Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

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S.E. (Instrumentation and Control) (First Sem.) EXAMINATION, 2010

FUNDAMENTALS OF INSTRUMENTATION

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Your answers will be valued as a whole.

(*vi*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vii*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain the requirement and contents of calibration certificate and calibration report in calibration process. [8]

(*b*) What is input, output impedance and loading effect in measurement systems ? [8]

P.T.O.

Or

2. (*a*) Explain the following terms : [8]

(*i*) Drift

(*ii*) Reproducibility

(*iii*) Dead zone

(*iv*) Hysteresis.

(*b*) A moving coil voltmeter has a uniform scale with 100 divisions. The full scale reading is 200 V and 1/10 of scale division can be estimated with fair degree of certainty. Determine the resolution of the instrument. [4]

(*c*) A 0.300 V voltmeter has an accuracy of +2% of full scale deflection. What would be the range of readings if true voltage is 30 V ? [4]

3. (*a*) Explain the construction and working of single phase induction type energymeter. [8]

(*b*) Design the Aryton (universal) shunt to provide an ammeter with current ranges of 1 A, 5 A and 10 A. A basic meter with internal resistance of 50 W and full scale deflection current of 1 mA is to be used. [8]

Or

4. (*a*) For the series type ohmmeter prove that : [8]

$$\frac{W}{S} = \frac{I_m}{I_{fs}} = \frac{R_h}{R_x + R_h},$$

where, I_m is the current when measuring the unknown resistance R_x.

I_{fs} is the full scale deflection current.

R_h is the half scale deflection meter.

(*b*) Explain how D.C. potentiometer can be used for calibration of voltmeter. [8]

5. (*a*) A resistance bridge has the configuration shown in Fig. 1, in which R_1 = 120.4 W, R_2 = 119.0 and R_3 = 119.7 W :

(*i*) What resistance must R_4 have for balancing of the bridge ?

(*ii*) If R_4 has a value of 121.2 and if the input voltage is 12 V d.c., what is the output voltage of the bridge, assuming it to be a voltage sensitive bridge. [8]

Fig. 1

(*b*) With the help of neat diagram derive the balancing condition in Hay's bridge and explain how it can be used for measurement of quality factor of a coil. [8]

(*c*) Differentiate voltage and current sensitive bridges. [2]

Or

6. (*a*) The Schering bridge as shown in Fig. 2 balances under the following conditions : [10]

C_2 = 400 pf, R_4 = 10

R_3 = 1 kW, C_4 = 100 pf

The bridge is driven by 1 kHz sine source. Find unknown capacitance C_1 and its internal resistance r_1. Find the dissipation factor.

Fig. 2

(*b*) Derive equation for sensitivity in Wheatstone bridge and show that the bridge sensitivity is maximum when ratio arm is equal to 1. [8]

SECTION II

7. (*a*) Explain how phase can be measured using digital phase-meter. [8]

(*b*) With the help of neat block diagram explain the working of DMM with typical specifications. [8]

Or

8. (*a*) List the advantages of Digital Instruments over analog instruments. [8]

(*b*) Write a note on Digital Tachometer. [8]

9. (*a*) Explain dual trace and dual beam oscilloscope. [8]

(*b*) How can phase and frequency be measured using X-Y mode of dual trace oscilloscope ? [8]

(*c*) Explain Z-modulation in CRO. [2]

Or

10. (*a*) What is the role of a time base generator in CRO ? [8]

(*b*) An electrically deflected CRT has a final anode voltage of 2000 V and parallel deflecting plates 1.5 cm long and 5 mm apart. If the screen is 50 cm from the centre of deflecting plates, find : [8]

(*i*) beam speed

(*ii*) the deflection sensitivity of the tube

(*iii*) the deflection factor of the tube

(Mass of electron = 9.1×10^{-31} kg, Charge of electron = 1.6×10^{-19} C)

(*c*) In XY mode if the frequency of signal applied to X channel is 200 Hz and Y channel is 100 Hz, then draw the Lissajous pattern obtained on the CRT screen. [2]

11. (*a*) The chart speed of a recording instrument is 10 mm/s. If the time base of the recorded signal is 20 mm, what is the frequency of the recorded signal ? [8]

(*b*) How are triangular and sine waves generated in a function generator ? [8]

Or

12. (*a*) Explain different marking mechanism used in recorders. [8]

(*b*) Explain the difference between strip chart recorder and X-Y recorder. [8]