

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 3

Biomedical Engineering

Subject Code 130901

Subject Name Circuits and Networks

Sr.No	Course Content
1	Circuit Variables and Circuit Elements: Electromotive Force, Potential and Voltage - A Voltage Source with a Resistance Connected at its Terminals - Two-terminal Capacitance - Two-terminal Inductance- Ideal Independent Two-terminal Electrical Sources - Power and Energy Relations for Two-terminal Elements - Classification of Two-terminal Elements - Multi-terminal Circuit Elements, Dot Convention.
2	Nodal Analysis and Mesh Analysis of resistive Circuits: Nodal Analysis of Circuits Containing Resistors and Independent Sources - Nodal Analysis of Circuits Containing Dependent Voltage Sources - Source Transformation Theorem for circuits with independent sources - Source Transformation Theorem for circuits with Dependent sources -Nodal Analysis of Circuits Containing Dependent Sources - Mesh Analysis of Circuits with Resistors and Independent Voltage Sources- Mesh Analysis of Circuits with Independent Sources - Mesh Analysis of Circuits Containing Dependent Sources
3	Circuit Theorems: Linearity of a Circuit and Superposition Theorem - Substitution Theorem - Compensation Theorem - Thevenin's Theorem and Norton's Theorem - Determination of Equivalents for Circuits with Dependent Sources - Reciprocity Theorem - Maximum Power Transfer Theorem - Millman's Theorem
4	Time domain response of First order RL and RC circuits: Mathematical preliminaries – Source free response –DC response of first order circuits – Superposition and linearity – Response Classifications – First order RC Op Amp Circuits
5	Time domain response of Second order linear circuits: Discharging of a Capacitor through an inductor – Source free second order linear networks – second order linear networks with constant inputs
6	Initial Conditions: Initial conditions in elements, procedure for evaluating initial conditions, Solution of circuit equations by using Initial Conditions.

7	Laplace Transform Analysis: Circuit Applications: Notions of Impedance and Admittance – Manipulation of Impedance and Admittance- Notions of Transfer Function- Equivalent circuits for inductors and capacitors – Nodal and Loop analysis in the s-domain – Switching in RLC circuits- Switched capacitor circuits and conservation of charge
8	Laplace Transform Analysis : Transfer Function Applications: Poles, Zeros and the s-plane- Classification of Responses – Computation of sinusoidal steady state response for stable networks and systems
9	Two –Port Networks : One port networks – Two port admittance Parameters – Admittance parameters analysis of terminated two- Port networks - Two port impedance Parameters –Impedance and Gain calculations of terminated two- Port networks modeled by z-parameters – Hybrid parameters – Generalized Two-port Parameters – Transmission parameters - reciprocity
10	Introduction to Network Topology: Linear Oriented Graphs (Connected Graph, Subgraphs and Some Special Subgraphs) - The Incidence Matrix of a Linear Oriented Graph -Kirchhoff's Laws in Incidence Matrix Formulation - Nodal Analysis of Networks - The Circuit Matrix of a Linear Oriented Graph- Kirchhoff's Laws in Fundamental Circuit Matrix Formulation - Loop Analysis of Electrical Networks – (Loop Analysis of Networks Containing Ideal Dependent Sources- Planar Graphs and Mesh Analysis –Duality)- The Cut-set Matrix of a Linear Oriented Graph (Cut-sets - The All cut-set matrix Q_a - Orthogonality relation between Cut-set matrix and Circuit matrix - The Fundamental Cut-set Matrix Q_f - Relation between Q_f , A and B_f) - Kirchhoff's Laws in Fundamental Cut-set formulation

Reference Books:

1. Electric Circuits and Networks :- By K. S. Suresh Kumar – Pearson Education
2. Linear Circuits Analysis 2nd edition :-By DeCarlo/ Lin – Oxford University Press (Indian edition)
3. Network Analysis :- By M.E Van Valkenburg PHI Publication
4. Engineering Circuit Analysis : - By W H Hayt, J E Kemmerly, S M Durbin 6th Edition TMH Publication
5. Network Analysis & Synthesis By Franklin S. KUO, Wiley Publication