

Code : 031607

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B.Tech 6th Semester Exam., 2019**ELECTRICAL INSTRUMENTS AND
MEASUREMENTS**

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Answer any *seven* of the following questions :

2×7=14

- (a) Give the merits and demerits of moving iron instrument.
- (b) Give merits and demerits of permanent magnet moving coil instruments.

- (c) What is a low-power factor electro-dynamometer type wattmeter?
- (d) Explain displacement constant and the constant of inertia for a galvanometer.
- (e) Write advantages and precautions to be considered for a Wheatstone bridge.
- (f) Explain ammeter shunt using schematic diagram.
- (g) How is leakage flux determined in a dynamic-electric machinery?
- (h) Give the merits and limitations of digital techniques.
- (i) Explain general working principle of a potentiometer.
- (j) Explain deflecting torque in moving iron instruments using mathematical expressions.

2. (a) A 3-phase balanced load connected across a 3 ϕ , 400 V AC supply draws a line current of 10 A. Two wattmeters are used to measure input power. The ratio of two wattmeter reading is 2 : 1. Find the readings of the two wattmeters. 4
- (b) Discuss induction type wattmeters and give a comparison between dynamometer and induction wattmeters. 5
- (c) Write working principle of attraction-type moving iron instruments using schematic diagrams. 5
3. (a) A current transformer with a bar has 350 turns in its secondary winding. The resistance and reactance of the secondary circuit are 2 Ω , 1.5 Ω respectively including the transformer winding. With 6 A flowing in the secondary winding, the magnetising m.m.f. is 120 ampere-turns and the iron loss is 1.5 watts. Determine the ratio and phase-angle errors. 7
- (b) Draw and discuss the phasor diagram of a potential transformer and explain the characteristics of potential transformers. 7
4. (a) Discuss vibration galvanometer using sufficient schematic diagrams and give its general features. 5
- (b) A galvanometer has the inertia constant 1.5, damping constant 6, deflection constant 8000 Nm/ampere. Determine the value of the restoring constant that would give critical damping. Under these conditions what will be the transient deflection when a current of 1 milli-ampere is being measured? What will be the deflection at the end of 2 seconds? 5
- (c) Determine the number of turns in a suspended coil of a galvanometer having 3.5 mm \times 2.5 mm mean area and situated in a magnetic field of 1.5 T. The moment of inertia of the moving parts is 0.30×10^{-6} kg-m and the control spring constant is 35×10^{-6} Nm-radian. A current of 12 mA produces a deflection of 110°. 4

5. (a) Discuss standardization, applications and precautions for a slide wire DC potentiometer. 5
- (b) Discuss Wheatstone bridge and its sensitivity analysis. 5
- (c) A four terminal resistance of approximately $60 \mu\Omega$ was measured by Kelvin's double bridge. The bridge has the standard resistance $140.03 \mu\Omega$, inner ratio-arms 260.62Ω and 420Ω , outer ratio-arms 230.62Ω and 490Ω . The resistance of the link connecting the standard and unknown resistances is $810 \mu\Omega$. Calculate the unknown resistance. 4
6. (a) The cores of two identical transformers A and B carry alternating fluxes whose instantaneous values are $0.01 \sin 314t$ Wb and $0.012 (1.1 \sin 628t + 0.1 \sin 1884t)$ Wb respectively. Find the ratio of eddy current loss of B to A. Find also the ratio of hysteresis loss of B to A. 7
- (b) Discuss any two AC bridge methods. 7
7. (a) Discuss the performance characteristics of digital to analog conversions. 5
- (b) Determine the output voltage caused by each bit in a 6-bit ladder if the input levels are $0 = 0$ V and $1 = +16$ V. Determine the resolution and full-scale output of this circuit. 4
- (c) Discuss ramp analog to digital conversion. 5
8. (a) Draw and discuss the phasor diagram of a current transformer and explain the characteristics of current transformers. 7
- (b) Discuss ballistic galvanometer and explain any one method for the calibration of ballistic galvanometer. 7
9. (a) Discuss two wattmeters method of power measurement for star and delta connection. Further, derive the expression of power factor using the phasor diagram of star connected inductive load. 7

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(b) Discuss Drysdale AC polar
potentiometer and Gall Tinsley AC
potentiometer. 7
