DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	**B.Tech- Instrumentation and Control Engineering**		
Course Title	**Circuit Theory**		
Course Code	**ICPC12**	**No. of Credits**	**4**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**July 2022**	**Section (if, applicable)**	**A**
Name of Faculty	**Dr. Geetha C**	**Department**	**ICE**
Email	**geethac@nitt.edu**	**Telephone No.**	**-**
Name of Course Coordinator(s) (if, applicable)	**NA**		
E-mail	**NA**	**Telephone No.**	**NA**
Course Type	☐ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

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.

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.

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.

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. 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.

Network Synthesis: Properties of RC, RL, and LC driving point functions, Synthesis of networks from given transfer functions.

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 behavior of different R-L-C circuits.
4. To teach the methods of AC circuit analysis and synthesis of 2-port networks.

COURSE OUTCOMES (CO)

On completion of this course, the students will be able to,

1. Analyze and solve the basic circuits using mesh and node analysis.
2. Analyze and solve the DC and AC circuits using network theorems and mathematical tools.
3. Apply the knowledge of the time domain and frequency domain characteristics of electrical circuits for design.
4. Apply Laplace Transform for circuit analysis.
5. Design and synthesis two port networks.

Course Outcomes	Aligned Programme Outcomes (PO)
1. Analyze and solve the basic circuits using mesh and node analysis	1,2,3,5,7,12
2. Analyze and solve the DC and AC circuits using network theorems and mathematical tools	1,2,3,5,7,12
3. Apply the knowledge of the time domain and frequency domain characteristics of electrical circuits for design	1,2,3,5,7,12
4. Apply Laplace Transform for circuit analysis	1,2,3,5,7,12
5. Design and synthesis two port networks	1,2,3,5,7,12

COURSE PLAN – PART II

COURSE OVERVIEW

The emphasis of this course is on the development of the basic ideas of electrical engineering. An additional objective of this course is to encourage the students to develop hierarchical thinking wherein they can see more complex systems as generalizations of simple circuits and techniques. An understanding of elementary calculus and simple matrix methods is necessary and sufficient.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	1st week	Review of Networks and Circuits, Elemental laws (V-I characteristics) for Resistors, Inductors, and Capacitors, Circuital laws (Kirchhoff's laws), Sign convention, Voltage and Current sources (Independent and Dependent)	Chalk and talk
2	2nd Week	Basic signals (dc and ac), Elementary signals (impulse, step, ramp, exponential), Synthesis of arbitrary waveforms (rectangular, triangular etc.) from elementary signals, Ladder and Bridge Circuits.	Chalk and talk

3	3rd Week	Analysis of Resistive Circuits energized by dc voltages and currents – Source Transformations, Nodal analysis	Chalk and talk
4	4th and 5th week	Mesh Analysis, Principle of Superposition, Network Theorems (Thevenin's and Norton's, Maximum Power Transfer), Circuits with dependent dc Sources.	Chalk and talk
Assessment – 1			
5	6th week	Transients with Energy Storage Elements, First and Second Order Circuits – Time-constant, Damping Ratio, and Natural Frequency.	Chalk and talk
6	7th week	Emphasis on Linear Ordinary Differential Equations, Step response of RC (series and parallel) Circuits	Chalk and talk
7	8th week	Step response of RL and RLC (series and parallel) Circuits Resonance in Second Order Circuits.	Chalk and talk
Assessment – 2			
8	9th week	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.	Chalk and talk
9	10th week	Transient and Steady-state Response of Circuits – Laplace Transformation and its application to circuit analysis	Chalk and talk
10	11th week	State Variables, Network Functions (Driving point impedance and admittance), Transfer function	Chalk and talk
Assessment 3			
11	12th week	Two-port Networks, Applications of Two-port networks, Introduction to General Linear Systems.	Chalk and talk
12	13th week	Network Synthesis: Properties of RC, RL, and LC driving point functions,	Chalk and talk
Compensation Assessment			
13	14th week	Synthesis of networks from given transfer functions. Discussion and doubt clarification	Chalk and talk
Final Assessment			

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment 1	3rd week of September	1 hour	20
2	Assessment 2	3rd week of October	1 hour	20
3	Assessment 3	3rd week of November	1 hour	10

	(In the form of Assignment, and /or Quiz)			
CPA	Compensation Assessment	4th week of November	-	20
4	Final Assessment	2nd week of December	3 hours	50

COURSE EXIT SURVEY

1. Feedback from the students during the class committee meetings and at the mid of the semester
2. Feedback before end semester examination through a questionnaire

COURSE POLICY

MODE OF CORRESPONDENCE (email/ phone etc) - Email

COMPENSATION ASSESSMENT POLICY

Compensation Assessment will be conducted for students who miss Assessment 1 or Assessment 2. But they should get permission from the faculty by giving valid reason in written form to write Compensation Assessment.

- **Grading Policy -** Relative grading will be used to decide the clusters (range) of the total marks scored. The passing minimum should be 35% or (Class average/2) whichever is greater.

Reassesment Examination

- A student may be permitted to withdraw from appearing for the End Semester Examination for valid reasons on production of valid medical certificate and with the approval of Head of the Department. Withdrawal application shall be valid only if it is made before the commencement of the examination.
- For students who miss the final semester assessment, reassessment will be conducted for 30% mark and internal marks remain same.
- Those who failed in the subject may register for reassesment examination which will be conducted for 100% mark (Absolute grading where passing minimum is 35).
- Grades for the students who have withdrawn from writing the end semester exam will be same as the regular assessment grades. For those who are failed or absent and appearing for reassessment, the maximum grade is restricted to 'E'.
- Reassessment exam will be conducted in the first week of the next semester or earlier during the vacation.
- Students who fail in reassesment exam have to register for formative assessment.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.

- A maximum of 10% shall be allowed under On Duty (OD) category / valid reasons on production of valid medical certificate with the approval of Head of the Department.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

- Any suggestions, queries and feedback can be communicated through email (geethac@nitt.edu)

FOR APPROVAL

Course Faculty	**CC-Chairperson**	**HOD** 22/8/22
Dr. Geetha C	**Dr. R. Periyasamy**	**Dr. K. Dhanalakshmi**