GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Electronics And Communication Engineering

Course / Subject Code: DI03011031

Course / Subject Name: Electronics Circuit Network & Measurement

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC

Prerequisite:	Basics of power supply, electronic components like resistor, capacitor, inductor, diode, transistors. Use of multimeter for basic parameter measurement. Knowledge of Ohm's Law.
Rationale:	Troubleshooting of electronic equipment is an essential skill required in service sector industry, which is growing very fast in our country. This course will help students to develop skills to become professional technicians with capability to measure various electrical, electronic and instrumentation parameters using instruments. By learning this course, students will be able to know the basics and use of various Instruments, transducers, sensors and working of electronic circuits used in electronic test and measuring instruments.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Analyze electrical network comprising various network elements.	R, U, A
02	Design various constant K type passive filters	R, U, A
03	Measure values of various passive components with proper accuracy, precision and resolution	R, U, A
04	Measure various signal parameters using advanced electronic instruments.	R, U, A
05	Select appropriate transducer and sensor for measurement of physical quantity.	R, U, A

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Teaching and Examination Scheme:

Teaching Scheme (In Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1 Network Elements and Network Analysis	1.1 Network Elements: Active, Passive, Bilateral, Unilateral, Lumped, Distributed, Linear and Non-Linear Elements 1.2 Distinguish the various networks: Passive and Active, Linear and Nonlinear, Lumped and Distributed, Unilateral and Bilateral, Symmetrical and Asymmetrical, Single port and Two port Network 1.3 Representation of Two Port Parameter:Z-parameter, Y-parameter, h-parameter, ABCD parameter 1.4 Define various two port impedances: Transfer Impedance, driving point Impedance, Image Impedance and Terminating Impedance, Input and Output Impedances 1.5 Define various terms related to network topology: Branch, Node, Loop, Mesh 1.6 Series and parallel connection of resistors, Mesh Analysis and Node Analysis 1.7 Network Theorems: Thevenin, Norton, Superposition, Maximum Power Transfer, Reciprocity, Principle of Duality	10	20 %

2 Resonance Circuits and Passive Filters	2.1 Determine Quality factor of a Coil and Capacitor. 2.2 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. 2.3 Classify various passive filter circuits 2.4 Design constant-k type Low Pass Filter 2.5 Design constant-k type High Pass Filter	08	20 %
3 Characteristic of Measurement and Bridges	3.1 Define Instrument, Error, Accuracy, Reproducibility and Repeatability. Precision, Sensitivity, Resolution, Linearity, Response time 3.2 Describe types of Error & Limiting of errors 3.3 Explain working and applications of AC and DC Bridge. 3.4 Wheatstone bridge,it's working and limitations 3.5 Maxwell's bridge 3.6 Schering bridge	09	20 %
4 Basic Electrical Parameter measurement	4.1 Differentiate between moving iron and moving coil type instruments. 4.2 Electronic Multimeter and its advantages 4.3 Explain working of Digital panel meter for voltage,current and frequency measurement 4.4 Explain working of clamp on Ammeter, Electronic Wattmeter and energy meter. 4.5 Electronic Multimeter and its advantages 4.6 Explain Construction, Block diagram, working and advantage of Digital Storage Oscilloscope (DSO)	09	20 %
5 Transducers and Sensors	5.1 Classification of transducers (active, passive, primary,secondary resistive,capacitive,inductive) 5.2 Describe working of LVDT and inductive transducer. 5.3 Capacitive Transducer. Pressure measurement using capacitive transducer 5.4 Explain working and principle of Temperature Transducers. RTD, Thermistor, Thermocouple	09	20 %

	5.6 Explain the working principle of temperature sensor (LM35), Gas sensor (MQ2) Humidity sensor(DHT-11), Ultrasonic sensors. 5.7 Explain absolute and incremental type of Optical encoder and its A,B,C waveform output		
	Total	**45**	

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	**40**	**30**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Network Analysis by *Mithal G.K.*, Khanna Publication,2008 or latest Edition
2. Network Analysis and Synthesis by Chakraborti A.Dhanpat Rai Publication,2009 or attest edition
3. Network Analysis by *M.E. Van Valkenburg*, PrenticeHallInc.2011orlatestedition
4. Electronic Instruments and Measurement Techniques Cooper, W.D. Halfrick, A.B. PHI Learning, New Delhi, latest edition
5. Elements of Electronic Instrumentation and Measurement, Joseph, J.Carr, Pearson, New Delhi, latest edition
6. Sensors and Their Applications, By S. J. Prosser, E. Lewis, CRC Press

(b) software / website:

1. http://www.allaboutcircuits.com/vol_1/index.html
2.https://onlinecourses.nptel.ac.in/noc25_ee53/preview
3. www.nptel.iitm.ac.in
4. www.khanacademy.org
5. https://phet.colorado.edu

6. https://ndl.iitkgp.ac.in
7. www.electrical4u.com
8. www.vlab.co.in
9. www.techtronics.in
10. www.scientificindia.com
11. www.sensorland.com/HowPage037.html
12. www.elprocus.com/category/sensors/
13. https://www.electronicscomp.com/
14. https://onlinecourses.nptel.ac.in/noc19_ee44/preview
15. https://thinkrobotics.in/

Suggested Course Practical List

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx Hours required
1	Use Thevenin's Theorem to calculate Vth, Rth and load current for various numerical.	1	02
2	For a given multisource network, determine the value of current in the specified branch and verify it using Superposition theorem	1	02
3	For a given network, determine the output impedance And voltage and verify it using Norton's Theorem	1	02
4	For a given multisource network, determine the output impedance And voltage and verify it using Maximum power transfer theorem.	1	02
5	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.	2	02
6	For a parallel resonance circuit, determine the frequency response Curve to obtain the resonance frequency, resonant impedance, Bandwidth (BW) and Quality factor.	2	02
7	For the given parameters, build constant K-low pass filter (T and π sections)	2	02
8	For the given parameters, build constant K-high pass filter (T and π sections	2	02
9	Measure voltage, current, and resistance using Digital Multimeter and analog millimeter and, and calculate error in the measurement.	2	02

10	Measure the value of unknown resistor using Wheatstone bridge.	3	02
11	Measure value of unknown inductor using Maxwell Bridge.	3	02
12	Measure Vrms , Vmax, Vp-p ,V average ,time and frequency of given signal using Analog oscilloscope	4	02
13	Obtain characteristics of LVDT.	4	02
14	Measure Temperature using Thermocouple.	4	02
15	Measure temperature using RTD.	4	02
16	Detection of Gas using a Gas sensor.	5	02
17	Measure Humidity using a Humidity Sensor.	5	02
18	Observe and draw output waveforms of rotary encoder	5	02
19	Mini/Micro project on general purpose/ Ki-Cad PCB	All COs	02
20	Mini/Micro project using Arduino Board and any one sensor	All COs	02
	Minimum 15 Practical Exercises		**30 Hours**

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.*

*ii. 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.*

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

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-project are group-based. However, in the fifth and sixth semesters, it should be preferably be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should not exceed three.

The micro-project could be industry application 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 a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. *The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course.* The student ought to submit a 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) Build a small circuit on bread board for Thevenin and Norton theorems.
b) Build a constant K low pass passive filter on bread board
c) Build a constant K high pass passive filter on bread board
d) Build a small circuit for 30 V DC measurement using PMMC meter
e) Build a simple circuit to measure DC voltage using ICL 7107 or MAX07
f) Build a small circuit for 300 V ac measurement using PMMC meter
g) Build a simple counter circuit for measuring line frequency (50 Hz)
h) Build a simple circuit for measurement of displacement using optical encoder
i) Build a simple circuit for measurement of room temperature using LM35
j) Build a simple circuit of function generator using IC 8038 or XR2206
k) Disposal of old instruments – Prepare a chart or report on handling, recycling and disposal of old instruments with figures, tables and comparative charts and strategies used or suggested.

Suggested Activities for Students:

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 conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare specification of electronics instruments.
b) Give seminars on DSO, MSO, Various transducers and sensors.
c) Undertake a market survey of different electronics instruments.
d) Prepare plan for disposal of E-waste of old and non-use electronic instruments as per GPCB and CPCB guidelines.

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