INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

Department of Electrical and Electronics Engineering

TUTORIAL QUESTION BANK

Course Name	:	**Electrical Measurements and Instrumentation**
Course Code	:	**AEE008**
Class	:	B.TECH IV- SEM
Branch	:	Electrical and Electronics Engineering
Year	:	2018-2019
Course Coordinator	:	Mr. P Shivakumar**,** Assistant Professor EEE
Course Faculty	:	Mr. P Shivakumar**,** Assistant Professor EEE

OBJECTIVE:

This course deals with measuring instruments mainly indicating instruments and the associated torques, instrument transformers, power factor meter, frequency meter, synchro scopes, wattmeter, energy meter, potentiometer, resistance measuring methods, ac bridges, extension range of indicating instruments. Oscilloscope, digital voltmeters, signal analyzers and transducers

UNIT – I

INTRODUCTION TO MEASURING INSTRUMENTS

PART – A (SHORT ANSWER QUESTIONS)

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes
1	Give the main classifications of electrical instruments.	Remember	01
2	Define the absolute instruments.	Remember	01
3	Define the secondary instrument.	Remember	01
4	Define the recording instruments.	Remember	01
5	State the principle of magnetic effect.	Remember	01
6	State the principle of electro-induction effect.	Remember	01
7	What are the different arrangements to provide damping torque?	Remember	01
8	Define control torque and classification of control torques?	Remember	01
9	What is the importance of MC instruments?	Understand	02
10	What is the importance of MI instruments?	Understand	02
11	Distinguish between PMMC and MI instruments?	Understand	02

12	Define damping torque.	Remember	01
13	Write expression for control torque for PMMC instrument?	Understand	02
14	Define deflection torque.	Remember	01
15	Differentiate between the spring control and gravity control	Remember	01
16	Why is scale of MI instrument calibrated non- linearly?	Understand	02
PART – B (LONG ANSWER QUESTIONS)			
1	Discuss the construction and working principle of repulsion type MI instrument. Derive the equation for deflection torque?	Understand	02
2	Explain the construction and working of PMMC instrument. Derive the equation for deflection if the instrument is spring controlled. Describe the method of damping used in these instruments?	Remember	02
3	Distinguish between gross error, systematic error and random error with examples. What are the methods for their elimination/reduction?	Remember	01
4	Define magnetic effect, electro-static effect, heat effect, chemical effect, induction effect.	Understand	01
5	Derive the expression for value of multiplier in the multi-range voltmeter?	Understand	02
6	Discuss construction and operation of electrostatic voltmeter and derive torque equation?	Remember	03
7	Explain the construction and principle of attraction type of moving iron instrument and derive its torque equation?	Understand	02
8	Write about extension of range of ammeters and voltmeters?	Understand	01
9	Distinguish between the permanent magnet moving coil and moving iron instruments?	Remember	02
10	Explain different types of instrument errors and give examples?	Understand	01
11	Discuss the construction and working principle of attracted type electrostatic voltmeter. Derive the equation for deflection torque?	Understand	03
12	What are the shunts and multiplier? Derive the expression for both, with reference to meters used in electrical circuits.	Remember	01
13	Discuss advantages and disadvantages of moving coil and moving iron instruments?	Remember	02
14	How to obtain different voltage ranges by using DC voltmeter? Discuss about sensitivity and loading effects of such meters.	Remember	02
PART – C (ANALYTICAL QUESTIONS)			
1	A moving-coil instrument gives a full scale deflection. When the current is 40 mA and its resistance is 25. Calculate the value of the shunt to be connected in parallel with the meter to enable it to be used as an ammeter for measuring currents up to 50 A.	Understand	01
2	A moving-coil instrument having a resistance of 20, gives a full scale deflection. When the current is 5mA. Calculate the value of the multiplier to be connected in series with the instrument so that it can be used as a voltmeter for measuring full. Scale. deflection up to 200 V	Understand	01

3	The coil of a measuring instrument has a resistance of 1 Ω and the instrument has a full scale deflection of 250 V when a resistance of 4999 Ω is connected with it. Find the current range of the instrument when used as an ammeter with the coil connected across a shunt of (1/499) Ω and the value of the shunt resistance for the instrument to give a full scale deflection of 50 A.	Remember	02
4	A PMMC instrument has a coil dimensions 15mm*12mm. the flux density in the air gap is 1.8 mWb/m*m and the spring constant 0.14micro N-m/rad. Determine the number of turns required to produce an angular deflection of 90degrees when a current of 5mA is flowing through the coil.	Understand	02
5	A coil of a moving coil voltmeter is 40 mm long and 30 mm wide and has 100 turns wound on it. The control spring exerts a torque of $0.25 * 10^{-3}$ Nm when the deflection is 50 divisions on the full scale. If the flux density of the magnetic field in the air gap is 1 Wb/m^2, estimate the resistance that must be put in series with the coil to give 1 V/division. Resistance of voltmeter is 10000 ohms.	Understand	02
6	A meter of resistance 50 ohms has a full scale deflection of 4 mA. Determine the value of shunt resistance required in order that full scale deflection should be (a) 15 mA (b) 20 A (c) 100 A	Understand	02
7	A moving coil ammeter has fixed shunt of 0.01 ohms. With a coil resistance of 750 ohms and a voltage drop of 400 mV across it, the full scale deflection is obtained. a) Calculate the current through shunt b) Calculate the resistance of meter to give full scale deflection if the shunted current is 50 A.	Understand	02
8	Design a multirange DC milliammeter with a basic meter having a resistance 75 ohms and full scale deflection for the current of 2 mA. The required ranges are 0-10 mA, 0-50 mA and 0-100mA.	Remember	02
9	An electrostatic voltmeter reading up to 1 kV is controlled by a spring with a torsion constant of $0.0981 * 10^{-6}$ Nm/degree and has a full scale deflection of 80^0. The capacitance at zero voltage is $10*10^{-12}$ farad. What is the capacitance when the pointer indicates 1 kV?	Remember	03
10	The capacity of an electrostatic voltmeter ranging from 0 to 2000 V increases from 80 to 90pF as the pointer moves from zero to full scale deflection. Calculate the value of external capacitor used to increase its range to 20 kV. If the capacitor is adjusted to make the full scale reading correct, what will be the error at half scale reading?	Understand	03
11	A 0–1 A ammeter having a resistance of 50is used to measure the current flowing in 1 k resistor when the supply voltage is 250 V. Calculate: (a) the approximate value of current (neglecting the ammeter resistance), (b) the actual current in the circuit, (c) the power dissipated in the ammeter, (d) the power dissipated in the 1 k resistor	Understand	01
12	A voltage of 240 V is applied to a circuit consisting of an 800 resistor in series with a 1.6 k resistor. What is the voltage across the 1.6 k resistor? The potential differences across the 1.6 k resistor are measured by a voltmeter of full scale deflection.250 V and sensitivity 100 ohms/V. Determine the voltage indicated.	Understand	02
UNIT – II			
POTENTIOMETERS AND INSTRUMENT TRANSFORMERS			
PART – A (SHORT ANSWER QUESTIONS)			
1	Why the secondary of a CT is never left open circuited?	Understand	06

2	What are the steps to be taken for minimizing errors in Potential Transformer?	Remember	06
3	What are the errors occurs in instrument transformers.	Remember	06
4	Differentiate the principle of DC potentiometer and AC potentiometer.	Remember	04
5	Define potentiometer?	Understand	04
6	Define polar type potentiometer?	Understand	04
7	Define co-ordinate type potentiometer?	Understand	04
8	Define turns ratio?	Understand	06
9	Define nominal ratio?	Understand	06
10	Define the ratio error?	Understand	06
11	Suggest the different methods to reduce the ratio and phase angle error of current transformer?	Remember	06
12	Suggest the different methods to reduce the ratio and phase angle error of potential transformer?	Remember	06
13	Define standardization?	Remember	05
14	Define burden of instrument transformers?	Remember	05
15	Explain any two applications of DC potentiometer?	Remember	05
16	Define AC potentiometer? Give classification of AC potentiometer?	Understand	04
17	List the basic requirements of AC potentiometer?	Understand	04
18	Define DC potentiometer? Give classification of DC potentiometer?	Understand	04
PART – B (LONG ANSWER QUESTIONS)			
1	Explain the principle of basic slide wire DC potentiometer with neat diagram?	Understand	04
2	Describe the construction, principle of operation of DC Crompton's potentiometer by drawing neat circuit diagram. Explain its advantages?	Remember	04
3	Compute the steps for measurement of unknown resistance and power using DC potentiometer?	Understand	05
4	Discuss the steps for measurement of voltage and current using DC potentiometer?	Understand	05
5	Describe construction and working of polar type potentiometer. How is it standardized? What are the functions of transfer instrument and phase shifting transformers?	Understand	04
6	State and explain the essential features of construction of one type of AC potentiometer with help of neat sketch?	Understand	04
7	State and explain the applications of AC potentiometers with the suitable diagrams?	Understand	05
8	Distinguish between DC and AC potentiometers?	Remember	04

9	Draw the equivalent circuit and phasor diagram of potential transformer and Derive expression for actual transformation ratio, ratio error and phasor angle error of a potential transformer.	Understand	06
10	Draw the equivalent circuit and phasor diagram of current transformer and derive the expression for the ratio and phase angle errors?	Understand	06
12	State the advantages and disadvantages of instrument transformers?	Remember	06
13	Enlist the difference between power transformer and instrument transformer?	Remember	06
PART – C (ANALYTICAL QUESTIONS)			
1	During the measurement of a low resistance using a potentiometer the following readings were obtained. Voltage drop across the low resistance under test = 0.4221 V, voltage drop across a 0.1 ohm standard	Understand	05
2	A single range potentiometer has a 18 step dial switch where each step represents 0.1 V. the dial resistors are 10 ohms. The slide wire of potentiometer is circular and has 11 turns and resistance of 11 ohms each. The slide wire has 100 divisions and interpolation can be done to $1/4^{th}$ of division. The working battery has a voltage of 6 V and negligible internal resistance. Calculate, i) the measuring range of potentiometer, ii) the resolution iii) working current and setting of rheostat.	Understand	05
3	Design a volt- ratio box with a resistance of 20 ohms/V and ranges 3 V, 10V, 30 V, 100 V. the volt-ratio box is to be used with a potentiometer having a measuring range of 1.5 V.	Understand	05
4	Design a volt- ratio box with a resistance of 50 ohms/V and ranges 25 V, 50V, 75 V, 150 V and 300 V. the volt-ratio box is to be used with a potentiometer having a measuring range of 1.6 V.	Understand	05
5	Power is measured with an AC potentiometer. The voltage across 0.1 ohms standard resistance connected in series with load is (0.35-j0.1) V. The voltage across 300:1 potential divider connected to supply is (0.8+j 0.15) V. determines power consumed by load and power factor.	Understand	06
6	Calculate the inductance of coil from the following measurement of ac potentiometer. Voltage across 0.1 ohm standard resistor in series with coil is 0.613 with 12.6 deg. Voltage drop across test coil through 100/1 volt-ratio box is 0.718 with 50.48 deg	Understand	06
7	A potential transformer ratio 1000/100 V has the following constants: Primary resistance = 945 ohms, secondary resistance = 0.86 ohm, primary reactance = 66.2 ohms, total equivalent reactance = 110 ohms, no-load current 0.03 A at 0.4 power factor lagging. calculate phase angle error on no load and burden in VA at unity power factor at which the phase angle will be zero	Understand	06
8	A potential transformer ratio 2000/100 V has the following constants: Primary resistance = 105 ohms, secondary resistance = 0.7 ohm, primary reactance = 75.2 ohms, total equivalent reactance = 0.087 ohms, no-load current at 0.03 A at 0.36 power factor lagging. calculate phase angle error on no load , phase angle error on a load of 5 A at 0.92 lagging power factor and burden in VA at unity power factor at which the phase angle will be zero	Understand	06

9	A single phase potential transformer has a turn's ratio of 3810/63. The nominal secondary voltage is 63 V and the total equivalent resistance and leakage reactance referred to the secondary side are 2 ohms and 1 ohms respectively. Calculate the ratio and phase angle errors when the transformer is supplying a burden of 100+j 200 ohms.	Understand	06
10	A current transformer with bar primary has 300 turns in its secondary winding. The resistance and reactance of the secondary circuit are 1.5Ω and 1.0 Ω respectively, including the transformer winding. With 5A flowing in the secondary winding, the magnetizing mmf is 100AT and the core loss is 1.2 W. Determine the ratio and phase angle errors.	Understand	06
11	A current transformer with 5 primary turns has a secondary burden consisting of a resistance of 0.16 ohms and an inductive reactance of 0.12 ohms, when the primary current is 200 A, the magnetizing current is 1.5 A and the iron loss current is 0.4 A. find the number of secondary turns needed to make the current ratio 100.	Understand	06
UNIT – III			
MEASUREMENT OF POWER AND ENERGY			
PART – A (SHORT ANSWER QUESTIONS)			
1	Define Power.	Understand	08
2	What are the main two coils in wattmeter?	Remember	08
3	Define element in wattmeter.	Remember	08
4	Suggest the type of connection of wattmeter into circuit under different conditions.	Remember	09
5	Define two wattmeter method and write power factor equation for balanced load?	Understand	09
6	Give the expression for three phase power using instrument transformer.	Remember	08
7	What is the importance of instrument transformer in collaboration with wattmeter?	Remember	08
8	How the pressure and control coil of wattmeter are connected in circuit?	Remember	08
9	Define the nature of resistance in pressure and current coil in wattmeter?	Remember	08
10	Discuss types of errors in wattmeter?	Remember	08
11	Define correction factor?	Remember	08
12	Write torque equation of single phase electrodynamometer type wattmeter?	Remember	08
13	Discuss eddy current errors in electrodynamometer wattmeter?	Understand	09
1	Define energy.	Remember	10
2	Define meter constant	Remember	10
3	What is the major cause of creeping error in an energy meter?	Remember	10

4	Write the expression for driving torque in single-phase induction type energy meter?	Remember	10
5	Define the nature of resistance in pressure and current coil in energy meter?	Understand	10
6	Write short notes on voltage compensation?	Remember	10
7	Write short notes on temperature compensation?	Understand	10
8	Define driving system of energy meter?	Remember	10
9	Define braking system of energy meter?	Understand	10
10	Define registering system of energy meter?	Understand	10
11	Define the static and running frictions in energy meter.	Remember	10
12	Write short notes on advantages of demand indicator?	Remember	10
13	Write short notes on advantages of trivector meter?	Remember	10
PART – B (LONG ANSWER QUESTIONS)			
1	Derive the formula for power in AC and DC circuits?	Remember	08
2	Discuss the shape of scale of single phase electrodynamometer type wattmeter with neat sketch?	Understand	08
3	Derive the torque equation of single phase electrodynamometer type wattmeter?	Understand	08
4	What are the special features that are incorporated into the electrodynamometer wattmeter for making a low power factor type of wattmeter?	Understand	08
5	Explain how the power in a three phase circuit is measured by the use of single wattmeter?	Understand	09
6	Distinguish between advantages and disadvantages of two wattmeter method?	Understand	08
7	Explain the working of a three phase dynamometer wattmeter. Describe how mutual effects between the two elements of the wattmeter are eliminated.	Understand	08
8	Obtain the expression for power, in terms of correction factor, wattmeter reading, and actual ratio of P.T. and C.T., in case of power measurement along with instrument transformer?	Understand	09
9	Explain with a neat sketch the construction and working of a single phase induction type energy meter.	Understand	10
10	Derive an expression for a single phase induction type energy meter to show that the number of revolutions of disc is proportional to power consumed by the load?	Understand	10
11	State the advantages and disadvantages of induction type energy meter?	Remember	10
12	Explain the construction of two element and three element of three phase energy meters.	Understand	10
13	Discuss the phantom load testing of energy meter?	Understand	10

14	Explain the testing of energy meter using R.S.S meter?	Understand	10
15	Summarize the working of trivector meter?	Understand	10
	PART – C (ANALYTICAL QUESTIONS)		
1	A wattmeter has a current coil of 0.03 ohms resistance and a pressure coil of 6000 ohms resistance. Calculate the percentage error if the wattmeter is so connected that i) the current coil is on the load side ii) the pressure coil is on the load side a) if the load takes 20 A at a voltage of 220 V and 0.6 power factor in each case b) What load current would give equal errors with the two connections?	Understand	08
2	A 500 V, 20 A dynamometer instrument is used as a wattmeter. Its current coil has 0.1 ohms resistance and pressure coil has 25 K ohms resistance with 0.1 H inductance. The meter was calibrated on DC supply. What is the error in the instrument if it is used to measure the power in a circuit with supply voltage of 500 V, load current of 24 A at 0.2 P.f. assume that pressure coil is connected across load?	Understand	08
3	In a dynamometer type wattmeter, the moving coil has 500 turns of mean diameter 3 cm. calculate the torque if the axis of the field and moving coils are at i) 30^0 ii) 60^0 and iii) 90^0 the flux density in the field coil is 15 m Wb/m^2, the current in the moving coil is 0.5 A and power being measured has a power factor of 0.866.	Understand	08
4	A wattmeter has a current coil of 0.1 ohms resistance and a pressure coil of 6500 ohms resistance. Calculate the percentage errors, due to resistance only with each of the two methods of connection of wattmeter when reading the input to an apparatus which takes i) 12 A at 250 V with unity power factor and ii) 12 A at 250 V and 0.4 power factor.	Understand	08
5	A three phase, 400 V load has power factor of 0.6 lagging. The two wattmeter's read a total input power of 20 kW. Find the reading of each wattmeter.	Understand	08
6	Two wattmeters connected to measure the input to a balanced three phase circuit indicate 2000 W and 500 W respectively. Find the power factor of the circuit: i) when both readings are positive ii) when the latter is obtained after reversing the connection to the current coil of one instrument.	Understand	08
7	The power flowing in a three phase, three wire balanced delta connected load system is measured by two wattmeter method. The reading of wattmeter A is 7500 W and of wattmeter B is -1500 W. i) what is the power factor of the system ii) if the voltage of the circuit is 400 V, what is the value of capacitance which must be introduced in each phase to cause the whole of the power measure to appear on wattmeter A. the frequency is 50Hz.	Understand	08
8	An energy meter is designed to make 100 revolutions of the disc for one unit of energy. Calculate the number of revolutions made by it when connected to a load carrying 20 A at 230 V at 0.8 p.f. for an hour. If it actually makes 360 revolutions, find the percentage error?	Understand	10
9	A correctly adjusted 240 V, induction watt-hour meter has meter constant of 600 revolutions per kWh. Determine the speed of the disc for a current of 10 A, at a power factor pf 0.8 lagging. If the lag adjustment is altered so that the phase angle between flux and applied voltage is 86^o, calculate the error introduced at i) unity p.f. ii) 0.5 p.f. lagging.	Remember	10

10	A 230 V, single phase, watt hour meter has a constant load of 4 A passing through it for 6 hours at unity power factor. If the meter disc makes 2208 revolutions during this period, what is the meter constant in revolutions per kWh. Calculate the power factor of the load if the number of revolutions made by the meter are 1472 when operating at 230 V and 5 A for 4 hours.	Understand	10
11	A 220 V, 5 A DC energy meter is tested at its marked ratings. The resistance of the pressure circuit is 8800 ohms and that of current coil is 0.1 ohms. Calculate the power consumed when testing the meter with phantom loading with current circuit excited by a 6 V battery.	Remember	10
UNIT – IV			
DC AND AC BRIDGES			
PART – A (SHORT ANSWER QUESTIONS)			
1	Classify resistances from the point of view of measurements.	Understand	11
2	Write various advantages of bridge circuit.	Remember	11
3	State advantages and disadvantages of Hay's bridge?	Remember	12
4	Write advantages and disadvantages of own's bridge?	Understand	13
5	Write the expression for sensitivity of wheat stone bridge.	Remember	13
6	What are the sources of errors in AC bridge measurement?	Remember	12
7	Draw a suitable AC bridge used for measurement of frequency.	Understand	12
8	State advantages and disadvantages of Anderson's bridge.	Remember	12
9	Discuss applications of megger?	Remember	12
10	Write various methods for measurement of unknown inductance?	Remember	12
11	Write various methods for measurement of unknown capacitance?	Understand	13
12	What is three terminal resistance? Explain its use.	Remember	11
13	Write various methods for measurement of medium resistance?	Remember	11
14	Write various methods for measurement of low resistance?	Remember	11
PART – B (LONG ANSWER QUESTIONS)			
1	Explain the following: why is the voltmeter-ammeter method unsuitable for the precise measurement of the low resistance?	Understand	11
2	Discuss the substitution method of measurement of medium resistances. List the factors on which the accuracy of the method depends.	Remember	11
3	Derive expression for bridge sensitivity for Wheatstone bridge with equal arms. Find also the expression for current through the galvanometer.	Understand	12
4	With a neat diagram describe the working of a Carey-Foster slide wire bride method.	Understand	11

5	State different problems associated with the measurement of low resistances. Explain principle of working Kelvin's double bridge and derive condition for balance.	Understand	11
6	Explain how insulation resistance of a cable can be measured with a help of loss of charge method.	Remember	11
7	Draw the circuit diagram and phasor diagram under balanced conditions for the Anderson's bridge. Also derive the equations under balances condition.	Understand	12
8	Explain the working of Hay's bridge for measurement of inductance with a circuit diagram. Derive the equations for balance and draw the phasor diagram under balanced condition.	Remember	12
9	Define dissipation factor. Derive equation for dissipation factor in case of low voltage Schering bridge with neat circuit diagram.	Understand	13
10	What is wien's bridge? Derive the expression for the frequency. Draw the phasor diagram.	Understand	13
11	Draw the circuit diagram and phasor diagram under balanced conditions for the De Sauty's bridge. Also derive the equations under balances condition	Understand	13
12	Distinguish between advantages and disadvantages of Owen's bridge and derive the equations under balance condition, write applications of Owen's bridge?	Understand	13
PART – C (ANALYTICAL QUESTIONS)			
1	In a carry foster bridge a resistance of 1.0125 ohms is compared with standard resistance of 1.0000 ohms, the slide wire has a resistance of 0.250 ohms in 100 divisions. The ratio arms nominally each 10 ohms, are actually 10.05 and 9.95 ohms. Slide wire is of 100 cm. find the position of balance.	Understand	11
2	A four arms of Whetstone's bridge are as follows: AB= 100 ohms, BC = 10 ohms, CD = 4 ohms, DA = 50 ohms The galvanometer. What should be the resistance in the arm DA from current through the galvanometer?	Understand	11
3	A Kelvin's double bridge is balanced with the following constants. Outer ratio = 100 ohms and 1000 ohms, Inner ratio arms = 99.92 ohms and 1000.6 ohms, resistance of link = 0.1 ohms, Standard resistance = 0.00377 ohms, calculate the value of unknown resistance.	Understand	11
4	A length of cable is tested for insulation resistance by loss of charge method. An electrostatic voltmeter of infinite resistance is connected between the cable conductor and earth, forming there with a joint capacitance of 600 pF. It is observed that after charging the voltage falls from 250 V to 92 V in one minute. Calculate the insulation resistance of the cable.	Understand	11
5	The four arms of the Maxwell's capacitance bridge at balances are: Arm ab: Unknown inductance L_1 having inherent resistance R_1, Arm bc : A non-inductive resistance of 1000 ohms, Arm cd : A capacitor of 0.05 uF in parallel with a resistance of 1000 ohms, Arm da : A resistance of 1000 ohms. Determine the values of R_1 and L_1. Draw the phasor diagram of the bridge.	Understand	13

6	The arms of five node bridge at balances are: Arm ab: An unknown impedance (R_1 , L_1) in series with a non – variable resistor r_1 . Arm bc : A non-inductive resistance R_3 = 100 ohms. Arm cd : : A non-inductive resistance R_4 = 200 ohms, Arm da : A non-inductive resistance R_2 = 250 ohms. Arm de : a variable non – inductive resistor r. Arm ec : a lossless capacitor C= 1 uF. An AC supply is connected between a and c. detector is between b and e. calculate the resistance R_1 and inductance L_1 when under balance condition $r_{1=}$ 43.1 ohms and r = 229.7 ohms.	Understand	12
7	The four arms of the Hay's bridge at balances are: Arm ab: Coil of unknown impedance Arm bc : A non-reactive resistance of 100 ohms, Arm cd : A non-reactive resistance of 833 ohms in series with 0.38 uF capacitor. Arm da : A non-reactive resistance of 16800 ohms. If the supply frequency is 50 Hz, determine the inductance and resistance at the balance condition.	Understand	12
8	A condenser brushing forms arm ab of a Schering bridge and a standard capacitor of 500 pF and negligible loss forms arm ad. Arm bc consists a non-inductive resistance of 300 ohms. When the bridge is balanced, arm cd has resistance of 72.6 ohms in parallel with a capacitance of 0.148 uF. The supply frequency is 50 Hz. Calculate the capacitance and dielectric loss angle of capacitor.	Understand	13
9	The four arm bridge ABCD, supplied with a sinusoid voltage, have the following values: AB = 330 ohms resistance in parallel with 0.2 uF capacitor. BC = 400 ohms resistance, CD = 800 ohms resistance: DA R in series with a 1.5 uF capacitor. Determine the value of R and supply frequency at which bridge will be balanced.	Understand	13
UNIT – V			
TRANSDUCERS AND OSCILLOSCOPES			
PART – A (SHORT ANSWER QUESTIONS)			
1	What are active and passive transducers? Give examples.	Remember	14
2	Define piezoelectric effect.	Understand	14
3	Define transducer?	Remember	14
4	Discuss characteristics of transducer?	Remember	14
5	List advantages and disadvantages of piezoelectric transducer?	Understand	14
6	Define Strain guage?	Remember	15
7	List advantages and disadvantages of Strain guage?	Remember	15
8	Write short notes on eddy current sensors.	Understand	14
9	Compare RTD with thermistor.	Remember	15
10	Classify various types of temperature sensors?	Remember	15

11	Discuss applications of various temperature sensors.	Remember	15
12	Define fluorescence?	Remember	16
13	Define phosphorescence?	Understand	16
14	Define persistence?	Remember	16
15	Differentiate between dual trace and dual beam CRO.	Understand	16
16	What is the function of time base generator in CRO?	Remember	16
17	A Lissajous pattern on an oscilloscope is stationary and has 5 horizontal tangencies and 2 vertical tangencies. The frequency of horizontal input is 1000Hz. Determine the frequency of vertical input.	Understand	16
PART – B (LONG ANSWER QUESTIONS)			
1	With neat diagram explain potentiometric resistance transducer. List advantages and disadvantages.	Understand	14
2	Derive the expression for the strain gauge factor (k) of a bonded resistance wire strain gauge.	Remember	15
3	Explain briefly the working of inductive transducers and give two applications for each.	Understand	14
4	Define and explain briefly about operating principle of an LVDT. What are its applications?	Understand	15
5	Explain pressure capacitive transducer with neat diagram. Write advantages and disadvantages of capacitive transducers.	Remember	14
6	Briefly explain the different types of resistance thermometers. Also give their applications.	Understand	15
7	Draw the block diagram of a general purpose CRO and explain the functions of various blocks.	Remember	16
8	Explain the electrostatic deflection method. Define electrostatic deflection sensitivity.	Understand	16
9	Explain the magnetic deflection method. Define magnetic deflection sensitivity.	Understand	16
10	Compare the electrostatic and magnetic deflection methods.	Remember	16
11	State various applications of CRO.	Understand	16
12	Compare between bonded and unbounded resistance wire strain gauge	Remember	15
13	Distinguish between the advantages and disadvantages of analog and digital type of oscilloscopes	Understand	16
14	Describe the characteristics of transducers?	Understand	14
PART – C (ANALYTICAL QUESTIONS)			
1	A CRT has anode voltage of 2000V and parallel deflecting plates 1.5 cm long and 5 mm apart. The screen is 50 cm from the center of the plates. Find i) beam speed (ii) deflection sensitivity (iii) deflection factor of the tube	Understand	16

2.	A CRT has anode voltage of 2000V and parallel deflecting plates 2 cm long and 5 mm apart. The screen is 30 cm from the center of the plates. Find the input voltage required to deflect the beam through 3 cm. The input voltage is applied to the deflecting plates through amplifiers having an overall gain of 100.	Understand	16
3	A CRT has anode voltage of 2000V and parallel deflecting plates 2 cm long and 5 mm apart. The screen is 30 cm from the center of the plates. Find the input voltage required to deflect the beam through 3 cm. The input voltage is applied to the deflecting plates through amplifiers having an overall gain of 100.	Understand	16
4	A lissajous pattern on the CRT screen is stationary and has 2 vertical tangencies and 5 horizontal tangencies. If the frequency of horizontal input is 1000 Hz. Calculate the frequency of the vertical input.	Understand	16
5	An electro statically deflected cathode ray tube has plane parallel deflecting plates which are 2.5cm long and 0.5cm apart, and the distance from their center to the screen is 20cm. The electron beam is accelerated by a potential difference of 2500v and is projected centrally between the plates. Calculate the deflecting voltage required to cause the beam to strike a deflecting voltage and find the corresponding deflection of the screen	Understand	16
6	A resistive position transducer with a resistance of 10 k ohm and a shaft stoke of 10 cm is applied with a voltage of 5 V. When the wiper is 3 cm from the reference, what is the output voltage?	Understand	14
7	Calculate the thermoelectric sensitivity of a device using Bismuth and Tellurium. Estimate the maximum output voltage for a 100 degree temperature difference at room temperature using one junction. Sensitivity of Bi is -72 uV/^{0}C and of Tellurium is 500 uV/^{0}C.	Understand	14
8	A strain gauge with a gauge factor of 4 has a resistance of 500Ω. It is to be used in a test in which the strain to be measured may be as low as 5x10-6. What will the change in resistance of gauge be?	Understand	15
9	A parallel plate capacitive transducer has a plates of 600 mm2 area which are separated by air by a distance of 0.2mm. The resistance of the transducer is 20x106Ω.Calculate the time constant of the transducer and fined the attenuation of the output at 1000Hz. The resistivity of air is 8.85x10-12 F/m.	Understand	15
10	A strain gauge having an unstrained resistance of 350Ω and a gauge factor of 2 is connected in series with a ballast resistance across a 10V supply. The ballast resistance is designed to give maximum sensitivity. The gauge is subjected to a dynamic strain of (10+20sin314t) micro strain.(a) Find the expression for the change in output voltage on account of strain.(b) If a capacitor is connected in one output lead and if the voltage is read by true rms.	Understand	15
11	A strain bridge uses a strain gauge of 100Ω resistance. Under no strain condition all the bridge arms have equal resistance. The resistance R1 has to be changed to a value 100.52Ω to obtain balance when the gauge is subjected to strain. The gauge factor is 2, find the value of strain.	Understand	15

Prepared by:
Mr. P ShivaKumar, Assistant Professor

HOD, EEE