

Printed Pages—4

EE405

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

PAPER ID : 121404 Roll No.

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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' ?

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- (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 $C_1 = 0.01 \mu\text{F}$, $R_1 = 470 \text{ k}\Omega$, $R_2 = 5.1 \text{ k}\Omega$ and $R_3 = 100 \text{ k}\Omega$. 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 platinum resistance thermometer has a resistance of 140.5Ω and 100Ω at 100°C and 0°C respectively. If its resistance becomes 305.3Ω when it is in contact with a hot gas, determine the temperature of the gas. The temperature coefficient of platinum is $0.0039^\circ \text{C}^{-1}$.
 - (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.