SCHEME OF COURSE WORK

Course Title	:Electronic Measurements and Instrumentation		
Course Code	:AEC1124	L T P C	4 1 0 4
Program:	:B.Tech		
Specialization:	: Electronics and Communication Engineering		
Semester	:VI		
Prerequisites	:Electronic Devices, Electronic Circuits		
Courses to which it is a prerequisite	: Biomedical Instrumentation		

Course Outcomes (Cos):

1	Comprehend concepts and performance characteristics of instruments.
2	Illustrate the functional blocks of CRO.
3	Compare various types of wave analyzers and analyze Digital meters.
4	Design different types of bridge circuits to measure unknown components of R, L, C and Quality factor.
5	Analyze various measuring techniques to measure non-electrical quantities such as pressure, force, temperature, displacement, speed and humidity.

Course Outcomes versus Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**S**	**M**	**M**		**M**						**M**	**M**
CO2	**S**	**M**	**S**	**M**	**M**	**M**				**M**	**M**	**M**
CO3	**S**	**M**	**M**	**M**	**M**	**M**					**M**	**M**
CO4	**M**	**M**	**M**		**M**							**M**
CO5	**M**	**S**	**M**	**M**	**M**	**M**		**M**		**M**	**M**	**M**

S - Strongly correlated, M - Moderately correlated, Blank - No correlation

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Week	Topic /Contents	Course Outcomes	Sample questions	Teaching-Learning Strategy	Assessment Method & Schedule
1	Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity.	CO1	1. Explain about Static characteristics of an instrument 2.Differentiate between accuracy and precision	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
2	Errors in Measurement, Dynamic Characteristics- speed of response, Fidelity, Lag and Dynamic error, Grounding and earthing concepts.	CO1	1. Define Fidelity and Dynamic Error 2. Explain Grounding Concept	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
3	DC Voltmeters, Ammeters- Multi-range, Range extension, AC voltmeters multi-range, range extension,- shunt.	CO1	1. What value of shunt resistance is required for using 50μA meter movement having an internal resistance of 250Ω for measuring current in the range 0-500mA? 2. With a neat diagram explain the operation of an A.C voltmeter using rectifiers.	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
4	Thermocouple type RF ammeter, Ohm meters series type, shunt type, Voltage, Current, Resistance measurement using DMM.	CO1	1. Write short notes on Thermocouple type RF Ammeter 2. Explain working of Digital Multimeter with a neat diagram 3. Explain about Series Type Ohmmeter with neat Diagram	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
5	Auto zeroing, Auto ranging, Frequency,	CO1	1. Explain the working principle of Digital Frequency Meter	Lecture/ Discussion	Assignment I/Quiz-I/Mid-I

	Time and Period measurements.		2. Explain the concepts of auto zeroing and auto ranging in digital volt meters.		
6	Phase and Magnitude Measurement at high frequency using instruments such as vector voltmeter, multiple Period measurement, Universal counter.	CO1	1. Explain about Universal Counter with a neat Block Diagram 2. Explain about vector voltmeter.	Lecture/ Discussion	Assignment I/Quiz-I/Mid-I
7	AC Bridges Measurement of inductance- Maxwell's bridge, Anderson bridge, Measurement of capacitance - Schearing Bridge, Wheatstone bridge.	CO4	1. Bridge consists of the following: Arm AD having resistance value of 500Ω Arm CD having resistance of 1000Ω Arm ED having a resistance of 600Ω Arm EC having capacitor of 0.5μF Arm BC having resistance value of 300Ω Arm AB having resistance and inductance in series. Determine the value of the unknown resistance and unknown inductance 2. Draw the Anderson bridge and derive the balancing condition	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
8	Wien Bridge, Errors and precautions in using bridges. LCR-Q meter - principle of digital LCR-Q meter, specifications & applications.	CO4	1. What are the sources of errors in measurement of Q of a coil? 2. What are the measurement errors associated with Wheatstone bridge?	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
9	Mid-Test-1	--	---------	------	----------

10	Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep.	CO2	1. Explain about CRT features. 2. Draw the basic block diagram of Oscilloscope and state the functions of each block.	Lecture/ Discussion	Assignment II/Quiz-II/Mid-II
11	Trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO.	CO2	1. Explain the operation of a trigger sweep circuit and draw its output waveform. 2. Explain the need for a time base generator and a trigger circuit in a CRO.	Lecture/ Discussion	Assignment II/Quiz-II/Mid-II
12	Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope.	CO2	1. Compare dual beam CRO and dual trace CRO. 2. Describe with the diagram operation of sampling oscilloscope.	Lecture/ Discussion	Assignment II/Quiz-II/Mid-II
13	digital storage oscilloscope, Lissajous method of phase measurement, standard specifications of CRO, probes for CRO- Active & Passive, attenuator types.	CO2	1. Explain how frequency can be measured by CRO using Lissajous figures. 2. Compare passive probes with active probes.	Lecture/ Discussion	Assignment II/Quiz-II/Mid-II
14	Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzer	CO3	1. Define a wave analyzer. Explain with diagram 2. With the help of block diagram explain	Lecture/ Discussion	Assignment II/Quiz-II/Mid-II

			the working of a general purpose spectrum analyzer.		
15	FFT analyzer, Logic analyzer, Digital signal analyzer, Digital Fourier analyzer.	CO3	1. Explain the operation of logic analyzer.	Lecture/ Discussion	Assignment II/Quiz-II/Mid-II
16	Transducers- active & passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT	CO5	1. Explain the Principle of strain gauge and define an expression for gauge factor in terms of poisons ratio. 2. Define transducer. Explain difference between active transducer and passive transducer.	Lecture/ Problem solving	Assignment II/Quiz-II/Mid-II
17	Piezo Electric transducers, Acoustic Transducers ,Resistance Thermometers, Thermocouples, Measurement of physical parameters: force, humidity, speed.	CO5	1. Describe with diagram the operation of Piezo- electric transducer. 2. Explain the working principle and construction of thermocouples. List the advantages and disadvantages of thermocouples.	Lecture/ Discussion	Assignment II/Quiz-II/Mid-II
18	Mid-Test 2	------	----------		
19/20	END EXAM	------	------		