Course code	Course name	L-T-P-Credits	Year of Introduction
AE303	ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS	3-0-0-3	2016

Prerequisite: Nil

Course objectives
- To impart knowledge on different types of measuring techniques using electrical and electronic measurement system.

Syllabus

General Principles of Measurements- Calibration of Meters- Errors in Measurement and its Analysis- Essentials of indicating instruments- Moving Iron, Dynamo Meter- D.C bridges- A.C bridges-Series and shunt type ohm meter- Electronic measurements- Analog and digital multimeters- Waveform analyzing instruments: Distortion meter- Spectrum analyser- Magnetic Measurements- Data Acquisition systems.

Expected outcome

The students will be able

i. To learn the use of different types of analogue meters for measuring electrical quantities such as current, voltage, power energy power factor and frequency.
ii. To learn the principle of working and applications of electronic measuring devices.

Text Books
1. Baldwin, C.T., "Fundamentals of electrical measurements" – Lyall Book Depot, New Delhi, 1973.
2. David.A.Bell, "Electronic Instrumentation and Measurements", 2nd Edition, Prentice Hall, New Jersy, 1994.
3. Golding, E.W. and Widdis, F.C., "Electrical Measurements and Measuring Instruments" A.H.Wheeler and Co, 5th Edition, 1993.

Reference Books
1. Cooper, W.D. and Helfric, A.D., "Electronic Instrumentation and Measurement Techniques" Prentice Hall of India, 1991.
2. Kalsi.H.S., "Electronic Instrumentation", Tata McGraw Hill, New Delhi, 1995
3. Pattanabis, "Sensors and Transducers", 2nd Edition, Prentice Hall India Pvt. Ltd., 2003.
4. Waldemar Nawrocki, "Measurement Systems and Sensors", Artech House, 2005

Course Plan			
Module	**Contents**	**Hours**	**Semester Exam Marks**
I	General Principles of Measurements: Absolute and Working Standards- Calibration of Meters- Qualities of Measurements- Accuracy, precision, sensitivity, resolution, loading effect. - Characteristics - Errors in Measurement and its Analysis	6	15%
II	Essentials of indicating instruments- deflecting, damping, controlling torques- Moving Coil , Moving Iron, Dynamo Meter, Induction, Thermal, Electrostatic and Rectifier Type meter; Shunts and Multipliers-Various Types of Galvanometers- Accuracy class.	7	15%
FIRST INTERNAL EXAMINATION			
III	DC Bridges: Introduction, sources & detectors for DC bridge,	7	15%

	general equation for bridge at balance. Wheatstone and Kelvin's double bridge, Carry Foster Slide Wire Bridge – Bridge Current Limitations.		
IV	AC bridges: Introduction, sources & detectors for a.c bridge, general equation for bridge at balance. Maxwell's Inductance & Maxwell's Inductance-Capacitance Bridge, Anderson bridge, Measurements of capacitance using Schering Bridge. Potentiometers: General principle, Modern forms of dc potentiometers, standardization, Vernier dial principle, AC potentiometers – coordinate and polar types, application of dc and ac potentiometers	8	15%
SECOND INTERNAL EXAMINATION			
V	Cathode ray oscilloscope (review), Special purpose oscilloscopes- delayed time base, analog storage, sampling oscilloscopes. Digital storage oscilloscopes-DSO applications. Method of measuring voltage, current, phase, frequency and period using CRO, DSO. Graphic Recording Instruments: strip chart recorder, X-Y recorder, Plotter, liquid crystal display (LCD).	7	20%
VI	Waveform analysing instruments: Distortion meter, Spectrum analyser, Digital spectrum analyser, Q meter, Watthour meter, Power-factor meter, Instrument transformers, Thermocouple instruments, Peak response voltmeter, True RMS meter	7	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100   Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)