Ref No: EX/EE/T/221/2018(OLD)

BACHELOR OF ELECTRICAL ENGINEERING EXAMINATION, 2018 (OLD)

2nd Year, 2nd Semester

SUBJECT: - ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS

Time: Three hours | Full Marks 100

Answer Question no.1 and any **eight** from the rest.

1. Justify or correct the following statements (any **four**): 4×5
   a) Torque-weight ratio of the moving system influences the performance of an indicating instrument.
   b) Moving coils of electro-dynamic wattmeters are used as current coil.
   c) A Kelvin double bridge is suitable for measuring low resistance – not the Wheatstone bridge.
   d) Spring controlled instruments have uniform scales.
   e) Shunt ohmmeters are suitable for measurement of low resistances.
   f) Product bridges should employ adjustable circuit elements in an arm adjacent to the arm containing the unknown element.

2. Write down the basic expressions of deflecting torque against various excitations for the following instruments and comment with justification on the shape of scale against these excitations: 10
   a) PMMC type of instrument;
   b) Electrodynamic type of instrument;
   c) Moving iron type of instrument;
   d) Induction type of instrument.

3. The dimensions of the coil of a PMMC voltmeter are 4 cm X 2.6 cm. The number of turns in the coil are 80 and the flux density in the air gap is 0.15T. The resistance of the coil is 30,000 Ω. Calculate the deflecting torque produced in the instrument when a voltage of 300V is applied to its terminals. 10

4. The inductance of a moving iron instrument is given by an expression $L = (0.01 + K\theta)^2$ μH, Where θ is the angular deflection in radians from zero position. The instrument angular deflections corresponding to currents of 2 and 5 amps are 45^0 and 90^0 respectively. Find the value of K. 10

5. Discuss, in brief the operating principle of a single phase energy meter. Hence prove that the total number of revolutions of the disc in a certain time is proportional to the energy consumed. 8+2

[Turn over

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6. Explain the term 'Standardization' of a potentiometer. Prove that in a multi range dc potentiometer circuit, current through the slide wire for X0.1 position is $1/10^{th}$ of the current through the slide wire for X1 position, source current being the same for both cases. 2+8

7. Draw a circuit employing guard terminal to measure resistance of an insulator sample. Explain in details the operating principle of Price's guard wire method. 3+7

8. Prove that in DC Wheatstone Bridge, the bridge sensitivity becomes maximum when the multiplier ratio becomes unity. Explain the purpose of 2nd ratio arm in Kelvin Double Bridge for measurement of low resistance. 10

9. How does the ambient temperature variation affect the measurement accuracy in strain gauges? Under what condition is a dummy gauge used? Derive bridge sensitivity in such a condition for Wheatstone bridge method based strain measuring system, using one active and one dummy gauge. 3+2+5

10. Describe the Llyod-Fisher square for measurement of iron losses in a specimen of laminations. How the corrections for resistance of wattmeter pressure coil and resistance of secondary winding are applied? 7+3

11. What are the merits and demerits of thermistor? What is meant by the specification "Pt-100 RTD"?
What is the importance of Cold Junction Compensation for a temperature measuring circuit using thermocouple? 5+5

12. Write short notes any **two**. 5×2
    a) Eddy current damping;
    b) Megger;
    c) Ratio error and phase angle error of a CT;
    d) Series type ohmmeter.