ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

V Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECC20	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes:15	Practical Classes: Nil				Total Classes: 60		

Prerequisites: Electronic Devices and Circuits

I. COURSE OVERVIEW:

The purpose of this course is to design, realization and use of electronic systems for the measurement of electrical and non-electrical quantities. It gives an emphasis on analog and digital instruments, oscilloscopes, signal generators, signal analyzers, AC/DC bridges and transducers. The knowledge of measurements and instrumentation is used to test and analyze the performance of measuring instruments in the field of science, engineering and technology.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The performance characteristics and working principle of analog and digital instruments for measuring electrical quantities.
II. The analysis of various signals by using oscilloscopes and signal analyzers which have built in signal generators.
III. The measurement of unknown resistive and reactive components by using various AC and DC bridge circuits.
IV. The construction and working of transducers for the conversion of physical quantities into electrical quantities.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Illustrate** the fundamentals and working principle of analog and digital instruments for measuring of electrical parameters.	Understand
CO 2	**Demonstrate** the building blocks and functionality of oscilloscopes to display and measure the parameters of the signals.	Understand
CO 3	**Utilize** the signal generators to produce various signals for design and test the signal processing applications.	Apply
CO 4	**Analyze** the relative amplitude of the signal and its harmoniccomponents in frequency domain by using Signal Analyzers	Analyze
CO 5	**Identify** appropriate bridge circuits for the measurement ofunknown electrical parameters.	Apply
CO 6	**Select** the suitable transducers for measuring electrical and non-electrical parameters to resolve the real-world problem.	Apply

IV. COURSE SYLLABUS:

MODULE –I: INTRODUCTION TO MEASURING INSTRUMENTS (08)

Block schematics of measuring systems, performance characteristics, Static characteristics: Accuracy, resolution, precision, gauss error, types of errors, Dynamic characteristics : Repeatability, reproducibility, fidelity, lag; Analog measuring instruments: D' Arsonval movement, DC voltmeters and ammeter, AC voltmeters and current meters, ohmmeters, multimeters, meter protection, extension of range, digital voltmeters: Ramp type, staircase, dual slope integrating type, successive approximation type, Specifications of instruments.

MODULE –II: OSCILLOSCOPE (09)

Oscilloscopes: CRT, block schematic of CRO, time base circuits, delay lines, high frequency CRO considerations, Applications. Special purpose oscilloscopes: Dual trace, dual beam CROs, Sampling oscilloscopes, Storage oscilloscopes, Digital storage CROs.

MODULE –III: SIGNAL GENERATOR AND SIGNAL ANALYZERS (09)

Signal Generators: AF and RF signal generators, sine and square wave generators, function generators: arbitrary waveform generator, sweep frequency generators, video signal generators, and specifications.

Signal Analyzers: AF, HF wave analyzers, heterodyne wave analyzers, harmonic distortion, spectrum analyzers, power analyzers.

MODULE –IV: AC AND DC BRIDGES (10)

Measurements using DC and AC bridges: Wheat stone bridge, Kelvin bridge, AC bridges, Maxwell, Hay, Schering, Wien, Anderson bridges, wagner & ground connection.

MODULE –V: TRANSDUCERS (09)

Transducers: Classification, strain gauges, bounded, unbounded; Force and displacement transducers, resistance thermometers, hotwire anemometers, LVDT, thermocouples, synchros, special resistance thermometers, piezoelectric transducers, variable capacitance transducers, magneto strictive transducers.

Measurement of Physical Parameters: Flow measurement, displacement meters, liquid level measurement, temperature - measurements, data acquisition systems.

V. TEXT BOOKS:

1. K.LalKishore, "Electronic Measurements and Instrumentation", Pearson Education, 2nd Edition, 2010.
2. H.S.Kalsi, "Electronic Instrumentation", TMH, 2nd Edition, 2004.
3. A.K.Sawhney, "Electrical and Electronics Measurements and Instrumentation", 19th Edition, 2011.

VI. REFERENCE BOOKS:

1. DavidA.Bell, "Electronic Instrumentation and Measurements", Oxford University Press, 1st Edition, 2007.
2. A.D.Helbincs, W.D.Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 56th Edition, 2003.
3. B.M.Oliver, J.M.Cage, "Electronic Measurements and Instrumentation", TMH, Reprint, 2009.
4. T.R.Padmanabham, "Industrial Instrumentation", Springer, 1st Edition,2009.

VII. WEB REFERENCES:

1. https://www.scribd.com/
2. https://www.worldcat.org/
3. https://www.infibeam.com/
4. https://www.abebooks.co.uk

VIII. E-TEXT BOOKS:

1. https://www.vssut.ac.in/lecture_notes/lecture1423813026.pdf
2. fmcet.in/ECE/EC2351_uw.pdf
3. https://books.askvenkat.com/tag/measurement-and-instrumentation-lecture-notes-pdf
4. https://www.jntubook.com/electronics-measurements-instrumentation-textbook-free-d