INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**				
Course Code	AECB32				
Program	B.Tech				
Semester	FIVE				
Course Type	Professional Elective				
Regulation	**IARE - R18**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Course Coordinator	Ms. P Annapurna, Assistant Professor				

COURSE OBJECTIVES:

The course should enable the students to:	
I	The construction and operation of AC & DC voltmeters and ammeters, signal generators, signal analyzers, transducers and LCR meters.
II	The application of the principles of electronic measurements to monitor high tension power quality and build spectrum analyzers for scientific and industrial applications.
III	To explore the applications of measuring instrument in environment monitoring and health monitoring of a smart car.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
Course Outcomes		**Knowledge Level (Bloom's Taxonomy)**
CO 1	**Recall** the schematics of measuring systems and performance characteristics of an instrument.	Remember

CO 2	**Explain** the measuring instruments and its working principle by using the instrument D' Arsonval Movement.	Understand
CO 3	**Demonstrates** the various types measuring meters like Digital Voltmeters.	Understand
CO 4	**Describe** the basic building blocks of Cathode ray oscilloscopes and cathode ray tubes	Understand
CO 5	**Compare** various types of special purpose oscilloscopes with its applications.	Analyze
CO 6	**Draw** Lissajous figures or patterns for the given frequencies.	Apply
CO 7	**Illustrate** the working principles of signal generators and signal analyzers	Understand
CO 8	**Design** a measuring instrument on requirement basis	Apply
CO 9	**Describe** Transducers and classify them according to their application	Understand
CO 10	**Extend** the concepts of balance bridge to find out the unknown parameter with the given specifications.	Analyze
CO 11	**Illustrate** the working functionality of strain gauges, LVDT	Understand
CO 12	**Compare** wave analyzers and spectrum analyzers based on its working functionality.	Understand
CO 13	**Develop** the appropriate Virtual instrument to solve the real world problem and also to measure different physical parameters.	Create

MAPPING OF EACH CO WITH PO(s), and PSO(s):

Course Outcomes	**Program Outcomes**												**Program Specific Outcomes**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	3	-	-	-	-	-	-	-	-	-	-	-	1	-
CO 3	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	-	2	-	2	3	-	-	-	-	-	-	-	-	1	-
CO 7	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 8	-	-	-	1	2	-	-	-	-	-	-	-	-	2	-
CO 9	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 10	2	-	-	2	-	-	-	-	-	-	-	-	-	3	-
CO 11	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 12	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 13	-	-	2	-	2	-	-	-	-	-	-	-	-	-	2

TUTORIAL QUESTION BANK

MODULE-I				
INTRODUCTION TO MEASURING INSTRUMENTS				
Part - A (Short Answer Questions)				
S. No	**Question**	**Blooms Taxonomy Level**	**How does this Subsume the level below**	**Course Outcome**
1	Define measuring system?	Remember	---	CO 1
2	List the classification of performance characteristics of an instrument?	Understand	This would require the learner to **recall** the performance characteristics of an instrument and **classify the performance characteristics**	CO 1
3	Define instrument?	Remember	---	CO 1
4	Distinguish between static and dynamic characteristics?	Understand	This would require the learner to **recall** the concepts of static and dynamic characteristics and compare them	CO 1
5	Define precision and accuracy.	Remember	---	CO 1
6	List out the characteristics of a precision.	Understand	This would require the learner to **recall** the concepts of static and characteristics	CO 1
7	What are the different types of errors possible in an instrument?	Understand	This would require the learner to **recall** the concepts of errors and list out them	CO 1
8	Explain ohmmeter and its classification?	Understand	This would require the learner to **recall** the concepts of ohmmeters and list out them base on its construction	CO 1
9	Explain about DC voltmeters AC voltmeters?	Understand	This would require the learner to **recall** the concepts of voltmeters and list out them base on its construction	CO 2
10	Define the terms Accuracy	Remember	---	CO 1
11	Define the following terms, Repeatability Reproducibility	Remember	---	CO 1
12	What are the different types of static errors in a system?	Understand	This would require the learner to **recall** the concepts of errors and list out static errors in a system	CO 1
13	Define measuring instrument	Remember	---	CO 1
14	Write short notes on Delay lines.	Understand	This would require the learner to recall the concepts of delay lines used in CROs	CO 1

15	List out the specifications of instruments	Understand	This would require the learner to **recall** the concepts of specifications of instruments	CO 1
16	Define successive approximation type of digital voltmeters	Remember	---	CO 2
17	Define the terms Precision	Remember	---	CO 1
18	Define the terms Resolution	Remember	---	CO 1
19	Explain about DC ammeters	Understand	This would require the learner to recall the concepts of ammeters and explain them	CO 2
20	Define sensitivity	Remember	---	CO 1
Part - B (Long Answer Questions)				
1	Discuss about the Aryton Shunt Circuit and explain how current Measurement is done?	Understand	This would require the learner to **recall** the concepts of ammeters list the different types of ammeters analyze the concepts and advatanges of Aryton Shunt over the remaining meters	CO 2
2	List out the different types of errors that occur in measurements, and explain in detail about them.	Understand	This would require the learner to **recall** the concepts of error and list its types and analyze the different types of errors that occur in measurements	CO 1
3	Describe the basic performance characteristics of a system? Explain in detail about it.	Understand	This would require the learner to **recall** the concepts of an instrument list out its performance characteristics and explain them with examples	CO 1
4	Explain the constructional details and difference between Ohmmeter series type and shunt type.	Understand	This would require the learner to **recall** the concepts of Ohmmeter and analyze the functions of series type and shunt type of ohmmeters and differentiate them	CO 2
5	Explain the working principle of PMMC movement with the help of equations.	Understand	This would require the learner to **recall** the concepts of PMMC meter and analyze its constructional details with the help of equations	CO 2
6	Define voltmeter sensitivity. What is the loading effect of a DC voltmeter?	Understand	This would require the learner to **recall** the concepts of voltmeter , voltmeter sensitivity, loading effect of a DC voltmeter and how to overcome the loading effect	CO 2
7	Discuss about D'Arsonval Movement with a neat diagram	Understand	This would require the learner to **recall** the concepts of D'Arsonval Movement analyze its functionality by using constructional diagram	CO 2

8	Give the block schematic of a general measuring system and explain the same.	Understand	This would require the learner to **recall** the concepts of measuring system and analyze each block	CO 1
9	Explain about different types of ammeters	Understand	This would require the learner to **recall** the concepts of ammeters list them and analyze the operation of ammeters	CO 2
10	Explain about different types of ohmmeters	Understand	This would require the learner to **recall** the concepts of ohmmeters list them and analyze the operation of ohmmeters.	CO 2
11	Define and express the following terms, a) Fidelity b) Speed of response c) Lag d) Dynamicerror	Understand	This would require the learner to **recall** the concepts of static characteristics of an instrument list out them and analyze static characteristics	CO 1
12	Explain in detail about characteristics and functionality of the Multimeter.	Understand	This would require the learner to **recall** the concepts of Multimeter analyze its working functionality and characteristics	CO 2
13	Compare AC and DC Voltmeters and ammeters	Understand	This would require the learner to **recall** the concepts of Voltmeters ,ammeters and analyze their characteristics to compare them	CO 2
14	Describe the function of DC voltmeter and multirange voltmeter with neat operation explanation?	Understand	This would require the learner to **recall** the concepts of voltmeters list the types of voltmeters analyze DC voltmeter and multirange voltmeter with neat diagram	CO 2
15	Explain the working of successive approximation type of digital voltmeter with the help of block diagram	Understand	This would require the learner to **recall** the concepts of digital voltmeter list them analyze the working of successive approximation type of digital voltmeterwith block diagram	CO 3
Part – C (Critical Thinking Questions)				
1	It is desired to extend the range of a 10mA Ammeter with Rm=100 Ω to measure 15A. Draw the circuit and determine the value of R.	Apply	This would require the learner to **recall** the concepts of meter range extension and ammeter characteristics and describe about ammeter range and **identify** the formulae **assign** the mathematical functions to get the result	CO 2
2	Determine the Multiplier resistance on the 50V range of a DC Voltmeter, which uses 300mA meter movement having internal resistance of 1.2Ω.	Apply	This would require the learner to **recall** the concepts of voltmeters and **assign** the appropriate formula to **find** out the resistance	CO 2

3	A Voltmeter having a sensitivity of 15k Ω /V reads 80V on a 100Vscale, when connected across an unknown resistor. The current through the resistor is 2mA. Calculate the % of error due to loading Effect.	Apply	This would require the learner to **recall** the concepts of voltmeter and **describe** about loading effects**& apply** the formulae to find out the % of error	CO 2
4	A basic D'Arsonval movement with a full scale deflection of 100 μA and an internal resistance of 2000 Ω 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.	Apply	This would require the learner to **recall** the concepts of D'Arsonval movement and **find** out different types of voltmeters and **apply** appropriate technique to measure the individual resistors	CO 2
5	A Voltmeter having a Sensitivity of 20k Ω /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.	Apply	This would require the learner to **recall** the concepts of voltmeter and **describe** about loading effects **& apply** the formulae to find out the % of error	CO 2
6	A 200 Ω basic movement is to be used as an ohmmeter requiring full scale deflection of 1 mA and internal battery voltage of 5 V. A half scale deflection marking of 2 k is desired. Calculate, The values of R1 andR2 . Maximum value of R to compensate for a 3% drop in battery voltage	Apply	This would require the learner to **recall** the concepts of D'Arsonval movement and **describe** the function of ohmmeters and **identify** formulae to be used and get the results and then **apply** the answer for drop in battery voltage	CO 2
7	A voltmeter having a sensitivity of 1KΩ/V is connected across an unknown resistance in series with a milli ammeter reading 80V on 150V scale. When the milli ammeter reads 10mA, Calculate the, apparent resistance of the unknown resistor Actual resistance of the unknown resistor, Error due to the loading effect of the voltmeter.	Apply	This would require the learner to **recall** the concepts of ammeter and **describe** its characteristics and **apply** the suitable formulae to find out error due to loading effect	CO 2
8	Two ammeters are joined in series in a circuit carrying	Apply	This would require the learner to **recall** the concepts ammeter and	CO 2

	100A. One ammeter has a resistance of 10000ohm shunted by 0.10 ohm while the other ammeter has a resistance of 150 ohm shunted by 0.02ohm. if the shunts are interchanged what would be the readings of the instruments		**describe** its characteristics and **apply** them to find out the ammeter reading	
9	The following values are obtained from the measurements of the value of a resistor:147.2 , 147.4 , 147.9 , 147.1 , 147.5 , 147.6 , 147.4 , 147.6 , 147.5 . Calculate,) Arithmetic mean) Average deviation) Standard Deviation	Apply	This would require the learner **to recall** the concepts of Arithmetic mean, Average deviation and Standard Deviation and **identify** appropriate formulae and **apply** the appropriate formulae to find out the statistical parameters	CO 1
10	Determine the Multiplier resistance on the 150V range of a DC Voltmeter, which uses 30mA meter movement having internal resistance of 5.2Ω	Apply	This would require the learner to **recall** the concepts of voltmeters and ohmmeters and **describe** their function then **apply** mathematical formulae to find out the multiplier resistance	CO 3
MODULE-II				
OSCILLOSCOPE				
Part - A (Short Answer Questions)				
1	Discuss about the CRT and its internal structure?	Understand	This would require the learner to **recall** the concepts of CRT analyze its internal structure	CO 4
2	Define CRO?	Remember	---	CO 4
3	Discuss vertical amplifier with a neat block diagram?	Understand	This would require the learner to **recall** the concepts of CRT and Analyze each block and Explain about vertical amplifiers	CO 4
4	Describe the roles of horizontal amplifiers?	Understand	This would require the learner to **recall** the concepts of CRT and Analyze each block and Explain about horizontal amplifiers	CO 4
5	Explain vertical section of CRT?	Understand	This would require the learner to **recall** the concepts of CRT and analyze vertical section of CRT	CO 4
6	Explain about horizontal section of CRT.	Understand	This would require the learner to **recall** the concepts of CRT and analyze Horizontal section of CRT	CO 4

7	Discuss about dual beam CRO?	Understand	This would require the learner to **recall** the concepts of CRO and analyze dual beam CRO	CO 5
8	Define dual trace oscilloscope?	Remember	---	CO 5
9	Define sampling oscilloscope?	Remember	---	CO 5
10	Write briefly about storage oscilloscope?	Understand	This would require the learner to **recall** the concepts of CRO and analyze storage oscilloscope	CO 5
11	Compare dual trace oscilloscopes and dual beam CRO.	Understand	This would require the learner to **recall** the concepts of CRO and list out the types CRO	CO 5
12	What are the different types of CRO probes?	Understand	This would require the learner to **recall** the concepts of CRO probes and list out the types of CRO probes	CO 5
13	Explain about digital CRO	Understand	This would require the learner to **recall** the concepts of digital CRO	CO 5
14	Discuss about the Lissajous figures	Understand	This would require the learner to **recall** the concepts of CRO and understand them to measure different parameters of a signal.	CO 6
15	Describe about storage oscilloscopes	Understand	This would require the learner to **recall** the concepts of oscilloscopes analyze storage oscilloscopes	CO 5
16	Discuss about Phosphor Screen Characteristics	Understand	This would require the learner to **recall** the concepts of CRO and analyze the Characteristics of Phosphor Screen	CO 5
17	Define Time-base generator	Remember	---	CO 5
18	Discuss about Triggering circuit	Remember	This would require the learner to **recall** the concepts of CRO and Explain about Triggering circuit	CO 5
19	List the Applications of CRO	Remember	This would require the learner to **recall** the concepts of CRO and List the Applications of CRO	CO 5
20	Discuss about Delay line circuit	Understand	This would require the learner to **recall** the concepts of CRO and how Delay line circuits are used in CRO	CO 5
Part - B (Long Answer Questions)				
1	Explain the major parts of CRT with a block diagram.	Understand	This would require the learner to **recall** the concepts of CRT and analyze every block in CRT explain them in breif	CO 4
2	Draw the neat diagrams of both vertical & horizontal deflection	Understand	This would require the learner to **recall** the concepts of CRO and	CO 4

	systems and explain briefly about their working.		explain vertical & horizontal deflection systems in breif	
3	Explain briefly about the Horizontal deflecting system?	Understand	This would require the learner to **recall** the concepts of CRO and explain horizontal deflection systems in breif	CO 4
4	Draw the block diagram of general purpose CRO and explain its working.	Understand	This would require the learner to **recall** the concepts of CRO and explain each block	CO 4
5	Explain about storage oscilloscope with block diagram?	Understand	This would require the learner to **recall** the concepts of CRO analyze the storage oscilloscope and its functionality	CO 4
6	Explain the working of Dual trace CRO with neat block diagram.	Understand	This would require the learner to **recall** the concepts of CRO and explain the concepts of Dual trace CRO	CO 5
7	Explain with neat Block Diagram of Digital Storage oscilloscope?	Understand	This would require the learner to **recall** the concepts of CRO and explain the Digital Storage oscilloscope with neat block diagram	CO 5
8	Draw the block diagram of Sampling oscilloscope and explain its working.	Understand	This would require the learner to **recall** the concepts of CRO and explain the Sampling oscilloscope with neat block diagram	CO 5
9	Explain the method of finding phase relationship of two waveforms using Lissajous figures?	Understand	This would require the learner to **recall** the concepts of Lissajous figures and obtain the phase relationships using waveforms	CO 6
10	Explain the method of finding frequency relationship of two waveforms using Lissajous figures?	Understand	This would require the learner to **recall** the concepts of Lissajous figures and obtain the frequency relationships using waveforms	CO 6
11	Explain the working of Dual Beam CRO with neat block diagram.	Understand	This would require the learner to **recall** the concepts of CRO and explain the Dual Beam CRO with neat block diagram	CO 5
12	Explain in detail about Delay lines in Cathode Ray Oscilloscopes.	Understand	This would require the learner to **recall** the concepts of CRO and analyze about delay lines in the operation of CROs	CO 5
13	List out the different types of probes used for CROs? Explain about each of them	Understand	This would require the learner to **recall** the concepts of CRO probes list out them analyze its application in the usage of CROs	CO 5
14	Explain the Applications of Oscilloscopes.	Understand	This would require the learner to **recall** the concepts of CROS and list out the Applications of	CO 5

			Oscilloscopes and explain them in brief	
15	Explain how different Lissajous figures can be used to measure various parameters?	Understand	This would require the learner to **recall** the concepts of Lissajous figures to measure frequency and phase at different points	CO 6
16	Compare Dual trace and dual beam CROs	Understand	This would require the learner to **recall** the concepts of Dual trace and dual beam CROs and Compare them with their applications and advantages	CO 5
17	Describe about high frequency CRO considerations and applications	Understand	This would require the learner to **recall** the concepts of CROs and describe them in breif	CO 5
18	Explain the operation of Time-Base Generator Using UJT Transistor	Understand	This would require the learner to **recall** the concepts of Time-Base Generators and how can an UJT will be acting as a Time-Base Generator	CO 5
19	Explain The operation of High frequency CRT or Travelling wave type CRT	Understand	This would require the learner to **recall** the concepts of CRT and explain about High frequency CRT or Travelling wave type CRT	CO 5
20	Give the Characteristics of a HF CRO	Understand	This would require the learner to **recall** the concepts of CRO and obtain its Characteristics at HF	CO 5
Part – C (Critical Thinking Questions)				
1	Determine the secondary emission ratio `S' of a digital storage oscilloscope, if the value secondary emission current I_S is 15μA, and the primary beam current I_P is 150μA.	Apply	This would require the learner to **recall** the concepts of CRO and **describe** the function of digital storage oscilloscope and **apply** the appropriate formulae to find out secondary emission ratio	CO 4
2	Determine the Velocity of electron beam of an oscilloscope when voltage applied is 2500V.	Apply	This would require the learner to **recall** the concepts of CRO and **describe** its mathematical analysis and **apply** the appropriate formulae to measure the Velocity of electron beam	CO 4
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.	Apply	This would require the learner to **recall** the concepts of CRT and **describe** the functionality of horizontal deflection plate and **apply** the desired formulae to find the applied voltage	CO 5
4	The x-deflection plates of a CRT are 20mm long and 5mm	Apply	This would require the learner to **recall** the concepts of CRT and	CO 5

	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.		**describe** its operation **apply** the desired formulae to **find** out the deflection sensitivity	
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.	Apply	This would require the learner to **recall** the concepts of CRT and **describe** its operation and **apply** the desired formulae to find out the electrostatic deflection sensitivity.	CO 5
6	Determine the Velocity of electron beam of an oscilloscope when voltage applied is 1400V.	Apply	This would require the learner to **recall** the concepts of CRO and **describe** its mathematical analysis and **apply** the appropriate formulae to measure the Velocity of electron beam	CO 5
7	The x-deflection plates of a CRT are 15mm long and 5mm apart. The centre of the plate from the screen is 20 cm away. The accelerating voltage is 1000V. Determine the deflection sensitivity and the factor.	Apply	This would require the learner to **recall** the concepts of CRT and **describe** its operation **apply** the desired formulae to **find** out the deflection sensitivity	CO 5
8	The deflection sensitivity of a CRT is 0.08mm/V and an unknown voltage is applied to the horizontal deflection plate, which shifts the spot by 10 mm towards the right. Determine the unknown applied voltage	Apply	This would require the learner to **recall** the concepts of CRT and **describe** the need of horizontal deflection plates and **apply** the desired formulae to find the applied voltage	CO 5
9	Determine the Velocity of electron beam of an oscilloscope when voltage applied is 1200V.	Apply	This would require the learner to **recall** the concepts of CRO and **describe** its mathematical analysis and **apply** the appropriate formulae to measure the Velocity of electron beam	CO 5
10	The deflection sensitivity of a CRT is 0.15mm/V and an unknown voltage is applied to the horizontal deflection plate, which shifts the spot by 15mm towards the right.	Apply	This would require the learner to **recall** the concepts of CRT and **describe** the need of horizontal deflection plates and **apply** the desired formulae to find the applied voltage	CO 5

	Determine the unknown applied voltage.			
MODULE –III				
SIGNAL GENERATORS AND WAVE ANALYZERS				
Part - A (Short Answer Questions)				
1	Distinguish between square and pulse wave generators?	Understand	This would require the learner to **recall** the concepts of wave generators and compare square and pulse wave generators	CO 7
2	Define a Function Generator?	Remember	---	CO 7
3	Distinguish between the oscillator and function generator?	Understand	This would require the learner to **recall** the concepts of oscillator and function generator and compare them with their operation	CO 7
4	List out the applications of function generator?	Remember	This would require the learner to **recall** the concepts of function generator and list out the applications	CO 7
5	What is sweep generator?	Remember	---	CO 7
6	Define AF Signal Generator	Remember	---	CO 7
7	List the specifications of Signal generators?	Understand	This would require the learner to **recall** the concepts of Signal generators and obtain its specifications	CO 7
8	Define duty cycle.	Remember	---	CO 7
9	List the requirements of a pulse.	Remember	---	CO 7
10	Define a video signal Generator	Remember	---	CO 7
11	Define a wave analyzer?	Remember	---	CO 7
12	List out the different types of wave analyzers.	Understand	This would require the learner to **recall** to identify the different types of the wave analyzers	CO 7
13	Differentiate between AF wave analyzer and RF wave analyzer	Understand	This would require the learner to **recall** the differences between AF and RF analyzers	CO 7
14	Define distortion, harmonics and the term ‘total harmonic distortion’	Remember	---	CO 7
15	Relate harmonic distortion analyzer and spectrum analyzer	Understand	This would require the learner to **recall** the explanation of relationship between harmonic distortion analyzer and spectrum analyzer	CO 7
16	What is the meaning of distortion factor?	Remember	---	CO 7

17	Explain the term 'heterodyning'?	Understand	This would require the learner to recall concept of the heterodyning to understand the concept of heterodyne distortion analyzer	CO 7
18	Mention the difference between fixed frequency and variable AF oscillator.	Understand	This would require the learner to **recall** the concept of frequency oscillator, which is used in wave analyzers	CO 7
19	State the applications of spectrum analyzer	Remember	---	CO 7
20	Differentiate Function generators from Signal generators.	Understand	This would require the learner to **recall** concept of types of generators.	CO 7
Part - B (Long Answer Questions)				
1	Explain the working of a standard sweep generator with diagram	Understand	This would require the learner to **recall** the concepts of generators list out them and analyze the working of standard sweep generator with diagram	CO 7
2	Discuss in detail about RF signal generator operation.	Understand	This would require the learner to **recall** the concepts of generators list out them and analyze the working of RF signal generator with diagram	CO 7
3	With a neat diagram discuss the operation of a pulse generator.	Understand	This would require the learner to **recall** the concepts of generators list out them and analyze the working of pulse generator with diagram	CO 7
4	With the help of block diagram explain the functioning of a conventional standard signal generator.	Understand	This would require the learner to **recall** the concepts of generator and list out them and analyze the working of a conventional standard signal generator.	CO 7
5	Draw the block diagram of a function generator and explain its operation.	Understand	This would require the learner to **recall** the concepts of of generator and list out them and analyze the working of a function generator.	CO 7
6	What is sweep generator? Explain in detail.	Understand	This would require the learner to **recall** the concepts of of generator and list out them and analyze the working of a sweep signal generator.	CO 7
7	Explain the method of producing sine waves in a function generator.	Understand	This would require the learner to **recall** the concepts of of generator and list out them and analyze the working of a sine wave generator.	CO 7
8	Explain the operation of a basic signal generator.	Understand	This would require the learner to **recall** the concepts of of generator and list out them and analyze the working of a basic signal generator.	CO 7

9	How broadband sweep frequencies are generated using a sweep generator.	Understand	This would require the learner to **recall** the concepts of of generator and explain the generation of sweep frequencies	CO 7
10	List various control on the front panel of a pulse generator. Mention their uses.	Understand	This would require the learner to **recall** the concepts of of pulse generator and list various panels present in the basic model and explain them each.	CO 7
11	Outline the working of Basic Spectrum Analyzer with neat schematic block diagram. List out the applications of Spectrum Analyzer?	Understand	This would require the learner to **recall** the concept of Spectrum Analyzer	CO 7
12	With neat sketches explain the principle of operation, and characteristics of suppression method of harmonic distortion analyzer	Understand	This would require the learner to **recall** the concept of harmonic distortion analyzer. And then explain how the distortion can be eliminated	CO 7
13	Discuss about basic principle of AF wave analyzer with neat block diagram.	Understand	This would require the learner to **recall** the concept of principle of wave analyzer	CO 7
14	Define Power analyzer? Explain the working of the Power analyzer with a neat block diagram.	Understand	This would require the learner to **recall** the concept of Power analyzer and then explain significance of power analyzer.	CO 7
15	Explain with a diagram the operation of a frequency selective wave analyzer.	Understand	This would require the learner to **recall** the concept of frequency selective wave analyzer. And then explain significance of frequency selective wave analyzer.	CO 7
16	Mention the considerations to be made in choosing an oscillator Instrument or Signal Generator Instrument?	Remember	---	CO 12
17	Explain in detail about the working of Video signal generators and mention its specifications.	Understand	This would require the learner to **recall** the concept of Video signal generators and then explain significance of Video signal generators	CO 7
18	With neat sketches explain principle of operation of Arbitrary waveform generator.	Understand	This would require the learner to **recall** the concept of Arbitrary waveform generator along with its application and usages	CO 7
19	Why is it necessary to measure distortion? Explain the wein bridge method used for measurement of harmonic distortion with a neat diagram.	Understand	This would require the learner to **recall** the concept of harmonic distortion analyzer. And then explain how the distortion can be eliminated	CO 7

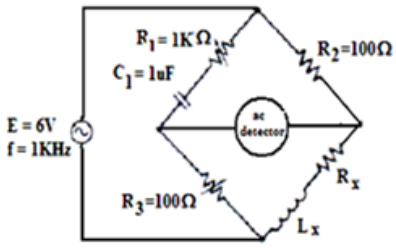
20	Define and explain the following terms associated with Spectrum Analyzer: i) Sensitivity ii) Dynamic Range iii) Harmonic Mixing	Remember	---	CO 7
Part – C (Critical Thinking Questions)				
1	Draw the block diagram of video signal generator and explain its operation.	Understand	This would require the learner to **recall** the concepts of of generator and list out them and analyze the working of a video signal generator.	CO 7
2	Mention standard specifications of a signal generator	Understand	This would require the learner to **recall** the concepts of of generator and list out them and analyze the working of a Signal generator.	CO 7
3	List the various control on the front panel of a pulse generator. Mention their uses.	Understand	This would require the learner to **recall** the concepts of of generator and list out them and pulse generator.	CO 7
4	Differentiate between a function generator and pulse and square wave generator.	Understand	This would require the learner to **recall** the concepts of pulse and square wave generator. and list out them with their applications	CO 7
5	Determine the dynamic range of a spectrum analyzer with a third-order intercept point of +40dBm and a noise level of -100dBm.	Analyze	This would require the learner to **relate** the concept of spectrum analyzer and its noise levels with a known value then **identify** a mathematical formulae and then **apply** the conditions to find out the dynamic range of a spectrum analyzer and **analyse** its dynamic range	CO 7
6	What is the minimum detectable signal of a spectrum analyzer with a noise figure of 20Db and using a 1-kHz, 3-Db filter?	Analyze	This would require the learner to **relate** the concept of spectrum analyzer and its noise figure with a known value then **identify** a mathematical formulae and then **apply** the conditions to find out the minimum detectable signal of a spectrum analyzer and **analyse** its response	CO 7
7	Compare the selectivity characteristics of the Spectrum Analyzer and Heterodyne Wave Analyzer.	Understand	This would require the learner to understand the characters tics of Spectrum and Heterodyne Wave Analyzer	CO 12
8	Describe the operation of a distortion analyzer using resonance to suppress the fundamental frequency.	Understand	This would require the learner to **recall** the concept of harmonic distortion analyzer. And then explain how the distortion can be eliminated	CO 7

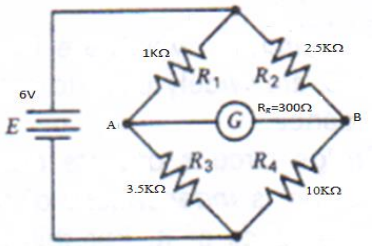
9	Explain the procedure of measurement of a harmonic distortion analyzer using a bridged-T type.	Understand	This would require the learner to **recall** the concept of harmonic distortion analyzer. And then explain how the distortion can be eliminated	CO 12
10	How the fundamental frequency is suppressed using fundamental suppression distortion analyzer? Explain	Understand	This would require the learner to **recall** the concept of fundamental suppression distortion analyzer and then explain How the fundamental frequency is suppressed	CO 7
MODULE –IV				
AC AND DC BRIDGES				
Part - A (Short Answer Questions)				
1	Define a Bridge? What is the importance of a bridge?	Remember	---	CO 8
2	Draw the circuit of a Wheatstone bridge and derive the conditions of balance.	Remember	---	CO 8
3	What are the modifications and additional features incorporated in a low voltage Schering bridge for it to be used on high voltages?	Understand	This would require the learner to **recall** the concept of Schering bridge for it to be used on high voltages	CO 8
4	Why is Hay's bridge suited for measurement of inductance of high Q coils?	Understand	This would require the learner to **recall** the concept of Hay's bridge suited for measurement of inductance of high Q coils	CO 8
5	How does the basic circuit of Kelvin's bridge differ from that of a wheatstone's bridge?	Understand	This would **require** the learner to **recall** about Kelvin's bridge and how it is differ from others	CO 8
6	State the limitations of a Wheatstone bridge. How is it overcome?	Remember	---	CO 8
7	Define the term 'null' as applied to bridge measurement?	Remember	---	CO 8
8	State the two balance conditions of wien bridge?	Remember	---	CO 8
9	Compare AC and DC bridges.	Understand	This would require the learner to **recall** the concept of AC and DC bridges. and then explain how and where to use.	CO 8
10	List out the various detectors used for ac measurements.	Remember	---	CO 8
11	State the two conditions that must be satisfied to obtain bridge balance?	Remember	---	CO 8
12	List out the different precautions to be taken when using a Bridge with an example.	Understand	This would require the learner to **recall** about precautions to be taken when using a Bridge	CO 8

13	What do you mean by Wagner's ground connection? What is its significance?	Understand	This would require the learner to **recall** the meaning and significance of Wagner's ground connection	CO 8
14	If a basic DC bridge arms are connected with R1 = 2.2 K, R2 = 3.9 K, R3 = 10 K, find R4.	Apply	This would require the learner to **recall** the concepts of bridges and **describe** the function of a bridge then **identify** a appropriate formulae then **assign** values and **find** out unknown Resistance	CO 10
15	Define Anderson Bridge? write the advantages of Anderson Bridge	Understand	This would require the learner to **recall** the concept of Anderson Bridge	CO 8
16	Write the expressions for the parallel combination of unknown resistance and capacitor in Schering bridge.	Understand	This would require the learner to **recall** the concept of Schering bridge to find the expressions for the parallel combination of unknown resistance and capacitor	CO 8
17	Write short notes on Opposite angle Bridge.	Understand	This would require the learner to **recall** the concept of Opposite angle Bridge.	CO 8
18	Mention the usage of Wagener earth connections.	Remember	---	CO 8
19	State the limitations of the Maxwell's Bridge..	Remember	---	CO 8
20	State the two conditions that must be satisfied to obtain bridge balance.	Understand	This would require the learner to **recall** the concept of conditions that must be satisfied to obtain bridge balance.	CO 8
Part - B (Long Answer Questions)				
1	What are the different problems associated with measurement of low resistances? Explain the principal of working a Kelvin's double bridge. Draw the circuit of a Kelvin's double bridge used for the measurement of low resistances. Write the condition for balance.	Understand	This would require the learner to **recall** the Kelvin's double bridge and then explain Kelvin's double bridge is balanced.	CO 8
2	What is the significance of bridge circuit measurements over direct meter measurements?	Understand	This would require the learner to **recall** the concept of bridge circuit measurements	CO 8
3	Describe the working of a low voltage schering bridge. Derive the equations for capacitance and dissipation factor. Draw the phasor diagram of the bridge under conditions of balance.	Understand	This would require the learner to **recall** the concept of Schering bridge for phasor diagram of the bridge under conditions of balance	CO 8
4	Derive the general equations for balance for an ac bridge. Prove	Understand	This would require the learner to **recall** the concept of ac bridge for	CO 8

	that the two conditions for magnitude and phase to be satisfied to get balance for an ac bridge		magnitude and phase diagram of the bridge under conditions of balance	
5	Derive the equations of balance for an Anderson's bridge. Draw the phasor diagram for conditions under balance.	Understand	This would require the learner to **recall** the concept of Anderson's bridge for phasor diagram of the bridge under conditions of balance	CO 8
6	Explain how Wien's bridge can be used for experimental determination of frequency. Derive the expression for frequency in terms of bridge parameters.	Understand	This would require the learner to **recall** about Wien's bridge and then explain how Wien's bridge can be used for experimental determination of frequency	CO 8
7	Explain the function and working of Wagner Earth Device connections. List out the uses of Wagner Earth Device connections.	Understand	This would require the learner to **recall** the functionality and significance of Wagner's ground connection	CO 8
8	Describe how Wheatstone bridge may be used to control various physical parameters	Understand	This would require the learner to **recall** about Wheatstone bridge and then explain how Wheatstone bridge can be used for experimental determination of various physical parameters	CO 8
9	State the limitations of Wheatstone bridge and how to overcome those limitations.	Understand	This would require the learner to **recall** about Wheatstone bridge and then explain how to overcome those limitations.	CO 8
10	State Hay's Bridge? Draw the circuit and obtain the balance condition of Hay's Bridge?	Understand	This would require the learner to **recall** about Hay's Bridge	CO 8
11	A Schering bridge has the following constants - Capacitor of 0.5μF in parallel with 1 kΩ resistance in arm AB, resistance of 2 kΩ in arm AD, capacitor of 0.5μF in arm BC and unknown capacitor Cx and RX in series. Assume frequency 1 kHz. Determine the unknown capacitance and dissipation factor.	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** the appropriate mathematical formulae to **Solve** unknown capacitance and dissipation factor.	CO 10
12	Identify the bridge used for measurement of inductance and explain the construction and operation of this bridge.	Analyze	This would require the learner to **relate** the concepts of different bridges and **identify** the appropriate formula and then **apply** the formulae to **measure u**nknown inductance	CO 8
13	The basic AC bridge consists of the following constants:	Apply	This would require the learner to **recall** the concepts of bridges and	CO 10

	AB: R=400 , BC: R=150 , CD: unknown and DA: R=100 in series with L=10mH. Oscillator frequency is 1KHz. Determine the constants of arm CD.		**describe** its functionality **identify** the formula and then **apply** formulae to Determine the constants of arm CD.	
14	A Maxwell bridge is used to measure inductive impedance. The bridge constants at balance are C1=0.01μF, R1=520k Ω, R2=6.2k Ω and R3=200k Ω. Find the series equivalent of the unknown impedance?	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** the appropriate mathematical formulae to **Solve** unknown impedance.	CO 10
15	What are the limitation of Wheat stone's bridge? Derive the balance equation of Kelvin's double bridge for unknown low resistance.	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** the appropriate mathematical formulae to **Solve** unknown resistance.	CO 10
16	In a certain Wheatstone bridge circuit measurements, RA=200k Ω, RB=400k Ω, RC=100k Ω, RD=300k Ω. E=1.5V, Rg=100 Ω, with usual notation. Determine the current through the detector galvanometer.	Apply	This would require the learner to **relate** the concepts of different bridges and **describe** the functionality of a bridge then **identify** the formula and then **apply** the appropriate mathematical formulae to **find** out the current	CO 10
17	In the case of a Schering Bridge, arm Ac has R=4.7kΩ. Arm CD has unknown elements. Arm BD has C=0.1μF Arm AB=4.7KΩ is shunt with 1MF. Determine Values of components is the arm CD.	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** formulae to Determine the constants of arm CD.	CO 10
18	An unbalanced Wheatstone bridge has the following standard arms: R1=1K Ω, R2=2K Ω, R3=3K Ω, R4=4K Ω, Rg=300 Ω and E=5V. Calculate the current through the galvanometer	Apply	This would require the learner to **relate** the concepts of different bridges and **describe** the functionality of a bridge then **identify** the formula and then **apply** the appropriate mathematical formulae to **find** out the current.	CO 10
19	Draw the phasor diagram and write the equations for balance conditions in the case of Maxwell's Inductance Bridge.	Understand	This would require the learner to **recall** the concepts of bridges and **find out** the condition for balanced bridge	CO 10
20	A Kelvin's Bridge consist of Ra=1600Rb, R1=800Rb and R1=1.25R2.Calculate the value of Rx, if applied DC voltage is 1.5V.	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** the formulae to measure unknown resistance.	CO 10

Part – C (Critical Thinking Questions)				
1	For a Maxwell bridge R1=235 k, R2=255k,R1=35k ,C1=0.012mF, C2=0.025mF calculate unknown inductive impedance in series.	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** the appropriate mathematical formulae to **calculate** unknown impedance	CO 10
2	A Maxwell bridge is used to measure inductive impedance. The bridge constants at balance are C1=0.01μF, R1=470k Ω, R2=5.1k Ω and R3=100kΩ. Find the series equivalent of the unknown impedance?	Apply	This would require the learnerto **define** a bridge and **describe** its functionality then **identify** the formula and **apply** the appropriate mathematical formulae to **Solve** unknown impedance.	CO 10
3	In a certain Wheatstone bridge Rb=400kΩ, Rb=100kΩ, Rd=300k Ω usual notation. Determine the current through the detector galvanometer.	Apply	This would require the learner to **relate** the concepts of different bridges and **describe** the functionality of a bridge then **identify** the formula and then **apply** the appropriate mathematical formulae to **find** out the current	CO 10
4	A Maxwell bridge is used to measure inductive impedance. The bridge constants at balance are C1=0.03μF, R1=500k Ω, R2=5k Ω and R3=10kΩ. Find the series equivalent of the unknown impedance	Apply	This would require the learner to **define** a bridge and **describe** its functionality then **identify** the formula and **apply** the appropriate mathematical formulae to **Solve** unknown impedance	CO 10
5	In a Wien bridge oscillator R1 = R2 =75k, C1=C.2= 400pf with usual notation. Determine the frequency of oscillations?	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** the appropriate mathematical formulae Determine the frequency of oscillations	CO 10
6	Given the Opposite-Angle (Hay's) bridge of Figure. Find, i. The equivalent series resistance, R_x. ii. The inductance, L_x. 	Evaluate	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** the appropriate mathematical formulae to **Calculate** inductance	CO 10

7	Find the equivalent series element for the unknown impedance of the Schering bridge network whose impedance measurements are to be made at null. $R_1 = 470\ k\Omega$ $C_1 = 0.01\ mF$ $R_2 = 100\ k\Omega$ $C_3 = 0.1\ mF$	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** the appropriate mathematical formulae to **find** the equivalent series element	CO 10
8	The four arms of an Hay's alternating current bridge are arranged as follows: AB is coil of unknown impedance, BC is non-reactive resistor of 1000 Ω, CD is a non-reactive of 833Ω in series with a standard capacitor of 0.38μF, DA is non-reactive resistor of 16800Ω. If the supply frequency is 50Hz, determine the inductance and resistance at the balanced conditions. Derive the conditions for balance and draw the phasor diagram under balanced conditions.	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply the formula to measure** equivalent series element and also draw the phasor diagram under balanced conditions.	CO 10
9	An unbalanced wheatstone bridge is given in figures. Calculate the current through the galvanometer. 	Evaluate	This would require the learner to **relate** the concepts of different bridges and **describe** the functionality of a bridge then **identify** the formula and then **apply** the appropriate mathematical formulae then **analyse** the performance of a bridge ,from this **evaluate** its output	CO 10
10	A sample Bakelite was tested by the bridge method(Schering) at 11KV, 50Hz. Balance was obtained at the following values **AB**- dielectric material under test in the form of a capacitor **BC**- a standard air capacitor at 100pF **CD**- capacitor of 0.6μF in parallel with a non-reactive resistance of 300Ω**DA**- nonreactive resistance of 100Ω. Calculate the capacitance and equivalent series resistance of the sample	Apply	This would require the learner to **recall** the concepts of bridges and **describe** its functionality **identify** the formula and then **apply** the appropriate mathematical formulae to **Solve** unknown capacitance and equivalent series resistance	CO 10

MODULE -V				
TRANSDUCERS				
Part - A (Short Answer Questions)				
1	Define transducer?	Remember	---	CO 9
2	List the classification of transducers?	Remember	---	CO 9
3	Define strain gauge and gauge factor.	Remember	---	CO 11
4	State the various parameters of electrical transducers	Remember	---	CO 11
5	Write brief notes on thermocouples?	Understand	This would require the learner to **recall** the concept of thermocouples	CO 9
6	Differentiate between primary and secondary transducers	Understand	This would require the learner to **recall** the concept of different types f transducers	CO 11
7	What is difference between active and passive transducers	Understand	This would require the learner to **recall** the concept of different types f transducers	CO 11
8	List out the factors to be considered while selecting a transducer	Understand	This would require the learner to understand the concept of transducers and explain the factors to select a transducer	CO 9
9	List out the advantages and limitations of thermocouples	Remember	--	CO 9
10	State the basic principle of hot wire Anemometer.	Remember	--	CO 9
11	What do you understand by electrical transducers?	Understand	This would require the learner to **recall** the electrical transducers	CO 13
12	State the advantages and disadvantages of potentiometer.	Remember	--	CO 10
13	Why are strain gauges used in bridge arrangement?	Understand	This would require the learner to **recall** the concept of strain gauges	CO 10
14	How can inductors are used as a transducer.	Understand	This would require the learner to **recall** How can inductors are used as a transducer	CO 10
15	List out the different methods of varying self inductance	Remember	---	CO 10
16	Define the principles of LVDT and RVDT.	Remember	---	CO 11
17	List out the various types of temperature transducer with an application of each one	Remember	---	CO 11
18	List out the five physical quantities that the transducer measures.	Remember	---	CO 11

19	What is the method for the measurement of Liquid level?	Understand	This would require the learner to **recall** the measurement of Liquid level	CO 11
20	Differentiate between thermistors and thermocouple.	Remember	---	CO 11
21	State the various advantages, disadvantages and applications of thermocouple.	Understand	This would require the learner to **recall** the concept of thermocouple.	CO 11
22	Give the principle of capacitive transducers.	Understand	This would require the learner to **recall** the concept of principle of capacitive transducers	CO 11
23	Give the operating principle involved in piezoelectric transducers.	Understand	This would require the learner to **recall** the concept of principle involved in piezoelectric transducers.	CO 9
24	What is mean by gauge factor? Give its expression.	Understand	This would require the learner to **recall** the concept of strain gauges	CO 11
Part - B (Long Answer Questions)				
1	Define a transducer? Write the classifications of transducers? Explain the difference between primary sensors and transducers with help of examples.	Understand	This would require the learner to **recall** the concept of primary sensors and transducers	C 9
2	Explain working of strain gauge and what are its specific advantages and limitations?	Understand	This would require the learner to **recall** the concept of strain gauge	CO 11
3	Define Piezo-electric effect? Describe with the diagram the operations of a piezo electric transducer.	Understand	This would require the learner to **recall** the concept of piezo electric transducer. And explain Piezo-electric effect	CO 9
4	What is mean by thermocouples Explain the desirable characteristics of thermocouples?	Understand	This would require the learner to **recall** the concept of thermocouples	CO 9
5	Explain in detail about method of measurement of displacement using Displacement transducers.	Understand	This would require the learner to **recall** about the Displacement transducers and then explain measurement of displacement	CO 11
6	Define resistance thermometers? Discuss in detail about resistance thermometers.	Understand	This would require the learner to **recall** about earner to recall the resistance thermometers	CO 9
7	What are capacitive transducers? Give the expression for a capacitance of a capacity transducer.	Understand	This would require the learner to **recall** the concept of capacitive transducers and then Give the expression for a capacitance	CO 9
8	Define Magneto Strictive transducers? Explain the working of Magneto Strictive transducers with a neat diagram.	Understand	This would require the learner to **recall** the concept of Magneto Strictive transducers and then explain the how to use Magneto Strictive transducers for measurement	CO 9

9	Explain the Principle, working, Construction, characteristics and applications of thermistors.	Understand	This would require the learner to **recall** the concept of thermistors and then explain the how to use thermistors for measurement	CO 9
10	What are Strain gauges? Explain the Principle and working of Strain gauges	Understand	This would require the learner to **recall** the concept of Strain gauges and then explain the how to use Strain gauges for measurement	CO 11
11	Distinguish between thermocouple and thermistor? State the limitations of thermocouple.	Understand	This would require the learner to **recall** the concept of thermistors and thermocouple	CO 9
12	Explain the principle , working , construction , Characteristics and applications of LVDTs	Understand	This would require the learner to recall the concept of LVDT and then explain the how to use LVDT for measurement	CO 11
13	List out the Salient features of Semiconductor Strain gauges? Explain the working principle of Semiconductor Strain gauges?	Remember	This would require the learner to recall the concept of Strain gauges and then explain the how to use Semiconductor Strain gauges for measurement	CO 11
14	Define and Explain the principle and working of Hot-wire Anemometer	Understand	This would require the learner to recall the concept of Hot-wire Anemometer and then explain the how to use Hot-wire Anemometer for measurement	CO 9
15	Describe the operations of resistance thermometer and state the advantages and limitations.	Understand	This would require the learner to **recall** the concept of resistance thermometer and then explain the how to use resistance thermometer for measurement	CO 9
16	Show that a parallel plate capacitor serves as the most suitable transducer for measurement of linear and angular displacements.	Understand	This would require the learner to **recall** how to measure linear and angular displacements.	CO 11
17	What are the factors to be considered for the selection of better transducer? Explain.	Remember	---	CO 9
18	Describe the construction and working of potentiometer type resistance transducer for measuring linear displacement.	Understand	This would require the learner to **recall** the concept of potentiometer type resistance transducer	CO 9
19	Explain the method f measuring displacement using LVDT. State advantages and disadvantages of LVDT.	Understand	This would require the learner to **recall** the concept of LVDT and how to measure displacement using LVDT.	CO 9
20	List out different types of Strain Gauges used Transducer and explain any one in detail.	Remember	This would require the learner to **recall** the concept of Strain Gauges	CO 11

Part – C (Critical Thinking Questions)				
1	A resistance strain gauge with a guage factor of 2 is cemented to a steel member, which is subjected to a strain of 1x10-6.If original resistance value of the gauge is 130 Ω, calculate the change in resistance.	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a resistance tranducer then obtain the appropriate formula and **apply** the formulae to calculate the change in resistance.	CO11
2	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 in. ii. The output voltage when the core is -0.25 in. from the centre.	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a resistance tranducer then obtain the appropriate formula and **apply** the formulae to calculate the change in resistance..	CO11
3	A resistance strain gage with a gage factor of 2 is fastened to a steel member subjected to a stress of 1050 kg/cm2. The modulus of elasticity of steel is approximately 2.1x106 kg/cm2 . Calculate the change in resistance ΔR, of the strain-gage element due to the applied stress.	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a resistance tranducer then obtain the appropriate formula and **apply** the formulae to calculate the change in resistance.	CO11
4	A 100Ω strain guage with a guage factor of 1 is affixed to a metal bar. The bar is stretched and this causes a change in resistance of 0.001Ω. Find the change in length if the original length is 10cm.	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a tranducer then obtain the appropriate formula and **apply** the formulae to calculate the change in Length	CO11
5	A thermistor has a resistance of 3980 Ω at the ice point0ºc and 749 Ω at 50ºc.the resistance temperature relationship is RT=a R0 eb/T. Find the values of a and b. Calculate the resistance to be measured in case of temperature varies from 400C to 100ºc	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a resistance tranducer then obtain the appropriate formula and **apply** the formulae to calculate the Value of resistance.	CO11
6	A transducer that measures force has nominal resting resistance of 300 W .and is excited by 7.5V. When a 980 dyne force is applied, all four equal resistance	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a resistance tranducer then obtain the appropriate formula	CO11

	bridge elements change resistance by 5.2W . Find the output voltage Eo.		and **apply** the formulae to calculate output voltage	
7	A platinum thermometer has a resistance of 100 Ω at 25C. i. Find its resistance at 65 C if the platinum resistance temperature co-efficient of 0.00392/C. ii. If the thermometer has a resistance of 150Ω, calculate the temperature.	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a resistance tranducer then obtain the appropriate formula and **apply** the formulae to calculate the resistance.	CO11
8	An LVDT has a secondary voltage of 5.0 V for a displacement of 12.5 mm. Determine the output voltage for a core displacement of 8.0 mm from its central position	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a LVDT then obtain the appropriate formula and **apply** the formulae to calculate the output voltage	CO11
9	A resistance strain gauge with a guage factor of 5 is cemented to a steel member, which is subjected to a strain of 2.5x10-6.If original resistance value of the gauge is 120 Ω, calculate the change in resistance.	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a resistance tranducer then obtain the appropriate formula and **apply** the formulae to calculate the change in resistance.	CO11
10	2 An ac LVDT has the following data. Input = 8.3V, Output = 2.2V, range ±0.4in. Determine, i. Calculate the output voltage vs core position for a core movement going from +0.55in. to -0.40 in. ii. The output voltage when the core is -0.25 in. from the centre.	Apply	This would require the learner to **recall** the concepts of a transducer and **describe** the function of a resistance tranducer then obtain the appropriate formula and **apply** the formulae to calculate the change in resistance..	CO11

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