



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

Course Name	:	Electronic Measurements and Instrumentation
Course Code	:	A50422
Class	:	III - B. Tech
Branch	:	ECE
Year	:	2017– 2018
Course Coordinator	:	C.Deepthi, Asst.Prof, Dept of ECE
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OBJECTIVES

This course is an introduction to Electronic Measurements and Instrumentation in which student will able to learn the measurement techniques and measurement systems and it teaches signal analyzers, signal generators and different types of oscilloscopes and their functioning and also teaches the operation of different types of electrical transducers and bridge measurement and also deals the measurement of physical parameters. Student gains the thorough knowledge in the measuring instruments and their functioning.

S. No	QUESTION	Blooms Taxonomy Level	Course Outcome
UNIT-I			
Block Schematic of Measuring Systems , Measuring Instruments			
Short Answer Questions			
1	Define the performance characteristics of an instrument?	Understand	1
2	List the classification of performance characteristics of an instrument?	Remember	1
3	Define precision and accuracy. Explain the difference between them.	Understand	1
4	List out the characteristics of a precision.	Understand	1
5	Explain the types of errors possible in an instrument?	Understand	1
6	Discuss about dynamic characteristics of a system?	Understand	1
7	Explain static characteristic?	Understand	1

8	Distinguish between static and dynamic characteristics?	Analyze	1
9	Explain ohmmeter and its classification?	Understand	5
10	Explain briefly about DC voltmeters and AC voltmeters?	Understand	5
Long Answer Questions			
1	Define the terms Accuracy, Precision, Resolution,	Remember	1
2	Repeatability, Reproducibility and Sensitivity.	Understand	1
3	Discuss about the Ayton Shunt Circuit and explain how current measurement is done?	Understand	1
4	Explain about different types of errors that occur in measurements.	Understand	5
5	Describe the basic performance characteristics of a system? Explain.	Remember	1
6	Explain the constructional details and difference between Ohmmeter series type and shunt type.	Understand	1
7	Explain the working principle of PMMC movement with the help of equations.	Understand	5
8	Define voltmeter sensitivity. What is the loading effect of a DC voltmeter?	Understand	5
9	Discuss about D'Arsonval Movement.	Understand	5
10	Give the block schematic of a general measuring system and explain the same.	Understand	5
11	Explain the terms : i. Significant figures ii. Conformity.	Understand	1
12	Classify and explain various types of errors in measurement.	Analyze	1
13	Define the following terms a) Fidelity b) Speed of response c) Lag d) Dynamic error	Remember	1
14	Explain about the Multimeter	Understand	5
15	Discuss about AC voltmeters	Understand	5
Analytical Questions			
1	It is desired to extend the range of a 10mA Ammeter with $R_m=100 \Omega$ to measure 15A. Draw the circuit and determine the value of R.	Evaluate	5
2	Determine the Multiplier resistance on the 50V range of a DC voltmeter, which uses 300mA meter movement having internal resistance of 1.2Ω .	Evaluate	5
3	A Voltmeter having a sensitivity of $15k \Omega /V$ reads 80V on a 100V scale , when connected across an unknown resistor. The current through the resistor is 2mA. Calculate the % of error due to loading Effect.	Evaluate	5
4	A basic D'Arsonval movement with a full scale deflection of $100 \mu A$ and an internal resistance of 2000Ω is available. It is to be Converted into a 0-5V , 0-10V, 0-25V, and 0-50V multi range voltmeter using individual multipliers for each range. Calculate the values of the individual resistors.	Evaluate	5

5	A Voltmeter having a Sensitivity of $20k \Omega / V$ reads 100V units 150V scale, when connected across an unknown resistor Rx. The current passing through the resistor is 2.0mA .Calculate the % error due to loading effect.	Evaluate	5
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UNIT-II
Signal Analyzers, Signal Generators

Short Answer Questions

1	Define wave analyzers?	Understand	7
2	List out the applications of wave analyzers?	Remember	7
3	Describe the t advantages incurred on spectrum analysis?	Understand	7
4	Define spectrum analyzer?	Understand	7
5	List out the applications of the spectrum analyzers?	Understand	7
6	Define harmonic distortion analyzer?	Understand	2
7	Distinguish between square and pulse wave generators?	Analyze	2
8	Define a Function Generator?	Understand	2
9	Distinguish between the oscillator and function generator?	Analyze	2
10	List out the applications of function generator?	Remember	2

Long Answer Questions

1	Explain how a Function Generator works?	Understand	2
2	Define a Sweep Generator, explain its functioning.	Remember	2
3	Explain the working principle of wave analyzer with neat block diagram.	Understand	2
4	Explain the principle of operation and generation of pulse and square wave.	Understand	2
5	List out the applications of Spectrum Analyzer?	Understand	2
6	Discuss about basic principle of AF wave analyzer with neat sketch.	Apply	7
7	Explain the working of the harmonic distortion analyzer?	Understand	2
8	Explain the working of Basic Spectrum Analyzer with neat schematic block diagram.	Apply	7
9	Differentiate between wave analyzer and harmonic distortion analyzer?	Analyze	7
10	Explain the working of the Power analyzer?	Understand	7
11	Explain Arbitrary Waveform Generator	Understand	
12	Explain the working of heterodyne wave analyzer with neat diagram.	Understand	7
13	List out the considerations to be made in choosing an oscillator Instrument or Signal Generator Instrument?	Remember	7
14	Explain about the Video signal generators.	Understand	2
15	Distinguish between wave analyzer and Harmonic distortion analyzer.	Analyze	7
16	Distinguish between wave Analyzer and Spectrum analyzer.	Analyze	7

17	Explain about basic spectrum analyzer using swept receiver design.	Understand	7
Analytical Questions			
1	Estimate the value of a minimum detectable signal (MDS) of a Spectrum analyzer with a NF of 25dB using 1KHz 3dB filter.	Evaluate	7
2	In a Wien bridge oscillator $R_1 = R_2 = 55k \Omega$. $C_1 = C_2 = 800$ pf with usual notation. Determine the frequency of oscillations.	Evaluate	7
3	In an ordinary phase shift oscillator $R_1 = R_2 = R_3 = 800k\Omega$, $C_1 = C_2 = C_3 = 100$ pf, with usual notation. Find the frequency of oscillations.	Evaluate	7
4	Determine the dynamic range of a spectrum analyser with a third-order intercept point of +40dBm and a noise level of -100dBm.	Evaluate	7
5	What is the minimum detectable signal of a spectrum analyzer with a noise figure of 20dB and using a 1-kHz, 3-dB filter?	Evaluate	7
UNIT-III Oscilloscopes			
Short Answer Questions			
1	Discuss about the CRT and its internal structure?	Understand	6
2	Define CRO?	Understand	6
3	Discuss vertical amplifier with a neat block diagram?	Understand	6
4	Describe the roles of horizontal and vertical amplifiers?	Remember	6
5	Explain vertical section of CRT?	Understand	6
6	Explain about horizontal section of CRT.	Understand	6
7	Discuss about dual beam CRO?	Understand	6
8	Define dual trace oscilloscope?	Understand	6
9	Define sampling oscilloscope?	Remember	6
10	Write briefly about storage oscilloscope?	Understand	6
Long Answer Questions			
1	Explain briefly the Basic Features of a CRT?	Understand	6
2	Explain briefly about the Vertical amplifier.	Understand	6
3	Explain briefly about the Horizontal deflecting system?	Understand	6
4	Draw the block diagram of general purpose CRO and explain its working.	Apply	6
5	Explain about storage oscilloscope with block diagram?	Understand	6
6	Explain the working of Dual trace CRO with neat block diagram.	Understand	6
7	Explain with neat Block Diagram of Digital Storage oscilloscope?	Understand	6
8	Draw the block diagram of Sampling oscilloscope and explain its working.	Apply	6
9	Explain the method of finding phase relationship of two waveforms using Lissajous figures?	Understand	6

10	Explain the method of finding frequency relationship of two waveforms using Lissajous figures?	Understand	6
11	Explain the working of Dual Beam CRO with neat block diagram.	Understand	6
12	Explain about Delay lines in CROs.	Understand	6
13	List out the different types of probes used for CROs? Explain about each of them	Remember	6
14	Explain the Applications of Oscilloscopes.	Understand	6
15	Explain how different Lissajous figures can be used to measure various parameters?	Understand	6

Analytical Questions

1	Determine the secondary emission ratio 'S' of a digital storage oscilloscope, if the value secondary emission current I_S is $15\mu A$, and the primary beam current I_P is $150\mu A$.	Evaluate	6
2	Determine the Velocity of electron beam of an oscilloscope when voltage applied is 2500V.	Evaluate	6
3	The deflection sensitivity of a CRT is 0.05mm/V and an unknown voltage is applied to the horizontal deflection plate, which shifts the spot by 5mm towards the right. Determine the unknown applied voltage.	Evaluate	6
4	The x-deflection plates of a CRT are 20mm long and 5mm apart. The centre of the plate from the screen is 25 cm away. The accelerating voltage is 3000V. Determine the deflection sensitivity and the factor.	Evaluate	6
5	The x-deflection plates in the CRT are 1mm apart and 25mm long. The centre of the plate is 20cm from the screen. The accelerating voltage is 3000V. Find the V_{rms} of the sinusoidal voltage applied to x-deflection plates if the length of the trace is 10cm. Find the electrostatic deflection sensitivity.	Evaluate	6

UNIT-IV Transducers

Short Answer Questions

1	Define transducer?	Remember	4
2	List the classification of transducers?	Understand	4
3	Define strain gauge?	Understand	4
4	Discuss about LVDT?	Understand	4
5	Write brief notes on thermocouples?	Understand	4
6	Discuss the principle of operation of strain gauges?	Understand	4
7	Explain the desirable characteristics of strain gauge?	Understand	4
8	List out the applications of transducers?	Remember	4

9	List out the advantages of thermocouples	Understand	4
10	List the limitations of thermocouple.	Understand	4
Long Answer Questions			
1	Define a transducer? Write the classifications of transducers?	Remember	4
2	Explain working of strain gauge and what are its specific advantages?	Understand	4
3	Explain about Piezo-electric effect?	Understand	4
4	Explain the desirable characteristics of thermocouples?	Understand	4
5	Explain about Displacement transducers.	Understand	4
6	Describe about resistance thermometers.	Understand	4
7	Explain about Variable Capacitance transducers.	Understand	4
8	Explain the Magneto Strictive transducers	Understand	4
9	Explain the Principle, working, Construction, characteristics and applications of thermistors.	Understand	4
10	Explain the Principle and working of Strain gauges	Understand	4
11	Distinguish between thermocouple and thermistor?	Analyze	4
12	Explain the principle , working , construction , Characteristics and applications of LVDTs.	Understand	4
13	Discuss the advantages and disadvantages of LVDT.	Understand	4
14	List out the Salient features of Semiconductor Strain gauges? Explain.	Remember	4
15	Discus the difference between active and passive transducers?	Understand	4
16	Explain the principle and working of Hot-wire Anemometer	Understand	4
17	Explain the operation of a Piezo electric transducer.	Understand	4
Analytical Questions			
1	A resistance strain gauge with a gauge factor of 2 is cemented to a steel member, which is subjected to a strain of 1×10^{-6} . If original resistance value of the gauge is 130Ω , calculate the change in resistance.	Evaluate	4
2	An ac LVDT has the following data. Input = 6.3V, Output = 5.2V, range ± 0.5 in. Determine (i) Calculate the output voltage vs core position for a core movement going from +0.45in. to -0.30 (ii) The output voltage when the core is -0.25 in. from the centre	Evaluate	4
3	A resistance strain gage with a gage factor of 2 is fastended to a steel member subjected to a stress of 1050 kg/cm^2 . The modulus of elasticity of steel is approximately $2.1 \times 10^6 \text{ kg/cm}^2$ Calculate the change in resistance ΔR , of the strain-gage element due to the applied stress.	Evaluate	4

UNIT-V			
Bridges, Measurement of Physical parameters			
Short Answer Questions			
1	Discuss the principle of Maxwell's bridge?	Understand	3
2	Explain the basic principle of Kelvin bridge?	Understand	3
3	Describe the operation of the wheat stone bridge?	Remember	3
4	Write short notes on data acquisition systems (DAS).	Understand	4
5	Discuss the method of measurement of force?	Understand	4
6	Explain the method of measurement of pressure	Understand	4
7	Discuss about the method of measurement of velocity	Understand	4
8	Discuss the method of measurement of humidity	Understand	4
9	Describe the method of measurement of moisture	Remember	4
10	Explain the method of measurement of displacement	Understand	4
Long Answer Questions			
1	Draw and explain the Maxwell Bridge with neat diagram and derive the expression for unknown inductance.	Apply	3
2	Explain the Kelvin Bridge with neat diagram and derive the expression for unknown resistance.	Understand	3
3	Explain the basic principle of wheat stone bridge and derive the expression for unknown resistance.	Understand	3
4	Explain general Data Acquisition System (DAS) with a neat block diagram?	Understand	4
5	Explain how pressure is measured.	Understand	4
6	Discuss about Flow measurement.	Understand	4
7	Describe the measurement of force.	Remember	4
8	Explain the method of measurement of humidity.	Understand	4
9	Discuss about the method of measurement of moisture.	Understand	4
10	Describe about the Liquid level measurement.	Remember	4
11	Explain the principle and working of Ionization gauge	Understand	
12	Explain the principle and working of ultrasonic Level gauge	Understand	3
13	Explain about Velocity measurement.	Understand	3
14	Discuss about Vacuum level measurement.	Understand	3
15	Explain about force measurement.	Understand	3
16	Define data acquisition? Mention the essential features of a data acquisition system.	Remember	4
17	Distinguish between magnetic flow meter with turbine flow meter	Analyze	4
18	Distinguish between ionization gauge and Pirani gauge.	Analyze	3
Analytical Questions			

1	In the case of Maxwell's bridge, one arm has resistance of $1K \Omega$, in another arm has also only resistance of $5K \Omega$. The third arm has a resistor $4-7k \Omega$ in shunt with a capacitor of $1\mu F$. The bridge is excited at frequency of $1KHz$. Determine the Values of an unknown L_x in the fourth arm.	Evaluate	3
2	In a certain Wheatstone bridge circuit measurements, $R_A=200k \Omega$, $R_B=400k \Omega$, $R_C=100k \Omega$, $R_D=300k \Omega$. $E=1.5V$, $R_g=100 \Omega$, with usual notation. Determine the current through the detector galvanometer.	Evaluate	3
3	A Maxwell bridge is used to measure inductive impedance. The bridge constants at balance are $C_1=0.01\mu F$, $R_1=470k \Omega$, $R_2=5.1k \Omega$ and $R_3=100k \Omega$. Find the series equivalent of the unknown impedance?	Evaluate	3

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