

Enrolment No.....



Faculty of Engineering  
End Sem (Odd) Examination Dec-2017  
EE3CO03 / EX3CO03 Electrical Measurement and  
Instrumentation

Programme: B.Tech.

Branch/Specialisation: EE/EX

**Duration: 3 Hrs.****Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

- Q.1 i. A null type of instrument as compared to a deflection type instrument has: 1
- (a) Faster response (b) Higher Accuracy  
(c) Lower Sensitivity (d) All of these
- ii. In a PMMC ammeter, deflection is proportional to flux density of field and current in the coil. If strength of the field becomes 95% of the original, the meter gives erroneous reading. This error is classified as: 1
- (a) Random error (b) Gross Error  
(c) Systematic Error (d) None of these
- iii. The power in a 3-ph circuit is measured with 2 wattmeters. The reading of one of the wattmeters is positive and that of other is negative. The magnitude of readings is different. It can be concluded that the power factor of the circuit: 1
- (a) Zero lagging (b) Unity  
(c) 0.5 Leading (d) Less than 0.5 Lagging
- iv. In a 1-ph Induction meter, in order to obtain true value of energy, the shunt magnetic flux should lag behind the applied voltage by: 1
- (a) 90° (b) 0° (c) 45° (d) 60°
- v. A CT has rating of 100/5A. Its magnetizing and loss component of current are 1A and 0.6 A respectively. Assuming Secondary winding burden to be purely resistive, R will be: 1
- (a) 20.012 (b) 201.2 (c) 20.12 (d) 200.12

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- vi. The value of resistance of an Earthing electrode depends upon: **1**  
 (a) Shape and material (b) Depth into the earth  
 (c) Specific soil Resistance (d) All of these
- vii. Frequency can be measured using: **1**  
 (a) Maxwell's Bridge (b) Schering Bridge  
 (c) Wien's Bridge (d) None of these
- viii. Maxwell's Inductance Capacitance Bridge is used for **1**  
 Measurement of Inductance of:  
 (a) Low Q coils (b) High Q coils  
 (c) Medium Q Coils (d) Low & medium Q Coils
- ix. In a CRT, the focusing anode is located **1**  
 (a) Before pre accelerating anode  
 (b) After accelerating anode  
 (c) Between pre accelerating and accelerating anode  
 (d) None of these
- x. A transducer converts **1**  
 (a) Mechanical to Electrical energy  
 (b) Electrical to mechanical Energy  
 (c) One form to another form of energy  
 (d) None of these
- Q.2 i. Define Accuracy and Precision. **2**  
 ii. What are various types of error? Explain each one in brief. **3**  
 iii. Explain construction of attraction type Moving Iron instrument **5**  
 with neat diagram. Also, Derive torque equation for the same.
- OR iv. The deflection torque corresponding to a deflection of  $60^\circ$  is **5**  
 $1000 \times 10^{-6} \text{ Nm}$  in an instrument. The control is exerted through  
 two phosphorous bronze springs. Allowing a maximum stress of  
 $65 \text{ MN/m}^2$  and taking the value of modulus of elasticity as  
 $112.8 \text{ GN/m}^2$ , Calculate Suitable Dimensions for control  
 springs. The width of strip is 1mm.
- Q.3 i. Why measurement of power in circuits having Low Power **2**  
 Factor is difficult and inaccurate?

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- ii. How can you measure power in 3-ph circuit with the help of **8**  
 Two watt-meters? Derive complete expression with the help of  
 Phasor diagram, considering the effect of power factor on watt-  
 meters Readings.
- OR iii. The power flowing in a 3-ph, 3 wire balanced load system is **8**  
 measured by two wattmeter method. The reading of wattmeter  
 $W_A = 7500 \text{ W}$  and of wattmeter  $W_B = -1500 \text{ W}$ . What is the  
 power factor of the system? If  $V_{L-L} = 400 \text{ V}$ , what is the value  
 of capacitance which must be introduced in each phase to cause  
 the whole of the power to appear on wattmeter B, take  
 frequency 50 Hz?
- Q.4 i. How will you classify Resistances? **3**  
 ii. How wheat-stone Bridge Method is used for Medium Resistance **7**  
 Measurement? Derive an expression for unknown resistance R.
- OR iii. A CT with a bar primary has 300 turns in its secondary winding. **7**  
 The resistance and Reactance of secondary circuit are 1.5 ohm and  
 1 ohm respectively including the transformer winding. With 5 A  
 flowing in secondary winding, the magnetizing mmf is 100 A and  
 iron loss is 1.2 W Determine the Ratio and Phase angle errors.
- Q.5 i. What are various factors causing errors in ac bridge circuit? **4**  
 ii. Derive an expression of Anderson bridge used for measurement **6**  
 of Self Inductance of a coil with the help of Phasor Diagram.  
 Also, discuss its advantages and disadvantages.
- OR iii. How Wien's bridge can be used for measurement of frequency? **6**  
 What range and accuracy is suitable for this bridge?
- Q.6 Attempt any two: **5**  
 i. Draw the diagram of Cathode ray tube (CRT) and explain its **5**  
 working in detail.  
 ii. Write detailed note on LVDT and its working. Also, Mention **5**  
 various advantages and disadvantages.  
 iii. What do you know about Hall Effect Transducer? Explain its **5**  
 working principle and various applications.

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**Marking Scheme**

Q.1	i.	A null type of instrument as compared to a deflection type instrument has: <b>(b) Higher Accuracy</b>	<b>1</b>	ii.	Types of error-( <b>1 mark</b> ) Explanation of one - ( <b>2 mark</b> )	<b>3</b>	
	ii.	In a PMMC ammeter, deflection is proportional to flux density of field and current in the coil. If strength of the field becomes 95% of the original, the meter gives erroneous reading. This error is classified as: <b>(c) Systematic Error</b>	<b>1</b>	iii.	Construction of attraction type Moving Iron instrument with diagram-( <b>3 marks</b> ) Torque equation for the same-( <b>2 marks</b> )	<b>5</b>	
	iii.	The power in a 3-ph circuit is measured with 2 wattmeters. The reading of one of the wattmeters is positive and that of other is negative. The magnitude of readings is different. It can be concluded that the power factor of the circuit: <b>(d) Less than 0.5 Lagging</b>	<b>1</b>	OR	iv.	The deflection torque corresponding to a deflection of $60^\circ$ is $1000 \times 10^{-6} \text{ Nm}$ in an instrument. The control is exerted through two phosphorous bronze springs. Allowing a maximum stress of $65 \text{ MN/m}^2$ and taking the value of modulus of elasticity as $112.8 \text{ GN/m}^2$ , Calculate Suitable Dimensions for control springs. The width of strip is 1mm. ( <b>2 marks +3 marks</b> )	<b>5</b>
	iv.	In a 1-ph Induction meter, in order to obtain true value of energy, the shunt magnetic flux should lag behind the applied voltage by: <b>(a) <math>90^\circ</math></b>	<b>1</b>	Q.3	i.	Reason for measurement of power in circuits having Low Power Factor is difficult and inaccurate - ( <b>2 marks</b> )	<b>2</b>
	v.	A CT has rating of 100/5A. Its magnetizing and loss component of current are 1A and 0.6 A respectively. Assuming Secondary winding burden to be purely resistive, R will be: <b>(c) 20.12</b>	<b>1</b>		ii.	measure power in 3-ph circuit with Two watt-meters-( <b>3 marks</b> ) Expression with the help of Phasor diagram -( <b>5 marks</b> )	<b>8</b>
	vi.	The value of resistance of an Earthing electrode depends upon: <b>(d) All of these</b>	<b>1</b>	OR	iii.	The power flowing in a 3-ph, 3 wire balanced load system is measured by two wattmeter method. The reading of wattmeter $W_A = 7500 \text{ W}$ and of wattmeter $W_B = -1500 \text{ W}$ . What is the power factor of the system? - ( <b>2 marks</b> ) If $V_{L-L} = 400 \text{ V}$ , what is the value of capacitance which must be introduced in each phase to cause the whole of the power to appear on wattmeter B, take frequency 50 Hz?-( <b>6 marks</b> )	<b>8</b>
	vii.	Frequency can be measured using: <b>(c) Wien's Bridge</b>	<b>1</b>	Q.4	i.	Classification Resistances- ( <b>1 mark+1mark+1mark</b> )	<b>3</b>
	viii.	Maxwell's Inductance Capacitance Bridge is used for Measurement of Inductance of: <b>(c) Medium Q Coils</b>	<b>1</b>		ii.	Wheat-stone Bridge Method is used for Medium Resistance Measurement - ( <b>3 marks</b> ) Expression for unknown resistance R-( <b>4 marks</b> )	<b>7</b>
	ix.	In a CRT, the focusing anode is located <b>(c) Between pre accelerating and accelerating anode</b>	<b>1</b>	OR	iii.	Ratio -( <b>4 marks</b> ) Phase angle errors-( <b>3 marks</b> )	<b>7</b>
	x.	a transducer converts <b>(c) One form to another form of energy</b>	<b>1</b>	Q.5	i.	Factors causing errors in ac bridge circuit -( <b>2 marks+2 marks</b> )	<b>4</b>
					ii.	Expression of Anderson bridge - ( <b>4 marks</b> ) Advantages and disadvantages - ( <b>2 marks</b> )	<b>6</b>
Q.2	i.	Define Accuracy-( <b>1 mark</b> ) Precision- ( <b>1 mark</b> )	<b>2</b>	OR	iii.	Wien's bridge for measurement of frequency ( <b>4 marks</b> ) Range and accuracy bridge ( <b>2 marks</b> )	<b>6</b>

- Q.6 Attempt any two:
- i. Parts of CRT - **(2 marks)** **5**  
Working - **(3 marks)**
  - ii. LVDT and working **(3 marks)** **5**  
Advantages and disadvantages - **(2 marks)**
  - iii. Hall Effect Transducer - **(2 marks)** **5**  
Working principle and applications **(3 marks)**