NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE OUTLINE			
Course Title	CIRCUIT THEORY		
Course Code	ICPC12	No. of Credits	4
Department	ICE	Faculty	Dr. K. DHANALAKSHMI
		E-mail & Telephone No.s	dhanlak@nitt.edu 00431 2503360 9443858456
Course Type	Programme Core		

COURSE OVERVIEW

The goal of this course is to make the student competent in analyzing dc and ac circuits after being introduced to the concepts of electric circuit laws and theorems. Students will learn the voltage - current relationship of basic circuit elements – resistors, inductors, capacitors, dependent and independent voltage and current sources; apply Kirchhoff's current and voltage laws to circuits in order to determine voltage, current and power in branches of any circuit excited by dc voltages and current sources. Apply simplifying techniques to solve dc circuit problems using basic circuit theorems and structured methods like node voltage and mesh current analysis. The goal also includes derivation of the transient responses of RC and RL circuits, steady state response of circuits to sinusoidal excitation in time domain, application of phasors to circuit analysis and network synthesis. The course is intended to introduce and impart problem solving techniques, through linear passive electrical circuits, useful for other core and elective courses of the department; and, to introduce algorithmic and computer-oriented methods for solving large scale circuits.

COURSE OBJECTIVES

1. To teach the electrical circuit laws and theorems, to aid in circuit analysis.
2. To impart problem solving technique of linear passive electrical circuits.
3. To expose the students to the transient behaviour of different R-L-C circuits.
4. To teach the methods of AC circuit analysis and synthesis of 2-port networks.

COURSE OUTCOMES (CO)

1. The student is motivated to study circuits in a systematic manner suitable for engineering analysis and design.
2. The student understands to formulate circuit analysis problems in a mathematically tractable way with an emphasis on solving linear systems of equations.
3. The student is exposed to subtle details in the responses of circuits subjected to sudden changes in excitation, and understanding the transient phenomena.
4. The student is exposed to the steady-state behaviour of circuits, generalization of ideas from simple dc to complex exponential signals, and learns the basic principles of power systems.
5. The student is motivated to understand the general behaviour of circuits in a unified framework, learn about input-output modeling, and extend the concepts to more general linear systems to be taught in future semesters.

COURSE TEACHING AND LEARNING ACTIVITIES			
S. No.	**Week**	**Topic**	**Mode of Delivery**
1.	**1, 2, 3**	Review of Networks and Circuits Elemental laws (v - i characteristics) for Resistors, Inductors and Capacitors Circuital laws (Kirchhoff's laws) Sign convention Basic signals (dc and ac), Elementary signals (impulse, step, ramp, exponential) Synthesis of arbitrary waveforms (rectangular, triangular etc.) from elementary signals Voltage and Current sources (Independent and Dependent) Ladder and Bridge Circuits.	**Chalk and Talk with homework exercises given in every class.**
2.	**4, 5, 6**	Analysis of Resistive Circuits energized by dc voltages and currents – Source Transformations Nodal and Mesh Analysis Principle of Superposition Network Theorems (Thevenin's and Norton's, Maximum Power Transfer) Circuits with dependent dc Sources.	
3.	**7, 8, 9**	Transients with Energy Storage Elements, First and Second Order Circuits – Time-constant, Damping Ratio, Natural Frequency, Emphasis on Linear Ordinary Differential Equations, Step response of RC, RL, and RLC (series and parallel) Circuits Resonance in Second Order Circuits.	
4.	**10, 11, 12**	Sinusoidal Sources and Response – Behaviour of elements with ac signals Impedance and Admittance Generalization of Network Theorems and Circuit Analysis Introduction to 3-ϕ power systems.	
5.	**13, 14**	Transient and Steady-state Response of Circuits – Laplace Transformation and its application to circuit analysis State Variables Network Functions (Driving point impedance and admittance) Transfer function Two-port Networks, Applications of Two-port networks. Introduction to General Linear Systems.	

COURSE ASSESSMENT METHODS (as stated in the rules and regulations)

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	CT 1	6th week	60 min	25
2.	CT 2	12th week	60 min	25
3.	Assignment/open book test/seminar/problem solving in class	As and when informed in the class		10
*	Compensation Test	Before the end sem. exam	60 min	25
4.	End semester exam	After the 14th week	180 min	40

ESSENTIAL READINGS

Text Books

1. Hayt, W.H, Kemmerly J.E. and Durbin, Engineering Circuit Analysis, McGraw Hill Publications, 8 th Edition, 2013.
2. Franklin F. Kuo, Network Analysis and Synthesis, Wiley International, 5th Edition, 2012
3. Van Valkenburg, Network Analysis, Prentice Hall, Revised 3 rd Edition,2019.

Reference Books

1. Charles K. Alexander, Mathew N.O Sadiku, Fundamentals of Electric Circuits TMH Education Pvt. Ltd, 5t h Edition, 2013.
2. Ramakalyan, A., Linear Circuits: Analysis and Synthesis, Oxford Univ. Press, 2005.
3. DeCarlo, R.A. and Lin, P.M., Linear Circuit Analysis: Time Domain, Phasor and Laplace Transform Approaches, Oxford University Press. 3rd Editions, 2009
4. SC Dutta Roy, Circuit Theory, NPTEL video lectures

COURSE EXIT SURVEY

A form will be prepared, and given to the students to provide the feedback at the mid and end of the semester.

The feedback obtained during the mid of the semester will be taken into consideration. The feedback obtained at the end of the semester will be used to assess the attainment of course outcome and about the effectiveness of teaching-learning.

COURSE POLICY

The rules and regulations framed by the institute as applicable for the batch of students admitted in 2022.

Students are expected to attend every theory class.

At least 75% attendance in each course is mandatory. A maximum of 10% shall be allowed under On Duty (OD) / Medical Grounds.

A student has to obtain prior permission when going on long leave (if he/she would miss more than 2 classes), to be considered as leave on permission.

Only if the student obtains prior permission, he/she will be permitted for the retest.

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____