

B. Tech. Year II Semester III

Subject Name: Electrical & Electronic Instrumentation
Code: BTIC13302

Subject

Type of course: PCC

Prerequisite (if any): Basic Electrical Engineering, Physics.

List of Courses where this course will be prerequisite: Industrial Measurement I, Industrial Measurement II, Analog Signal Processing, Power Electronics

Rationale: To prepare students for experiments and design with various electrical, electronic measurements and instrumentation systems.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Content	Total Hrs	
1	Methods of measurement- direct methods, indirect methods, instruments- mechanical, electrical and electronic instruments, classification of instruments- analog and digital, elements of generalized measurement system, standards and their classification	3	6%
2	Analog DC and AC meters PMMC construction, analog DC ammeters, analog DC voltmeters, analog AC ammeters, analog AC voltmeters, analog multi-meters, special purpose analog meters, extending the range of meters, moving iron instruments-attraction type and repulsion type electro-dynamometer type instruments-construction and working, true RMS voltmeter	8	16%
3	DVM- Ramp type, Integrating type, Successive approximation type, Digital Multi-meter Displays: LED, LCD, 7-segment, types of 7-segment displays	3	8%
4	Cathode ray Oscilloscope: Introduction, Cathode Ray Tube, Vertical and Horizontal Deflection Systems, Delay lines, Probes and Transducers, Specification of an Oscilloscope, Special Oscilloscopes – Digital Storage Oscilloscope, Sampling Oscilloscope, measurement of voltage and current, measurement of phase and frequency(Lissajous pattern)	6	15%

5	Power and Energy measurement Power in AC-DC circuits, single phase power measurements, Poly phase power and measurements, measurement of power factor, Electrical energy measurements, Power measurement problems, applications of Current and Potential transformers	5	12%
6	D.C potentiometers, D.C bridges-Wheat stone, Kelvin and Kelvin Double bridge, A.C bridges - Maxwell, Anderson , Schering, Hays bridge, Q factor Interference signals and their elimination: Capacitance Interference, inductive Interference and shielding, electromagnetic Interference and shielding, conductive coupling Interference, ground loop Interference and input guarding to reduce internal noise	7	15%
7	Data transmission and communication The Open System Interconnection (OSI) Architecture, functions of each layer Amplitude Modulation (AM) theory - Frequency spectrum of AM wave, mathematical representation of AM wave, Frequency Modulation (FM) theory - Frequency spectrum of FM wave, mathematical representation of FM wave, Phase modulation (PM) ,RS 232C standard, 20 mA current loop, RS 232 Interface standard	5	12%
8	Introduction to RS485 serial communication Introduction to serial communication, when where and why to use RS485, the RS485 standard, various levels of OSI model of RS485, RS485 network topology. Advantage of using RS485.	8	16%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
28	28	7	7	7	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

Sr no	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Student reference manual for Electronics and Instrumentation measurement	Wolf & Smith,	PHI Publication, ISBN-13 : 978-0130421821	2003	2nd edition
2.	Electrical measurements and measuring	E.W. Golding and	Pitambar Publishing, ISBN-13	2011	5th edition

	instruments	F.C. Widdis	: 978-8190630726		
3.	Electronic Measurements and Instrumentation	Bernard Oliver and John Cage	Tata Mcgraw Hill, ISBN-13 : 978-0070139381	2017	International Student Edition
4.	Electronic Instrumentation and Measurement Techniques	William D. Cooper, Albert D. Helfrick	Prentice-Hall, ISBN-13 : 978-0132507219	1985	Old edition
5.	A course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawhney	Dhanpatrai Publication, ISBN-13 : 978-8177001006	2015	4th edition
6.	Electronic Instrumentation	H. S. Kalsi	McGraw Hill Education ISBN-13: 978-0070702066	2017	3rd edition
7.	Electronic Instrument Design	Kim Fowler	OUP, USA, 1996, ISBN-13: 978-0195083712	1997	--

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Measure resistance, inductance and capacitance with the help of different types of AC bridges.	25
CO-2	Demonstrate working of analog & digital meters.	30
CO-3	Describe working of different techniques for power, energy, frequency & time measurements.	20
CO -4	Demonstrate working of signal generators.	25

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO-1	3	3	2	0	0	0	0	0	3	0	0	2	3	1	1

CO-2	0	3	2	1	0	0	0	0	3	0	2	0	3	1	1
CO-3	0	3	3	2	2	0	2	0	3	2	2	0	3	2	1
CO-4	0	1	0	2	2	0	0	0	3	3	3	0	3	3	3
Rationale*															

Rationale* : Explaining why it is matching this particular program outcome

List of Open learning website:

<https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio>

(Copy the above link and paste in your browser)

List of Open Source Software:

FOR LAB SESSIONS:

List of Experiments:

1. Measurement of voltage and current using analog meter.
2. Extend the range of given ammeter and voltmeter.
3. Measurement of unknown resistance using Wheatstone bridge.
4. Measurement of low resistance using Kelvin double bridge.
5. Measurement of unknown inductance using Maxwell bridge.
6. Measurement of unknown inductance using Anderson bridge.
7. Measurement of unknown inductance using Hays bridge.
8. Measurement of unknown inductance using Schering bridge.
9. Operation of CRO for voltage, current and frequency measurement.
10. Operation of CRO to obtain Lissajous pattern for Phase angle measurement.
11. Operation of DSO for voltage, current and frequency measurement.
12. Calibration of single phase energy meter direct loading.
13. Measurement of power factor.
14. Develop application using CT and PT.
15. Develop application using RS232C
16. Develop application using 4-20mA current loop.

Major Equipment Needed:

CRO, DSO, AC/DC bridges, LCR meter, Power and Energy meter etc.