance
Concept of Admittance, Conductance & Susceptance, Solution by admittance method and impedance method.**(Numericals only)**
3.2 Parallel resonance, quality factor.
3.3 Comparison of series and parallel circuits
	08	12

Topic 4. Polyphase A.C. Circuits :
Specific Objectives:
  ➢ Calculate current, reactance and impedance of each phase of polyphase a.c. circuit.
  ➢ Calculate line quantities.
  ➢ Draw phasor diagram of polyphase a.c. circuit.
  ➢ Calculate various powers, and p.f. of polyphase a.c. circuit.
 	
Contents
4.1 Advantages of polyphase circuits over single phase circuits
4.2 Generation of three phase e. m. f.
4.3 Phase sequence, polarity marking.
4.4 Types of three-phase connections.
4.5 Concept of unbalanced load and balanced load.
4.6 Line, phase quantities and power in three phase system with balanced star and Delta connected load & their interrelationship.**(Derivations and numerical)**
	10	18

Topic 5 : Principles of Circuit Analysis (ONLY DC Circuits):
Specific Objectives:
  ➢ Realize importance of source transformations and λ /Δ or Δ / λ transformations.
  ➢ Solve examples of simple d.c. circuits by mesh or node analysis.
Contents:
5.1 Source transformation **(No Numericals).**
5.2 Star/delta & Delta/star transformations **(No Numericals).**
5.3 Mesh analysis **(Numericals with two equations).**
5.4 Node analysis **(Numericals with two equations).**
	08	12

Topic 6 : Network Theorems: **Note: Simple Numericals on DC Circuits only with maximum two simultaneous equations** Specific Objectives:	16	20

➢ Calculate the current in a given network by applying proper therom. ➢ Realize importance of maximum power transfer thermo. **Contents:** 6.1 Superposition Theorem for both AC Voltage & DC Source. 6.2 Thevenin's Theorem 6.3 Norton's Theorem 6.4 Maximum Power Transfer Theorem		
Topic 7 : Initial And Final Conditions Of Elements In A Network : Specific Objectives: ➢ Understand importance of initial and final conditions. ➢ Use such initial and final conditions in switching circuits and electronic circuits. **Contents** Concept of initial and final conditions in switching circuits. Meaning of t = 0 -, t = 0+ and t = ∞. R,L, and C at initial conditions R,L, and C at final conditions	04	06
Total	**64**	**100**

Practical:
Skills to be developed:

Intellectual Skills:
1. Distinguish between series and parallel a.c. circuits
2. Interpret electrical circuit diagram.
3. Identify safety equipments required.
4. Decide the procedure for setting experiments.

Motor Skills:
1. Connect as per circuit diagram along with various required proper range meters.
2. Measure electrical current, voltage drop, power etc.
3. Select proper supply for a given experiment.(a.c. or d.c.)
4. Use safety devices while working.

List of Practicals:
All Experiments Are Compulsory.
1. To determine impedance, phase angle and plot phasor diagram of R-L a.c. series circuit. To calculate also active, reactive and apparent power consumed in R-L series circuit
2. To determine impedance, phase angle and plot phasor diagram of R-C a.c. series circuit. To calculate also active, reactive and apparent power consumed in R-C series circuit.
3. To determine impedance, phase angle and plot phasor diagram of R-L-C a.c. series circuit. To calculate also active, reactive and apparent power consumed in R-L-C series circuit.
4. To obtain resonance in R-L-C a.c. series circuit either
   ➢ By varying L or C or
   ➢ By using variable frequency supply.
5. a. To measure current of each branch of R-C parallel a. c. circuit

   b. To calculate p. f., active, reactive and apparent power taken by same R-C parallel
     a. c. circuit (Resistor in parallel with capacitor)

6. a. To measure current of each branch of RL-C parallel a. c. circuit
   b. To calculate also p.f., active, reactive and apparent power taken by the a. c. circuit.
     (Series connection of resistor and inductor in parallel with capacitor)

7. To verify line and phase values for balanced three phase load and to calculate all types of power.
     ➤   Star connected
     ➤   Delta connected

8. To verify superposition therom.

9. To verify Thevenin's and Norton's therom.

10. To verify maximum power transfer theorem.

Learning Resources:
   1. Books:

Sr. No	Author	Title	Edition	Publisher
1	B. L. Theraja A. K. Theraja	A Text Book of Electrical Technology Vol-I (Basic Electrical Engg.)	Multicolour Edition 2005 And Subsequent Reprint	S. Chand & Co. Ramnagar New Delhi
2	V. N. Mittle	Basic Electrical Engg.	Any Edition After 2005	Tata McGraw-Hill
3	Edward Hughes	Electrical Technology	Second And Any Subsequent Edition	Pearson Education, New Delhi
4	A. Sudhakar	Circuit and network	Fourth Edition	Tata McGraw Hill
5	R.S. Ananda Murthy	Basic Electrical Engineering	Second Edition	Pearson
6	P.Ramesh Babu	Electric Circuits	First Edition	Scitech
7	Richard C. Dorf and James A. Svoboda	Electric Circuits	Sixth Edition	WILLEY student WILLEY INDIA Edition
8	Sunil T. Gaikwad	Basic Electrical Engineering	First Edition	Dreamtech Press 19-A Daryaganj, N.Delhi
9	David A. Bell	Electric Circuits	Seventh Edition	Oxford Univesity Press
10	K Murugesh Kumar	Elements of Electrical Engg.	First Edition	Vikas Publishing House Pvt Ltd. Noida

   2. Websites:
     www.wikipedia.com , www.youtube.com , www.norsa.com, www.dreamtechpress.com