GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title**:** Electronic Networks
(Code: 3321102)

Diploma Program in which this course is offered	Semester in which offered
Electronics and Communication Engineering	Second Semester

1. RATIONALE

Electronic networks is a core area, the knowledge of which is essential for electronic engineering diploma holders and they need to assimilate it in order to succeed in the Industry. In this regard, the basic knowledge of various theorems, resonance, filtering and attenuation related to passive electronic components is essential. Understanding of these concepts will be useful to determine the various parameters required to solve various problems and applications. This course has been designed to achieve these aims.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Analyse electronic networks in terms of voltage, current, power, attenuation and frequency response.**

3 . TEACHING & EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
3	2	2	7	70	30	20	30	

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit **ESE** - End Semester Examination; **PA** - Progressive Assessment

Note: It is the responsibility of the institute heads that marks for **PA of theory** & **ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **Network Elements and Network Topology**	1a. Differentiate between voltage source and current source.	1.1 Conversion of voltage source to Current Source (Ideal and Practical) and vice versa
	1b. Determine voltage, current and power relationship for resistors connected in series, parallel and in combination 1c. Determine voltage, current and power relationship for capacitors connected in series, parallel and in combination 1d. Determine voltage, current and power relationship for capacitors connected in series, parallel and in combination 1e. Analyze the circuit to calculate voltage and current at various points in circuit	1.2 Resistors connected in series, parallel and in combination 1.3 Capacitors connected in series, parallel and in combination 1.4 Inductors connected in series, parallel and in combination 1.5 Voltage and Current division method 1.6 Branch, Node, Loop, Mesh and terms related to network topology
	1f. Describe various terms related to network topology 1g. Compare various types of networks 1h. Define terms related to impedances of multi-port network	1.7 Passive and Active network, Linear and Non- linear , Lumped and Distributed , Unilateral and Bilateral, Symmetrical and Asymmetrical, Single port and Double port, Three and Four terminals 1.8 Transfer Impedance, Driving point Impedance, Image Impedance and Terminating Impedance, Input and Output Impedances
	1i. Describe steps to obtain characteristic impedance of standard T and π networks (Z_{OT} and $Z_{O\pi}$) 1j. Describe steps to obtain relation between Z_{OT} and $Z_{O\pi}$ 1k. Describe steps of conversion between T to π networks and vice versa	1.9 Characteristic Impedance of standard T and π networks (Z_{OT} and $Z_{O\pi}$) and relation between them 1.10 T to π and π to T networks conversion or Star to Delta and Delta to Star conversion
Unit– II **Network Theorems**	2a. Analyse the circuit to Calculate voltage and current in the given resistive circuits using KCL and KVL 2b. Analyse the resistive circuits to calculate voltage and current using Mesh and nodal analysis method 2c. Explain the steps to find the dual of given circuit having R-L-	2.1 Kirchhoff's Voltage and Current law(KVL and KCL) 2.2 Mesh Analysis and Nodal Analysis of Networks 2.3 Principle of Duality

Unit	Major Learning Outcomes	Topics and Sub-topics
	2d. Explain the steps to Calculate the current in any branch of the circuit using Superposition Theorem. 2e. Use Superposition Theorem to calculate the current in any branch of the circuit. 2f.Explain the steps to calculate the Vth, Rth and load current in the circuit using Thevenin's Theorem. 2g.Use Thevenin's Theorem to calculate V_{th}, R_{th} and load current in the given circuit. 2h. Explain the steps to calculate the load current in the circuit using Norton's Theorem. 2i. Calculate the load current in the given circuit using Norton's Theorem. 2j. Describe the Maximum Power Transfer condition for any given circuit 2k. Define the Reciprocity Theorem	2.4 Super Position Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem
Unit– III **Resonance and Coupled Circuits**	3a Determine Quality factor of a Coil and Capacitor. 3b Analyse the behavior of Series and Parallel resonant circuit using frequency response curve and calculate resonance frequency and various parameters of Series and Parallel resonant circuit. 3c.Compare the performance of single tuned and double tuned circuit (without derivation).	3.1 Quality factor or Q-factor of coil and capacitor 3.2 Series and parallel resonant circuit, resonance frequency, impedance at resonance, bandwidth and selectivity of series and parallel resonance circuit. 3.3 Coupled circuit**,** mutual inductance 3.4 Transformers: Iron core, Air core, single tuned and double tuned air core transformer used in tuned circuit
Unit – IV **Attenuators and Equalizers**	4a. Classify various types of attenuators. 4b. Explain relation between decibel and neper 4c. Using the relation N= Is / IR obtain the equations of R1 and R2 for Symmetrical T and π types of attenuators offering given amount of attenuation(Kirchhoff's Laws and Mesh analysis)	4.1 Attenuators, T and π attenuators, Lattice attenuators

Unit	Major Learning Outcomes	Topics and Sub-topics
	4d. Define Lattice attenuator	
	4e. Classify various types of equalizers. 4f. Explain series and shunt amplitude equalizers and obtain the equations for power ratio. 4g. Describe bridge T and lattice phase equalizers.	4.2 Series and Shunt amplitude Equalizers 4.3 Bridge T and Lattice Phase equalizers
Unit – V Filters	5a. Classify the various passive filter circuits. 5b. Derive the cut-off frequency equations for constant-k type, T and π sections of low Pass and High Pass filters 5c. Use the pass band equation $-1 < Z1 / 4Z2 < 0$ to obtain the equation of cut-off frequency for Constant-k type T & π sections– Low Pass and High Pass filters and calculate fc. 5d. Use the equations $R_0^2 = L / C$ and the equation for fc to obtain the equations for L and C and calculate values of L and C for given specifications. 5e. Describe limitations of constant-k type filters. 5f. Use the equation Z_{OT} and $Z_{O\pi}$ to obtain the equation of m in terms of fc and f∞ for m-derived T & π sections – Low Pass and High Pass filters and calculate values of m, L and C for given specifications. 5g. Explain band pass and band stop filter using Low pass and high pass filter. 5h. Compare high pass, low pass, band pass and band stop filters.	5.1 Passive Filters: Constant 'k' and 'm' derived type T and π sections – Low Pass, High Pass, 5.2 Band pass and band stop filters

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Network Elements and Network Topology	08	04	06	00	10
II	Network Theorems	10	04	08	08	20
III	Resonance and Coupled Circuits	08	02	06	04	12
IV	Attenuators and Equalizers	08	02	06	06	14
V	Filters	08	02	06	06	14
Total		**42**	**14**	**32**	**24**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table

6. SUGGESTED LIST OF EXERCISES/PRACTICALS

The exercises/practical should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire above mentioned competency.

S. No.	Unit No.	Practical/Exercise	Apprx. Hours Required
1.	II	For a given multisource network, determine the output impedance and voltage and verify it using Thevinin's Theorem	02
2.	II	For a given multisource network, determine the value of current in the specified branch and verify it using Superposition theorem	02
3.	II	For a given multisource network, determine the output impedance and voltage and verify it using Norton's Theorem	02
4.	II	For a given multisource network, determine the output impedance and voltage and verify it using Maximum power transfer theorem.	02
5.	III	For series resonance circuit, determine the frequency response curve to obtain the resonant frequency, resonant impedance, Bandwidth (BW) and Quality factor for series resonance circuit.	02
6.	III	For a parallel resonance circuit, determine the frequency response curve to obtain the resonant frequency, resonant impedance, Bandwidth (BW) and Quality factor.	02
7.	IV	Build and test T-type, π-type attenuator for given attenuation.	02
8.	IV	Build and test Lattice attenuator for given attenuation.	02
9.	IV	Measure Transfer Impedance, Driving point Impedance, Image Impedance and Terminating Impedance, Input and Output Impedances for given two-port network.	04
10.	V	For the given parameters, build constant k-low pass filter (T and π sections)	02
11.	V	For the given parameters, build constant k-high pass filter (T and π sections)	02
12.	V	Obtain the frequency response curve for the given m -derived low pass and high pass filter.	02
		Total	**26**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- Teacher guided tutorial exercises to solve problems based on all units.
- Implement small circuits on bread board and verify the design.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Title of Book	Author	Publication
1.	Network Analysis	Mithal G. K.	Khanna Publication , 2008 or latest edition
2.	Network Analysis and Synthesis	Chakraborti A.	Dhanpat Rai Publication,2009 or latest edition
3.	Networks and Transmission lines	T. Anil Kumar	Pearson Education, 2006 or latest edition
4.	Networks Lines and Fields	Ryder J. D.	Prentice Hall Inc. 2008 or latest edition
5.	Network Analysis	M.E.Van Valkenburg	Prentice Hall Inc. 2011 or latest edition

B. List of Major Test and Measuring Instruments and other components

i. Breadboard, Experimental boards for study of series and parallel resonance circuits and different types of filters
ii. Function generator
iii. Regulated power supply
iv. Multi-meter
v. LCR-Q meter

C. List of Learning Websites

i. http://www.nptel.com
ii. http://www.allaboutcircuits.com/vol_1/index.html
iii. http://en.wikipedia.org/wiki/Electrical_network
iv. http://www.mhhe.com/engcs/electrical/hkd/tutmenu.htm
v. http://en.wikipedia.org/wiki/Network_analysis_(electrical_circuits)
vi. http://www.indianshout.com/tag/circuit-theory-study-material

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. R. D. Raghani**, HOD, Dept. of Electronics and Communication, L.E. College of Engineering, Morbi

- **Prof.(Smt.) K. R. Shah**, Sr. Lecturer, Dept. of Electronics and Communication, Government Polytechnic, Ahmedabad

- **Prof. N. R. Merchant**, Sr. Lecturer, Dept. of Electronics and Communication, Government Polytechnic, Ahmedabad

- **Prof. D. R. Bhojani**, HOD, Dept. of Electronics and Communication, Darshan Institute of Engineering and Technology for Diploma Studies, Rajkot

Coordinator & Faculty Members from NITTTR Bhopal

- **Prof. (Mrs.) Susan S. Mathew**, Associate Professor, Dept. of Electrical and Electronics Engg.

- **Dr.(Mrs.) Anjali Potnis**, Assistant Professor, Dept. of Electrical and Electronics Engg.