

# GUJARAT TECHNOLOGICAL UNIVERSITY

## PDDC - ELECTRICAL ENGINEERING

### Semester: II

**Subject Name:     CIRCUITS AND NETWORKS**

Sr. No.	Course content
1.	<p><b>Circuit Variables and Circuit Elements:</b></p> <p>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.</p>
2.	<p><b>Nodal Analysis and Mesh Analysis of resistive Circuits:</b></p> <p>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</p>
3.	<p><b>Circuit Theorems:</b></p> <p>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</p>
4.	<p><b>Time domain response of First order RL and RC circuits:</b></p> <p>Mathematical preliminaries – Source free response –DC response of first order circuits – Superposition and linearity – Response Classifications – First order RC Op Amp Circuits</p>
5.	<p><b>Time domain response of Second order linear circuits:</b></p> <p>Discharging of a Capacitor through an inductor – Source free second order linear networks – second order linear networks with constant inputs</p>
6.	<p><b>Initial Conditions:</b></p> <p>Initial conditions in elements, procedure for evaluating initial conditions, Solution of circuit equations by using Initial Conditions.</p>

7.	<b>Laplace Transform Analysis: Circuit Applications:</b>  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.	<b>Laplace Transform Analysis : Transfer Function Applications:</b>  Poles, Zeros and the s-plane- Classification of Responses – Computation of sinusoidal steady state response for stable networks and systems
9.	<b>Two –Port Networks :</b>  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.	<b>Introduction to Network Topology:</b>  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) - 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 2<sup>nd</sup> 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 6<sup>th</sup>  
Edition TMH Publication
5. Network Analysis & Synthesis By Franklin S. KUO, Wiley Publication