CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication)**

Semester: **IV**

Course Code: **202060401**

Course Title: **Instrumentation and Measurements**

Course Group: Professional Core Course

Course Objectives: The objective of the course is to introduce the student fundamentals of Electronics Instruments and Measurement providing an in-depth understanding of Measurement errors, Bridge measurements, Digital Storage Oscilloscope, Function Generator and Analyzer, Isolation techniques, Data acquisition systems and transducers.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Qualities of Measurements and Measurement Errors:** Introduction, Performance Characteristics, Static Characteristics, Dynamic Characteristics, Measurement Errors and Standards: Definitions, Accuracy and Precision, Significant Figures, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors, Time and Frequency Standards, Electrical Standards	6
2	**DC/AC Bridges**: Bridge Fundamentals, Equations for bridge balance, Bridge Classification, measurement of low and high resistances, Wheatstone Bridge, Kelvin's double bridge measurement of self-inductance by Maxwell's bridge (with variable inductance & variable capacitance), Hay's bridge, Owen's bridge, measurement of capacitance by Shearing bridge	6
3	**Transducer:** Introduction, Electrical Transducer, Selecting a Transducer, Strain Gauges, Capacitive Transducers, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Optical Transducer, Capacitor (Condenser) Microphone, Piezo-Electric transducers, photo-electric tachometers, Hall Effect Transducer	6

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4	**Oscilloscope:** Introduction to Oscilloscope, Basic Principle, Block diagram of Oscilloscope, sweep generation, vertical amplifiers, use of CRG in measurement of frequency, phase, Amplitude and rise time of a pulse, Digital Storage Oscilloscope fundamentals, Block diagram, Comparison of CRO and DSO	**6**
5	**Signal Generators and Signal Analyzer:** Introduction, Sine-wave generator, standard signal generators, Audio frequency signal generation, Pulse generator, Function generator, Construction and operation of Signal analyzer, Wave analyzer	**7**
6	**Isolation Techniques:** Transformer Isolation, Optical Isolation, Digital Techniques for Optical Isolation, Hall-Effect Principle and Measurement of displacement, Current and power using Hall sensors, Guarding, Shielding.	**7**
7	**Data Acquisition System:** Signal conditioning and its necessity, process adopted in signal conditioning, Functions of Signal conditioning, AC/DC Conditioning systems, Data conversion: ADC, DAC, Generalized data acquisition system: single channel and multi-channel DAS.	**7**
		45

List of Practicals / Tutorials:

1	To study the front panel controls of storage CRO and Measurement of frequency using Lissajous method.
2	To study and verify characteristic of strain gauge transducer.
3	To study and verify characteristic of LVDT.
4	To study and verify characteristic of Thermocouple.
5	To study and verify characteristic of Thermistor.
6	To study and verify characteristic of RTD.
7	To study and verify characteristic of Thermocouple.
8	To find the value of unknown capacitance and inductance using Maxwell's bridge.
9	To find the value of unknown resistor using Wheatstone bridge.
10	To demonstrate signal acquisition with the help of DAQ Card.
11	To Learn advance Data Acquisition with virtual instrumentation.
12	Open Ended Problem based on real time application

Reference Books:

1	David A. Bell**, Electronic Instrumentation and Measurements,** 3rd Edition, Oxford University Press.
2	A. K. Sawhney, **A course in Electrical and Electronic Measurements and Instrumentation**, Dhanpat Rai & Sons.
3	M B Stout, **Basic Electrical Measurements**, 2nd Edition, Prentice Hall.
4	R.K. Rajput, **Electronic Measurements and Instrumentations**, 2nd edition S. Chand Pub.
5	A.D. Helfrick and W.D. Cooper **Modern Electronic Instrumentation and Measurement Techniques**, 3rd Edition, Prentice Hall.

Supplementary learning Material:	
1	Joseph J. Carr: "Elements of Electronic Instrumentation and Measurement", Pearson Education Publications.
2	A course on Electrical Measurement and Electronic Instruments by Prof. Avishek Chatterjee,

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	IIT Kharagpur on Swayam Portal
3	H. S. Kalsi: "Electronic Instrumentation", 3rd edition, The Tata McGraw-Hill Publication

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20	20	20	20	10	10	

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.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Explain basic concepts and definitions in measurement	**10**
CO-2	Explain the operation and design various Bridges with their applications.	**20**
CO-3	Gain Knowledge on Utilization & interpretation of various Transducers along with practical implementation.	**20**
CO-4	Explain fundamentals for Signal generators, Signal analyzer and Oscilloscope	**30**
CO-5	To understand basics of isolation techniques and data acquisition process and utilize for measurement.	**20**

Curriculum Revision:	
Version:	**2.0**
Drafted on (Month-Year):	June -2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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