SARVAJANIK UNIVERSITY
SarvajanikCollege of Engineering and Technology
Bachelor of Technology

B.Tech. II Semester IV	
Subject Name: Electrical Measurement and Instruments	**Subject Code: BTEL13402**

Type of course: **Professional core course**
Prerequisite: NA
Rationale: Electrical installations ranging from residential or industrial consumers, all are equipped with measuring instruments. In view of this, study of principles of Electrical measurements and measuring instruments becomes mandatory for all electrical engineers. This subject deals with principles of measurements, and measuring instruments

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	5	60	25	15	30	20	

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.	Topics	Teaching Hrs.	Module Weightage
1.	**Measurement Systems** :- Performance and characteristics : Elements of generalized measurement system, input-output configuration of instruments and measurement systems, methods of connection for interfering and modifying inputs, static performance characteristics of measurement system, noise, signal to noise ratio, sources of noise. Standards: Standards and their classification, electrical standards: emf, current, resistance, inductance, and capacitance.	**05**	**11**
2.	**Measurement of Resistance, Inductance and Capacitance:** Classification of resistances, measurement of low resistance by Kelvin's bridge, measurement of medium resistance: precision measurement with Wheatstone's bridge, measurement of high resistance: direct deflection method, loss of charge method, megaohm bridge, and meggar, General 4 arm a.c. bridge network, theory ; vector diagram; merits and demerits of	10	**22**

	Maxwell's; Hay's; Anderson's ; Schering and Wien's bridge network, LCR meter - working principle with block diagram		
3.	Indicating and Integrating Instruments : Classification, operating principles, general constructional details of indicating instruments, deflecting, control and damping, theory and construction of PMMC; moving iron; and electrostatic and rectifier instruments, theory and construction of electro-dynamic wattmeter, methods of wattmeter connections, induction type energy meter, principles ofp.f. meter and frequency meter, Calibration of instruments, calibration of indicating instruments using DC potentiometer, calibration of induction type energy meter, power analyser	12	**27**
4.	Localization of Cable Faults :- Blavier, earth overlap & voltage drop tests for ground faults, loop tests for locating ground fault and short circuit faults : Murray's method, Varley's method and inverted loop method, localization of open circuit faults, induction method, test for flashing fault, pulse echo technique of localizing faults, treatment of fault.	07	**15**
5.	Instrument Transformers : Theory of current and potential transformers, ratio error and phase angle, testing of CT/PT : Biffi's method; and clothier – Medina method, use of CT/PT for extension of instruments range and measurement of power	07	**15**
6.	Digital instruments: Digital meter displays: LED and LCD, Digital voltmeters, Digital multi meter, Digital Storage Oscilloscope - Block Diagram, theory and applications.	04	**10**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
25	**30**	**20**	**10**	**10**	**5**

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

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

PCC: Professional Core Course

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Electrical and ElectronicMeasurements and Instrumentation	A.K.Sawhney	DHANPAT RAI & CO	2015	
2	Electrical Measurement and Measurement instrument	Golding &Widis	Wheelar Books		
3	A Course in Electronics and Electrical Measurements and Instrumentation	Gupta J. B	S.K. Kataria& Sons		
4	Measurement systems	Ernest O. Doebelin	Tata-McGraw Hill,	2011	6th Edition
5	Modern Electronic Instrumentation & Measuring Instruments	A. D. Heltrick&W.D. Cooper	PHI	1992	

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	**Comprehend the basics of electrical measurements and digital instruments.**	20
CO-2	**Describe the importance of bridges networks (AC and DC) for the accurate measurement of various electrical parameters (R, L, C)**	25
CO-3	**Describe the importance and principle of operation of different indicating and integrating instruments**	25
CO-4	**Identify the importance of different methods for the accurate localization of cable faults**	15
CO-5	**Identify the necessity and utilization of instrument transformer for the measurement of current or voltage**	15

Mapping with POs:

PCC: Professional Core Course

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
CO-1	3	2	1	2	1			1	1		1		3		
CO-2	3	2	1	2	1				2		2		3	1	
CO-3	3	2	1	2	1				2		2		3	1	
CO-4	3	2	1	2	1	1			2		2		3		
CO-5	3	2	1	2	1	1			2		2		3		
Rationale*															

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

LIST OF PRACTICALS: (Minimum 8 performed.)

1. To measure value of unknown capacitance by Schering's bridge.
2. To measure unknown inductance by & demonstrate operation of Hay's bridge.
3. To calibrate voltameter using potentiometer.
4. To locate fault using Murray loop method.
5. To locate fault using Varley loop method
6. To demonstrate the Kelvin Double Bridge for Low resistance measurement.
7. To measure value of unknown resistance, inductance and capacitance using LCR meter.
8. To measure medium resistance using whetstone's bridge.
9. Measurement of current/volatge using shunt/multiplier.
10. Testing of CT by Biffi's method.
11. Measurement of different parameters using power analyser.

Major Equipment:

1. LCR meter
2. Wheatstone bridge, Kelvin's double bridge
3. Hay's bridge, Schering bridge
4. Potentiometer

List of Open Source/learning website:

- https://vlab.co.in
- https://nptel.ac.in

PCC: Professional Core Course