GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
III – Semester
Course Title: Electronic Circuits & Networks

(Course Code: 4331101)

Diploma programmer in which this course is offered	Semester in which offered
Electronics and Communication Engineering	Third

1. RATIONALE

Electrical, Electronic, Instrumentation and allied engineering diploma holders are expected to Design and analyze various Electronic networks. "**Electronic Circuits & 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 purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Analyze Electronic Circuits & Networks in terms of Voltage, Current Power, Attenuation and Frequency Response.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Analyze the DC circuit to calculate voltage and current at various points in the circuit.
b) Understand Concepts Of Two Port Network With Parameters.
c) Use various network theorems to analyze electronic networks.
d) Calculate parameters of series/parallel resonant and coupled circuits.
e) Build different types of Attenuators and constant K-type passive filters.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	2	4	30	70	25	25	150

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

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.

5. SUGGESTED PRACTICAL EXERCISES

Following practical outcomes (PrOs) are the sub-components of the Course Outcomes (Cos). Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Determine voltage, current and power relationship for resistors connected in series, parallel and in combination.	1	02
2	Calculate current in the given resistive circuits using KCL.	3	02*
3	Calculate voltage in the given resistive circuits using KVL.	3	02*
4	For a given multisource network, determine the output impedance and voltage and verify it using Thevinin's Theorem	3	02*
5	Use Thevenin's Theorem to calculate Vth, Rth and load current for various numericals.	3	02
6	For a given multisource network, determine the value of current in The specified branch and verify it using Superposition theorem.	3	02
7	Use Superposition Theorem to calculate V and I for various numericals.	3	02
8	For a given multisource network, determine the output impedance And voltage and verify it using Norton's Theorem	3	02*
9	For a given multisource network, determine the output impedance And voltage and verify it using Maximum power transfer theorem.	3	02
10	For series resonance circuit, determine the frequency response curve to obtain the resonance frequency, resonant impedance, Bandwidth (BW)and Quality factor for series resonance circuit.	4	02*
11	For a parallel resonance circuit, determine the frequency response Curve to obtain the resonance frequency, resonant impedance, Bandwidth	4	02*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	(BW) and Quality factor.		
12	Calculate resonance frequency and various parameters (Q Factor, BW, and Selectivity) of Series and Parallel resonant circuit.	4	02
13	Build and test T-type, π-type attenuator for given attenuation.	5	02*
14	Using the relation N=Is/IR and design equations of R1 and R2 for Symmetrical T and π types of attenuators offering given amount of attenuation solve the numericals.	5	02
15	For the given parameters ,build constant K-low pass filter (T and π sections)	5	02*
16	For the given parameters, build constant K-high pass filter(T and π sections)	5	02*
17	To solve numericals for constant K-low pass and high pass filter(T and π sections)	5	02
	Minimum14PracticalExercises		**34**

Note

*i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Prepare of experimental setup	20
2	Operate the equipment setup or circuit	30
3	Follow safe practices measures	10
4	Record observations correctly	30
5	Interpret the result and conclude	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to user in uniformity of practical's in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Dual variable DC power supply ,0- 30V, 2A, With Short circuit protection, separate display for voltage and current	1,2,3,4
2.	Cathode Ray Oscilloscope ,Dual Trace 20Mhz, 1MegaΩ Input Impedance	1,2,3,4,5
3.	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude.	1,2,3,4,5
4.	Digital Multimeter: 3 1/2 digit display, 9999 counts digital multimeter measures: Vac, Vdc (1000V max), Adc, Aac (10 amp max) , Resistance (0 – 2 Mega Ohm) , with diode and transistor tester	1,2,3,4
5.	Bread Board 840 -1000 contact points: Positive and Negative DC power rails on opposite sides of the board	1,2,3,4
6.	Trainer kit for Network Theorems, Resonance and Passive Filters	1,2,3,4,5

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a) Work as a leader/a team member.
b) Follow safety practices while using electrical, electronics, pneumatic instruments and tools.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit–I **Network Elements And Network Topology**	1a. Define network elements . 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	1.1 Active elements, Passive elements, Bilateral and unilateral elements, Lumped and distributed elements, Linear and nonlinear elements. 1.2 Resistors connected in series, parallel and in combination 1.3 Capacitors connected in series,

	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	parallel and in combination 1.4 Inductors connected in series, parallel and in combination 1.5 Voltage and Current division method
	1f. Explain Energy source and source transformation. 1g.Differentiate between voltage source and current source.	1.6 Energy sources 1.7 Transformation of energy sources- Voltage source to current source and vice versa (ideal and practical)
	1h. Define various terms related to network topology.	1.8 Branch, Node, Loop, Mesh and terms related to network topology 1.9 The" graph" of a network 1.10 "Tree" of a network 1.11 Link current: Tie-set Schedules 1.12 Tree-branch voltages: Cut set Schedules 1.13 Mesh current method of choosing current variables 1.14 Loop current method 1.15 Node-pair voltage Method 1.16 Node-to-datum Voltage Method
UNIT- II **Two Port Networks**	2a.Distinguish the various networks.	2.1 Passive and Active, Linear and Non-linear, Lumped and Distributed, Unilateral and Bilateral, Symmetrical and Asymmetrical, Single port and Two port Network
	2b. Explain Network Configuration	2.2 T and π section : Symmetrical and Asymmetrical sections
	2c. Represent Two Port Parameter	2.3 Representation of Z-parameter 2.4 Representation of Y-parameter 2.5 Representation of h-parameter 2.6 Representation of ABCD parameter
	2d. Define various two port impedances	2.7 Transfer Impedance, Driving point Impedance, Image Impedance and Terminating Impedance, Input and Output Impedances

	2e. Describe steps to obtain characteristic impedance of standard T and π networks (ZOT and ZOπ) 2f. Describe steps to obtain relation between ZOT and ZOπ	2.8 Characteristic Impedance of standard T and π networks (Z_{OT} and $Z_{O\pi}$) and relation between them
	2g.Describe steps of conversion between T to π networks and vice versa	2.9 T to π and π toT network conversion or Star to Delta and Delta to Star conversion
Unit–III **Network Theorems**	3a. Analyze the circuit to Calculate voltage and current in the given resistive circuits using KCL and KVL 3b.Analyse the resistive circuits to calculate voltage and current using Mesh and nodal analysis method 3c.Explain the steps to find the dual of given circuit having R-L-C	3.1 Kirchhoff's Voltage and Current law(KVL and KCL) 3.2 Mesh Analysis and Nodal Analysis of Networks 3.3 Principle of Duality
	3d.Explain the steps to Calculate the current in any branch of the circuit using Superposition Theorem. 3e. Use Superposition Theorem to calculate the current in any branch of the circuit. 3f.Explain the steps to calculate the Vth, Rth and load current in the circuit using Thevenin's Theorem. 3g.Use Thevenin's Theorem to calculate Vth, Rth and load current in the given circuit. 3h. Explain the steps to calculate the load current in the circuit using Norton's Theorem. 3i. Calculate the load current in the given circuit using Norton's Theorem. 3j. Describe the Maximum Power Transfer condition for any given circuit 3k. Define the Reciprocity Theorem	3.4 Super Position Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem

Unit–IV **Resonance and Coupled Circuits**	4a.Determine Quality factor of a Coil and Capacitor. 4b. Analyze 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.	4.1 Quality factor or Q-factor of coil and capacitor 4.2 Series and parallel resonant circuit, resonance frequency, impedance at resonance, bandwidth and selectivity of series and parallel resonance circuit. 4.3 Coupled circuit**,** mutual Inductance 4.4 Derive equation for co-efficient of coupling
Unit–V **Attenuators & Filters**	5a.Classify various types Of attenuators. 5b.Explain relation between decibel and neper 5c.Using the relation N= Is / IR obtain the equations of R1 and R2for Symmetrical T and π Types of attenuators offering Given amount of attenuation (Kirchhoff's Laws and Mesh analysis) 5d.Define Lattice attenuator	5.1 Attenuators, T and π attenuators, Lattice attenuators
	5e. Classify the various passive Filter circuits. 5f. Derive the cut-off frequency equations for constant-k type, T and π sections of low Pass and High Pass filters 5g. 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. 5h. Use the equations R02=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. 5i. Describe limitations of constant-k type filters. 5j. Compare high pass, low pass, band Pass and band stop filters.	5.2 Classification of passive filters 5.3 Passive Filters: Constant 'K 'type filter (T and π sections – Low Pass, High Pass) 5.4 Introduction and comparison of band pass and band stop filters

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Network Elements and Network Topology	10	05	05	05	15
II	Two port networks	06	03	04	05	12
III	Network Theorems	08	05	06	04	15
IV	Resonance and Coupled Circuits	08	02	06	06	14
V	Attenuators and Filters	10	02	06	06	14
Total		**42**	**17**	**27**	**26**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's 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

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

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

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

b) Guide student(s) in undertaking micro-projects.

c) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.

d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature can be given to the students for ***self-learning***, but to be assessed using different assessment methods.

e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro project should be about **14**-**16** ***(fourteen to sixteen) student engagement hours*** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Different types of electronic component: Prepare a board consist of different Resistor, Capacitor, Inductor, chokes, transformer, fuse, diode, and transistor.

13. SUGGESTED LEARNING RESOURCES

S.No.	TitleofBook	Author	Publication
1.	Network Analysis	Mithal G.K.	KhannaPublication,2008orlatest Edition
2.	Network Analysis and Synthesis	Chakraborti A.	DhanpatRaiPublication,2009orlatestedition
3.	Networks and Transmission lines	T. AnilKumar	PearsonEducation,2006orlatestedition
4.	Networks Lines and Fields	RyderJ.D.	PrenticeHallInc.2008orlatestedition
5.	Network Analysis	M.E.VanValkenburg	PrenticeHallInc.2011orlatestedition

14. SOFTWARE/LEARNING WEBSITES

a. http://www.nptel.com
b. http://www.allaboutcircuits.com/vol_1/index.html
c. http://en.wikipedia.org/wiki/Electrical_network
d. http://www.mhhe.com/engcs/electrical/hkd/tutmenu.htm
e. http://en.wikipedia.org/wiki/Network_analysis_(electrical_circuits)
f. http://www.indianshout.com/tag/circuit-theory-study-material

15. PO-COMPETENCY-CO MAPPING

Semester III	Electronic Circuits & Networks (Course Code: 4331101)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ develop-ment of solutions	PO 4 Engineering Tools, Experimen-tation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Manage-ment	PO 7 Life-long learning
Competency	Analyze Electronic Circuits & Networks in terms of Voltage, Current Power, Attenuation and Frequency Response.						
Course Outcomes CO1 Analyze the DC circuit to calculate voltage and current at various points in the circuit.	3	3	3	3	2	2	2
CO2 Understand Concepts Of Two Port Network With Parameters.	3	3	2	2	1	1	3
CO3 Use various network theorems to analyze electronic networks.	3	3	2	2	1	2	2
CO 4 Calculate parameters of series/parallel resonant and coupled circuits.	3	2	3	2	2	2	2
CO 5 Design different types of Attenuators and constant K-type T and pai type filters.	3	3	3	2	2	2	2

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Sr. No.	Name and Designation	Institute
1.	Kshama Rajesh Shah ,Lecturer EC	Government Polytechnic , Gandhinagar
2.	Aruna J Solanki ,Lecturer EC	BBIT,V V NAGAR
3.	Ravindra .R. Dudani , Lecturer EC	AVPTI RAJKOT