Kadi Sarva Vishvavidyalaya, Gandhinagar
Bachelor of Engineering (Electrical Engineering Syllabus)

CIRCUIT THEORY
B.E SEM - III
SUB CODE: EE- 302

A. **Course Objective:**

- To present a problem oriented introductory knowledge of Electrical Engineering Circuits.
- To understand the basics of circuit components, their characteristics and responses
- To solve the networks using various theorems and laws
- To reduce the complex network using network topology

B. **Teaching / Examination Scheme**

SUBJECT		Teaching Scheme				Total Credit	Examination Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EE-302	Circuit Theory	4	0	2	6	5	3	70	30	20	30	150

SYLLABUS

Concepts of Circuits:

Network classification, Energy sources, VI relations for R, L and C. Graphical analysis of Voltage, Current and Charge for passive elements, Dot convention

Basic Network Analysis methods: Kirchhoff's laws (KVL & KCL), Branch current and mesh currents, Mesh analysis for independent, dependent and sinusoidal sources, Supermesh, Nodal analysis for independent, dependent and sinusoidal sources, Supernode, Source transformation techniques, duality concept

Network Theorems

Superposition, Thevenin's, Norton's, Reciprocity, Substitution, Compensation, Millman's, Tellegen's, Maximum Power Transfer Theorem.

Two Port Parameters

Z-parameters, Y-Parameters, h- Parameters, g-Parameters, ABCD Parameters, Inverse T Parameters, Relations between various Parameters

Network Graph Theory

Formation of graph and its orientation, Basic concepts of graph, Incidence matrix (A_a), Reduced Incidence Matrix (A), Fundamental Tie-sets(B_f) and Cut-sets (Q_f) , Relation between A_a, A, B_f and Q_f, Kirchhoff's laws in A_a, B_f and Q_f formations

Initial Conditions

Initial Conditions in elements, Derivative interpretation, Initial condition evaluation

Transients in First and Second order linear circuits-RL, RC and RLC

First order differential equation and solution, Time constant, Second order homogeneous differential equation and solution, RL and RC sinusoidal transient

Laplace Transform for Network Analysis

Basic Laplace and Inverse Laplace transformation rules, Laplace of Unit step, Ramp, Impulse waveforms, Initial and Final value theorem, Step response of RL,RC and RLC using Laplace transforms.

INSTRUCTIONAL METHOD AND PEDAGOGY (Continuous Internal Assessment (CIA) Scheme)

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, practicals and Tutorial which carries 05 Marks.
- At regular intervals assignments is given. In all, a student should submit all assignments of 05 marks each.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries 05 Marks.
- Viva Voce will be conducted at the end of the semester of 05 Marks.
- One internal exam of 30 marks is conducted as a part of mid semester evaluation.
- Experiments shall be performed in the laboratory related to course contents.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.

STUDENTS LEARNING OUTCOME:

On successful completion of the course

- The student can learn about various methods of network reduction and analysis.

C. **Lesson Planning**

SR No.	Lectures (Hours)	Weightage in % in Exam	Topic
1	06	35	**Concepts of Circuits:**Network classification, Energy sources, VI relations for R, L and C. Graphical analysis of Voltage, Current and Charge for passive elements, Dot convention
2	06		**Basic Network Analysis methods:** Kirchhoff's laws (KVL & KCL), Branch current and mesh currents, Mesh analysis for independent, dependent amd sinusoidal sources, Supermesh, Nodal analysis for independent, dependent amd sinusoidal sources, Supernode, Source transformation techniques, duality concept.
3	08		**Network Theorems** Superposition, Thevenin's, Norton's, Reciprocity, Substitution, Compensation, Millman's, Tellegen's, Maximum Power Transfer
4	06	25	**Two Port Parameters** Z-parameters, Y-Parameters, h- Parameters, g-Parameters, ABCD Parameters, Inverse T Parameters, Relations between various Parameters
5	08		**Network Graph Theory** Formation of graph and its orientation, Basic concepts of graph, Incidence matrix (A_a), Reduced Incidence Matrix (A), Fundamental Tie-sets(B_f) and Cut-sets (Q_f) , Relation between A_a, A, B_f and Q_f, Kirchhoff's laws in A_a, B_f and Q_f formations
6	08	20	**Initial Conditions** Initial Conditions in elements, Derivative interpretation, Initial condition evaluation
7	05		**Transients in First and Second order linear circuits-RL, RC and RLC** First order differential equation and solution, Time constant, Second order homogeneous differential equation and solution, RL and RC sinusoidal transient
8	06	20	**Laplace Transform for Network Analysis** Basic Laplace and Inverse Laplace transformation rules
9	07		Laplace of Unit step, Ramp, Impulse waveforms, Initial and Final value theorem, Step response of RL,RC and RLC using Laplace transforms.
TOTAL	60	100	

D. **Instructional Method & Pedagogy**

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.

Suggested List of Experiments:

1. To Verify Kirchoff's Voltage Law (KVL) and Kirchoff's current Law (KCL).
2. To Verify Thevenin's Theorem for Resistive Network.
3. To Verify Norton's Theorem for Resistive Network.
4. To Verify Maximum Power Transfer Theorem for Resistive Network.
5. To Verify Superposition theorem for Resistive Network.
6. Transient Response of a RL Circuit.
7. Transient Response of a RC Circuit.
8. Determination of Z-Parameters of given Two Port Network.
9. Determination of ABCD Parameters of given Two Port Network.
10. Determination of H- Parameters of given Two Port Network.

Students Learning Outcomes

On successful completion of the course

- The student can be acquired the basic knowledge of electric circuits, electrical fundamentals, thus being prepared to pursue any area of engineering spectrum in depth as desired.
- The students will be able to effectively employ electrical systems and lead the exploration of new applications and techniques for their use.

TEXT BOOK:

- Network Analysis and Synthesis by U.A.Patel 6th Edition, Mahajan Publishing House.

REFERENCE BOOKS:

- Circuit Theory (Analysis and Synthesis) By A. Chakrabarti, Dhanpat Rai & Company.
- Network Analysis by M.E.Vanvalkenburg, PHI Publication.
- Linear Circuit Analysis by De Carlo/Lin 2nd Edition, Oxford University Press Indian Edition.

Web Materials: http://www.wikipedia.org