GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: ELECTRONICS INSTRUMENTS AND MEASUREMENT
(Code: 3341104)

Diploma Programme in which this course is offered	**Semester in which offered**
Electronics And Communication Engineering	4th Semester

1. RATIONALE

Troubleshooting of electronic equipment is an essential requirement of Service sector industry. This course will help to develop skills to become professional technician with capability to measure electrical parameters using various instruments. By learning this course students will able to know basics of various Instruments, transducers and working of electronic circuits used in electronic test and measuring instruments.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of following competency

- **Maintain various electronic, test and measuring instrument.**

3. COURSE OUTCOME

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

i. Measure various electrical parameters with accuracy, precision, resolution.
ii. Use AC and DC bridges for relevant parameter measurement.
iii. Select appropriate passive or active transducers for measurement of physical phenomenon.
iv. Use Signal Generator, frequency counter, CRO and digital IC tester for appropriate measurement.
v. Test and troubleshoot electronic circuits using various measuring instruments.
vi. Maintain various types of test and measuring instruments.

4. TEACHING AND 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	
3	-	2	5	70	30	20	30	150

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

5. COURSE DETAIL

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Characteristic of Measurements and Bridges	1a. Define accuracy, precision, resolution	1.1 Accuracy, precision, resolution, error and noise
	1b. Describe the types of error	1.2 Types of errors 1.3 Limiting of errors
	1c. Explain working and application of DC bridges	1.4 Wheatstone bridge, Kelvin's double bridge
	1d. Explain working and application of AC bridges	1.5 Maxwell's bridge, Hay bridge, Schering bridge
Unit – II Basic Parameter Measurements	2a. Differentiate between moving iron and moving coil type instruments 2b. Measure DC and AC voltage and current using analogue meter. 2c. Extend the measuring range of the meters.	2.1 Moving coil and moving iron type instruments 2.2 DC and AC voltmeter
	2d. Explain its working of DVM with sketches. 2e. Describe working and advantage of digital multi meter	2.3 Electronic multimeter (DVM) 2.4 Types- ramp type, integrating type and successive approximation type DVMs
	2f. Discriminate between energy and power. 2g. Measure energy and power using Watt meter and Energy Meter. 2h. Describe the construction of hot wire instrument .	2.5 Watt meter, Energy meter, clip-on meter 2.6 Hot wire instrument
	2i. Describe its working LCR –Q meter with sketches 2j. Measure quality factor of a	2.7 LCR- Q meter : Basic circuit, applications 2.8 Series and parallel

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	coil and a capacitor .	connection of Capacitor and Inductor.
Unit – III Oscilloscopes	3a. Describe functions of basic building of CRO 3b. Explain deflection systems. 3c. Measure parameters viz. Amplitude, frequency and time period using CRO.	3.1. Block diagram of C.R.O. 3.2. Cathode ray tube: construction, operation, screens, graticules 3.3. Vertical deflection system, Horizontal deflection system, Delay line, 3.4. Measurement of frequency, time delay, phase angle and modulation index (trapezoidal method) 3.5. Oscilloscope probe: structure of 1:1 and 10:1 probes 3.6. multiple trace CRO
	3d. Explain working principle of digital storage oscilloscope.	3.7. Digital storage oscilloscope and its features
Unit – IV Transducers	4a. Differentiae the following: active and passive, primary and secondary transducers. 4b. Describe working of LVDT transducer.	4.1. Classification of transducers 4.2. Unbonded strain gauge 4.3. Displacement transducers 4.4. LVDT
	4c. Explain the principle of Capacitive and Inductive transducer	4.5. Capacitive transducers 4.6. Inductive transducers 4.7. Resistive and capacitive touch screen transducer used in mobile
	4d. Describe functions of velocity and pressure transducers. 4e. Explain optical & stroboscopic tachometer.	4.8. Piezo-electric transducer 4.9. Velocity transducer 4.10. RPM measurement technique
	4f. Describe the working if different types of temperature transducers. 4g. Explain principle of Thermocouple. 4h. Describe working of of RTD and Thermistor	4.11. Temperature measurement: Thermocouples: Seebeck, Peltier Effect, J,K,R,S,T Types, Thermistors 4.12. Resistance thermometer RTDs – PTC,PT-100 (2-3-4 Wire systems-only circuit

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – V Test And Measuring Instruments	5a. Describe working principle of function generator. 5b. Describe working principle of audio signal generator. 5c. Describe working principle of Sweep frequency generator	5.1. Function generator 5.2. Audio frequency signal generation 5.3. Sweep frequency generator
	5d. Define pulse parameters viz. pulse duration ,pulse width, duty cycle, On and off time of pulse	5.4. Pulse and square wave generator
	5e. With sketches explain the functions of different types of frequency counters	5.5. Simple frequency counter, Display counter, Cascading counters 5.6. Multiplexing of display in frequency counter 5.7. Period measurement
	5f. Explain working of digital IC tester. 5g. Explain working of Logic analyzer 5h. Explain working function of Spectrum analyzer. 5i. Explain working function of Harmonic distortion analyzer. 5j. Explain working function of Field Strength Meter.	5.8. Digital IC tester, Logic analyzer, Spectrum analyzer, Harmonic distortion analyzer, Field strength meter (dB meter)

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Characteristic of Measurements and Bridges	05	04	03	03	10
II	Basic Parameter Measurements	10	03	06	07	16
III	Oscilloscopes	07	02	08	02	12
IV	Transducers	10	03	05	08	16
V	Test and Measuring Instruments	10	02	08	06	16
Total		**42**	**14**	**30**	**26**	**70**

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

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

7. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.*
Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

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S. No.	Unit No.	Practical/Exercise (outcomes in psychomotor domain)	Approx. Hrs. Required
1	I	Measure various parameters viz. voltage, current, resistance using Digital Multimeter.	2
2	I	Measure the value of unknown resistor using Wheatstone bridge.	2
3	II	Convert given galvanometer to DC/AC current- meter.	2
4	II	Convert given galvanometer to DC/AC Volt-Meter.	2
5	II	Measure quality Factor of given Inductor and Capacitor using LCR Q-Meter.	
6	IV	Obtain characteristic of LVDT.	2
7	IV	Obtain characteristics of strain gauge.	2
8	IV	Obtain characteristics of thermocouple.	2
9	IV	Obtain characteristics of thermistor.	2
10	IV	Obtain characteristics of RTD transducer.	2
11	IV	Control temperature using RTD in any specific application.	2
12	III	Measure voltage, frequency, phase and modulation index (trapezoidal method) using CRO.	2
13	III	Measure Unknown frequency using Lissajous patterns.	2
14	III	Demonstrate features of digital storage oscilloscope.	2
15	V	Analyse sine/square wave in frequency domain using spectrum analyser.	
16	V	Test various digital IC using I.C. Tester.	2
17	V	Measure various RF signal strength using field strength meter.	2
	Total		34

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities:

i. Explore data sheets/ technical specifications of transducers.
ii. Present seminar on advanced Instrumentation topic.
iii. Mini project based on transducer.
iv. Explore Circuit of temperature/pressure control.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

i. Computer based CBT describing operation of transducer.
ii. Bridge simulation using Software like Electronic Workbench/multiSIM.
iii. Seminars /experts lecture and group discussion.
iv. Visit of Electronics Instruments calibration laboratories.

10. SUGGESTED LEARNING RESOURCES

(A) List of Books

S. No.	Title of Books	Author	Publication
1	Electronic Instruments and Measurement Techniques	Cooper, W.D. Halfrick, A.B.	PHI Learning, New Delhi, latest edition
2	Electrical and Electronic Measurements	Sahani, A.K.	Dhanpat Rai, New Delhi, latest edition
3	Elements of Electronic Instrumentation and Measurement	Joseph, J.Carr	Pearson, New Delhi, latest edition
4	Electronic Instrumentation and Measurements	David, Bell	PHI New Delhi, latest edition
5	Electronic Measurements and Instrumentation	Kishor, K Lal	Pearson, New Delhi, latest edition

B. List of Major Equipment/Materials with broad specification

i. Function generator
ii. Digital multimeter
iii. D.C. power supply
iv. Cathode Ray Oscilloscope
v. Digital Storage Oscilloscope
vi. LCR-Q meter
vii. Field strength meter(dB meter)
viii. Experimental trainer kits, Bread board, Computers

C List of Software/Learning Websites

i. Electronic Workbench/MultiSIM/Circuit Maker
ii. www.ocw.mit.edu
iii. www.home.agilent.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Shri B. P. Raval**, Sr. Lecturer, (EC), Government Polytechnic, Rajkot
- **Shri B. B. Renuka**, Sr. Lecturer, (EC) Government Polytechnic, Ahmadabad
- **Shri A. R. Chandegara** Sr. Lecturer, (EC), Government Polytechnic, Palanpur

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. (Mrs.) Anjali Potnis**, Assistant Professor, Department of Electrical and Electronics Engineering.
- **Prof. (Mrs.) Susan S. Mathew,** Associate Professor**,** Department of Electrical and Electronics Engineering.