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B. Tech
CPEN 5306

Fifth Semester Examination – 2007

INSTRUMENTATION AND MEASUREMENTS

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory
and any **five** from the rest.*

*The figures in the right-hand margin
indicate marks.*

1. Answer the following questions : 2 × 10
- (a) Give two examples of each (i) Absolute Instrument, (ii) Secondary Instrument.

P.T.O.

(b) A wattmeter has a current coil of 0.03Ω resistance and a pressure coil of 6000Ω resistance. Calculate the percentage error if the wattmeter is so connected that (i) The current coil is on the load side, (ii) The pressure coil is on the load side. Load takes 20 A at a voltage of 220 V and 0.6 power factor in each side.

(c) What is Creep and how Creep adjustment are made in a single phase induction type energy meter ?

(d) What are the advantages of Instrument Transformer ?

(e) If 'J' is the inertia constant, 'D' is the damping constant and 'K' is the control constant of a D'arsonval galvanometer. Write down the condition for underdamped, critically damped and overdamped cases.

(f) A simple slide-wire is used for measurement of current in a circuit. The voltage drop across a standard resistor of 0.1Ω is balanced at 75 cm. Find the magnitude of current if the standard cell e.m.f of 1.45 V is balanced at 50 cm.

(g) Write down four application of D.C. potentiometer.

(h) Draw the circuit diagram of Owen's bridge. What it measures ?

(i) Write down the expression for the gauge factor of a strain gauge in terms of Poisson's ratio (μ).

(j) What are the different forms of Thermistor available ? Draw them.

2. (a) What are the different forces acting on an indicating type of instrument? Discuss them. 6
- (b) A weight of 5 g is used as the controlling weight in a gravity controlled instrument. Find its distance from spindle if the deflecting torque corresponding to a deflection of 60° is 1.13×10^{-3} Nm. 4
3. Construct the different parts of Electrodynamic-meter wattmeter and explain its theory for measurement of power. Discuss about the shape of scale also. 10
4. (a) Derive the steady state deflection of a D'arsonval galvanometer. What are intrinsic constants of a galvanometer? Explain these. 6

- (b) A D'arsonval galvanometer has the following data. Flux density = 8×10^{-3} Wb/m², Number of turns = 300, Length of coil = 15 mm, Width of coil = 30 mm. Spring constant = 2.5×10^{-9} Nm/rad. Calculate (a) The deflection of galvanometer for a current of 1 μ A, (b) Current sensitivity in mm/ μ A if the scale is kept 1 m away from the mirror. 4
5. Draw the equivalent circuit and phasor diagram of a current transformer. Derive the expression for ratio and phase angle error. 10
6. Describe the working of Maxwell's Inductance-Capacitance bridge for measurement of Inductance. Derive the equation for balance and draw the phasor diagram under balance condition.

What are the advantages and disadvantages of this bridge circuit ? 10

7. (a) Explain the function of a Time base generator in a CRO. 5

(b) Explain how voltages and current are measured with the help of CRO ? 5

8. Write short notes on any two of the following :

5 × 2

(a) Electrical Resonance type Frequency Meter

(b) Slide-wire D. C. Potentiometer

(c) L. V. D. T.

(d) Capacitive Transducer.