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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; Dec. - 2019

Measurements and Instrumentation

Time: 3 hrs

Max. Marks: 100

Note: Answer FIVE full questions, selecting ONE full question from each unit.

UNIT - I

- 1 a. Write short notes on SI system of units stating the advantages of it. 7
- b. The eddy current loss in a round wire/unit length is given by, $P_e \propto B_{\max}^a f^b d^c \rho^e$, find the values of a , b , c and e using dimensional analysis and write the equation for P_e . 7
- c. The expression for the eddy current produced in a metallic former moving in the field of a permanent magnet is found as, $I_e \equiv k \frac{Blba}{(2b+l)\rho}$, check for the dimensional correctness of the equation. 6
- 2 a. Describe the construction and working principle of single phase energy meter. 7
- b. The meter constant of a 230 V, 10 A energy meter is 1800 rev/kW/hr. The meter is tested at half load and rated voltage at upf. The meter found to make 80 revolutions in 138 seconds. Determine the meter error at half load. 6
- c. Explain the special features of electro-dynamometer type wattmeter so that it can be used for LPF measurement. 7

UNIT - II

- 3 a. A supply of 450 Hz is given between a and c and the detector is connected between b and d of the bridge. Arm ab is an unknown impedance, arm $bc = 200 \Omega$ resistance, arm $ad = 0.5$ microfarad standard capacitor in series with a resistance of 5.2Ω and arm $cd = 2850 \Omega$ resistance. Find the elements of unknown arm impedance and its dissipation factor at balance. 6
- b. Define sensitivity of the Whetstone's bridge and hence obtain an expression for the bridge sensitivity. 7
- c. With the help of circuit and Phasor diagram, show that how unknown inductance can be measured using Anderson's bridge. 7
- 4 a. The ratio arms of a Kelvin's double bridge are 100Ω each. $R_g = 500 \Omega$. Sensitivity $K = 200$ mm / microampere, $R = 0.1002 \Omega$ and $S = 0.1 \Omega$. A current of 10 A is passed through R and S from a 2.2 V battery in series with a rheostat. Neglecting the link resistance. Find; 7
 - i) Galvanometer deflection
 - ii) Total internal resistance of the battery
- b. With the help of circuit and Phasor diagram show that how the unknown capacitance can be measured using Schering Bridge. 7
- c. Write short notes on; 6
 - i) Sources and Detectors
 - ii) Shielding of bridge

UNIT - III

- 5 a. What are shunts and multipliers? Explain. 7
- b. A moving coil instrument has a resistance of 5Ω and gives a full scale reading of 50 mA. Calculate;
- i) The resistance value required to increase the range to 200 A 7
- ii) The resistance value required to increase the range to 750 V
- iii) The power consumed in both cases
- c. Discuss the advantages of instrument transformers over shunts and multipliers. 6
- 6 a. With the help of equivalent circuit and Phasor diagram, write the expression for ratio and phase angle of CT naming the terms involved. 7
- b. A potential transformer of ratio 2000/100 V has the following constants:
 $r_p = 105 \Omega$, $r_s = 0.7 \Omega$, $x_p = 75.2 \Omega$, $x_s = 0.087 \Omega$. The no load current is 0.03 A at 0.36 pF lag. Find;
- i) Phase angle error at no load 7
- ii) Phase angle error on a load of 5 A at 0.92 pF lag
- iii) Burden in VA at upf to have zero phase angle
- c. Define and explain turns compensation in CT's and PT's. 6

UNIT - IV

- 7 a. With the help of block diagram, explain the working of Electronic Energy Meter. 7
- b. Mention the different types of Digital Volt Meters (DVM) and hence, explain successive approximation type DVM. 7
- c. Explain the procedure for interfacing sensitive transducers to electronic circuit. 6
- 8 a. What are transducers? Discuss the classification of transducers. 6
- b. With a neat sketch, explain the use of LVDT in displacement measurement. 7
- c. The resistance of strain gauge wire with a gauge factor of 2 is bonded to steel structure subjected to a stress of 100 MN/m^2 . The modulus of elasticity of steel is 200 GN/m^2 . Calculate the % change in the value of gauge resistance due to applied stress. 7

UNIT - V

- 9 a. A coil with a resistance of 10Ω is connected in direct connection in Q meter Resonance occurs when the oscilloscope frequency is 1 MHz and the resonating capacitor is 65 pF. Calculate the % error introduced in the calculate value of Q when a resistance of 0.02Ω is inserted. 4
- b. With a neat sketch, explain the working of a dual trace oscilloscope. 8
- c. Discuss the role of lissajous figures in frequency and amplitude measurement. 8
- 10 a. Write short notes on LCD and LED display. 6
- b. With the help of neat sketch, explain the working of digital storage oscilloscope . 8
- c. With a neat sketch, explain the working of XY- recorder. 6