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 - 2017 / Jan - 2018
Electrical 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. Discuss briefly on :

(i) Derived and fundamental units giving illustrations 8

(ii) Advantages of SI units in Electrical measurements.

b. Explain the special features of wattmeter incorporated in it, so as to use it as a LPF meter. 6

c. For a 20 A, 230 V, energy meter, the number of revolutions per kWH is 480. If at FL, the disc makes 40 revolutions in 66 seconds. Find the percentage error in the consumed power as a percentage of the metered value. 6

2 a. Discuss in brief on :

(i) Essential torques in indicating type of instruments 8

(ii) Basic types of instruments in electrical measurements.

b. Derive the dimensions in LMTI system for the following electrical quantities : 6

(i) EMF (ii) Magnetic flux density (iii) Resistance.

c. Determine by dimensional analysis, the indices *a*, *b*, *c* and *g* in the expression given below for eddy current loss, *w*, per unit length of wire:

$$w = Kf^a B_m^b d^c \rho^g$$

6

Where; K = constant, B_m: Maximum flux density, f : frequency (Hz),

ρ = resistivity of material (Ωm), d : Diameter (m).

UNIT - II

3 a. Define sensitivity of Wheatstone bridge. Give the necessary circuit diagram and hence deduce the expression for sensitivity of the bridge, 'S_B'. 8

b. Write briefly on the importance of 'Shields' used in AC bridge-arms. Hence discuss on the 'Shielding' of resistors and capacitors. 6

c. An insulator bushing forms arm-AB of a Schering bridge. A standard capacitance of 500 pF forms arm-AD. Arm-BC has a resistance of 300 Ω. Arm-CD has a resistance of 72.6 Ω in parallel with a capacitance of 0.148 μF. The supply frequency is 50 c/s. Find the capacitance and dielectric loss angle of the capacitor in the arm-AB. 6

4 a. Derive the balance equations of an Anderson Bridge. Draw the Phasor diagram under balance. 8

b. Discuss through a neat sketch, the principle of measuring earth's resistance, using a 'MEGGER'. 6

c. The ratio-arms of a Kelvin Bridge are 100 Ω each, Rg = 500 Ω, Sensitivity, K = 200 mm/μA; R = 0.1002 Ω and S = 0.1 Ω. A current of 10 A is passed through R and S from a 2.2 V battery with a rheostat. By neglecting link resistance, Find;　　6

(i) Galvanometer deflection　　　　(ii) Total internal resistance of battery circuit.

UNIT - III

5 a. Explain the principle and constructional features of,　　8

(i) Current transformer　　　　　　(ii) Potential transformer.

b. Write a note on the turns compensation in CT's and PT's, giving illustrations.　　6

c. A moving coil instrument gives a full scale deflection for a current of 20 mA with a potential difference of 200 mV across it. Calculate the;　　6

(i) Shunt needed to use it as an ammeter to get a range of 0 - 200 A

(ii) Multiplier required to use it as a voltmeter of range, 0 - 500 V.

6 a. What are shunts and multipliers? Derive an expression for both, with reference to the meters used for extension of their measuring range.　　8

b. Give a comparison between a current transformer and a potential transformer, giving their circuit equivalent models.　　6

c. A 1000/5 A, 50 Hz, CT has a secondary burden of a non-inductive impedance of 1.6 Ω. The primary has one turn. Calculate the ratio and phase angle errors at F.L. Neglect leakage reactance. Assume iron loss = 1.5 W at FL and magnetizing mmf = 100 AT.　　6

UNIT - IV

7 a. Mention the different types of digital voltmeters. Explain the ramp type digital voltmeter.　　8

b. Discuss on the advantages of an electronic energy meter.　　6

c. Write a note, in brief, on the digital tachometers used in practice for speed measurements.　　6

8 a. What are Transducers? Give an account of their classification and selection for measurement purposes.　　8

b. With a neat schematic diagram, explain briefly about the significance of strain gauges.　　6

c. Discuss briefly on interfacing technique used for interfacing resistive transducers to electronic circuits.　　6

UNIT - V

9 a. Draw the block diagram of a general purpose CRO and explain the functions of the following controls :　　10

(i) Intensity　　　　　(ii) Horizontal positioning　　　(iii) Vertical positioning.

b. With a set of suitable diagrams, write a note on LCD and LED displays.　　10

10 a. With suitable circuit diagrams, explain the working of an X-Y Recorder.　　10

b. What are Lissajous patterns? Through a set of illustrative patterns, explain their applications in electronic measurements.　　10

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