(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 121404   **Roll No.** ☐☐☐☐☐☐☐☐☐☐☐

B.Tech.

(SEM. IV) THEORY EXAMINATION 2013-14

SENSOR AND INSTRUMENTATION

Time : 3 Hours   *Total Marks : 100*

Note :   Question No. 1 to 5 are compulsory for students of all branches. Question No.6 is branch specific and students are advised to attempt the part specific to their branch.

SECTION–A

1. Attempt all parts. All parts carry equal marks :   **(10×2=20)**

    (a) Differentiate between static and dynamic characteristics of measuring instruments.

    (b) Give the temperature range for J-type and K-type thermocouple respectively. Name the materials also by which they are made of.

    (c) Write down the transfer function of 'first order high pass filter'. Draw its frequency response.

    (d) Platinum inspite of its low sensibility and high cost as compared to nickel and copper is the most widely used material for metallic resistance element. Why ?

    (e) Name the basic stages of 'analog-to-digital' conversion process.

    (f) What do you mean by 'quantization' ?

(g) Draw the circuit diagram of 'sample and hold' circuit.

(h) What is 'Amplitude Modulation' & Modulation Index.

(i) Define 'Data Acquisition'.

(j) Give the classification of display device.

SECTION–B

2. Attempt any **three** parts of the following :   (10×3=30)

(a) How can you classify transducers ? Explain each of them in detail. Give their suitable application with examples.

(b) With the help of a neat sketch explain the working of a 'piezoelectric pressure transducer'. What are its advantages and disadvantages ?

(c) (i) List six characteristics of an ideal OPAMP. Draw the circuit diagram of an 'integrator' and 'differentiator'. Write down the expression for output voltage for them.

    (ii) A Maxwell Bridge is used to measure an inductive impedance. The bridge constants at balance are $C_1 = 0.01 \ \mu F$, $R_1 = 470 \ k\Omega$, $R_2 = 5.1 \ k\Omega$ and $R_3 = 100 \ k\Omega$. Find the series equivalent of the unknown impedance.

(d) Draw and explain the instrumentation system for 'Temperature' measurement.

SECTION–C

Note:– All questions are compulsory. **(50 marks)**

3. Attempt any **two** parts of the following: (5×2=10)

(a) Draw and explain the block diagram of a PCM Telemetry system.

(b) Explain the principle of operation and working of a 'thermal flowmeter' briefly.

(c) What is an 'LCD' ? Briefly describe its operation.

4. Attempt any **two** parts of the following :   (5×2=10)

   (a) Differentiate between 'traditional instruments' and 'virtual instruments'.

   (b) Describe the operation of 'successive approximation' type ADC with suitable figure.

   (c) How can you classify recorders ? Briefly explain a 'magnetic tape recorder'.

5. Attempt any **two** parts of the following :   (5×2=10)

   (a) Draw and explain a DAQ system.

   (b) A plantinum resistance thermometer has a resistance of 140.5 Ω and 100 Ω at 100° C and 0° C respectively. If its resistance becomes 305.3 Ω when it is in contact with a hot gas, determine the temperature of the gas. The temperature coefficient of platinum is 0.0039° C^{-1}.

   (c) Briefly describe a 'Capacitive-type' level sensor.

6. Attempt any **two** parts of the following :   (10×2=20)

                    (For EE, EN, CE Branch only)

   (a) Give the classification of telemetry system. With the help of a block diagram explain a telemetry system. Write the functions of each block.

   (b) What is a landline telemetry system ? What are its different types. Explain any one of them. Mention the advantages and disadvantages of landline telemetry system.

   (c) With the help of a block diagram, explain a frequency modulation telemetry system. What are the disadvantages of frequency modulation ?

(d) (i) Briefly describe a PAM system.

    (ii) Write short note on 'Transmission Channels'.

OR

(For Branch EI / AEI / IC)

6. Attempt any **two** parts of the following :

(a) Derive the balance equation for Maxwell Bridge. Draw its circuit diagram with Phasor diagram.

(b) Draw a block diagram for harmonic distortion analyser.

(c) Write short notes on the following :

    (i) True RMS Voltmeter

    (ii) Q Meters

OR

(For ME (Mechanical Engg) Branch only)

6. Write short note on any **three** parts of the following :

(a) Taylor's principle of gauge design.

(b) Measurement of screw threads and gears

(c) Interferometry

(d) Tool maker's microscope

(e) Johansson's microkrator.

OR

(For FT (Food Technology) Branch only)

6. Write short notes on application of sensors and instrumentation of any three parts of the following :

(a) Food processing

(b) Food packaging

(c) Food quality & safety

(d) Vegetable processing industry

(e) Automation and Robotics in Food Processing Industry.