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EE305

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

PAPER ID : 1256 Roll No.

B.Tech.

(SEM. III) ODD SEMESTER 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) What is the concept of Smart Sensor? Where can they be used ?

   (b) Enlist the classification of errors.

   (c) Define the working principle of K type thermocouple.

   (d) Differentiate between sensor and transducer.

   (e) Why active filters are preferred over passive filters ?

   (f) Define semiconductor strain gauge with its applications.

   (g) Give the classification of Display device.

   (h) What do you mean by Virtual Instrumentation System ?

   (i) Differentiate between Modulation and Modulation Index.

   (j) Differentiate between Accuracy and Precision with suitable example.

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SECTION–B

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

   (a) Discuss the working principle of LVDT with the help of neat sketch and characteristic. Explain the advantages and disadvantages of LVDT.

   (b) (i) Explain the R/2R Ladder techniques for converting the signal from digital to analog converter.

   (ii) Draw a Sample/Hold (S/H) circuit.

   (c) (i) Draw the circuit diagram of inverting operational amplifier. Derive the expression for voltage gain.

   (ii) With the help of neat circuit diagram, explain the operation of voltage to frequency converter.

   (d) (i) Explain all the basic components of a data acquisition system.

   (ii) Discuss the Basic principle of Digital telemetry.

   (e) Explain the working of Electromagnetic flowmeter and Ultrasonic flowmeter in brief.

SECTION–C

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

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

   (a) Draw the circuit diagram of a first order low pass filter and derive its transfer function.

   (b) Explain the working of strip chart recorder.

   (c) Explain the working of envelop detector with circuit diagram.

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

   (a) Explain the operation of thermocouple sensor for the measurement of temperature.

   (b) Draw the circuit diagram of inverting operational amplifier. Derive the expression for voltage gain.

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(c) Explain the working principle of linear potentiometric displacement sensor and derive the expression for output voltage.

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

(a) Explain the feature of Lab VIEW and how it can be used to measure the input signal.

(b) Determine the convolution of two discrete time signal given by $x_1[n] = \{\underset{\uparrow}{1}, 2, 3, 4\}$ and $x_2[n] = \{\underset{\uparrow}{2}, 4, 6, 8\}$.

(c) Explain the principle and working of a strain gauge and prove $G_F = 1 + 2\vartheta + \frac{\Delta\rho/\rho}{\varepsilon}$ where ϑ is Poisson ratio, ρ is resistivity of material and ε is strain.

Note :– In Question No. 6, attempt only the question specific to your branch.

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

(For Branches CS/IT/EC/EI/IC/EE)

(Branch Code 10/13/30/31/33)

(a) Derive the balance equation for Anderson's Bridge. Draw its circuit diagram with phasor diagram.

(b) Draw a block diagram for spectrum analyzer and explain each function in detail.

(c) For Q meter circuit is in resonance E = 100 mv, R = 5 Ω and $X_L = X_C = 100\ \Omega$.

(i) Calculate the coil Q and voltmeter indication

(ii) Determine the Q factor and voltmeter indication for another coil that R = 10 Ω and X_L = 100 Ω at resonance.

(d) A basic D' Arsonoval movement with resistance of 50 Ω and a full scale deflection current of 2 mA is to be used as a multi range voltage meter. Design the series string of multimeter to obtain the voltage range of 0-10V, 0-50V, 0-100V and 0-500V.

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

(For Branch Textile/TT) (Branch Code 61)

(a) Explain the Textile Instrumentation and Colorimeter.

(b) Write the working principle of stroboscope and nep counting.

(c) Explain the Instrumentation for computer Color matching.

(d) Explain the functioning of tension meters.

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

(For Branches CE/AG) (Branch Code 00/80)

(a) Discuss why frequency telemetry is considered superior to voltage or current telemetry, even in short distance cases.

(b) Draw the block diagram of a complete telemetry scheme using frequency division multiplexing and de-multiplexing.

(c) Write a short note on radio frequency telemetry.

(d) Draw a schematic arrangement to show that PWM and PPM can be obtained from PAM signals.

6. Write short notes on any **two** of the following : **(10×2=20)**

(For Branch Env) (Branch Code 97)

(a) Application and Monitoring of Sensor in Environmental Analysis.

(b) Ionic chromatography for analysis of inorganic ions in water.

(c) Infrared absorption Spectroscopy.

(d) Nano Sensors.

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

(For Branch CHE) (Branch Code 51)

(a) What are the different types of monometers ? Explain the working of any one of them with a neat sketch.

(b) Explain the principle, construction and working of McLeod gauge.

(c) Write short note on any **one** of the following :

(i) Pirani Gauge

(ii) Optical Pyrometers.

(d) Describe thermal dying method of moisture measurement.