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

Paper ID : 121411 Roll No. | | | | | | | | | | |

B.TECH.

Theory Examination (Semester-IV) 2015-16

INSTRUMENTATION & PROCESS CONTROL

Time : 3 Hours *Max. Marks : 100*

Section-A

Q.1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (2×10=20)

(a) What are the transfer characteristics of transducer?

(b) Define Gauge factor.

(c) A quartz piezo-electric crystal having thickness of 2 mm and voltage sensitivity of 0.055 V- m/N is subjected to a pressure of 1.5 MN/m^2. Calculate the voltage output. If the permittivity of quartz is 40.6×10^{-12} F/m, calculate its charge sensitivity.

(d) Name the transducers used to measure the force.

(e) Give the classifications of land line telemetry system.

(f) What are the major reasons for resorting to radio channels for telemetry in case of missiles?

(g) A tape receives 12,000 numbers per second. The tape speed is 1.5 m/s. Determine the density of the tape.

(h) What is meant by direct digital control?

(i) Name the components of Magnetic tape recorder.

(j) What is meant by DAQ?

Section-B

Q.2. Attempt any 5 questions from this section. (10×5=50)

(a) Describe the construction, theory and working of thermocouples. Describe the different types of compensations used.

(b) In order to measure strain in a cantilever beam, a single strain guage of resistance 1 kΩ, and guage factor 2 and a temperature co-efficient $10\times10^{-6}/^{o}C$ is mounted on the beam and connected in one arm of a bridge circuit. The other three arms of the bridge have resistance of 100Ω each. The bridge detector resistance is 100Ω and its sensitivity is 10 mm/ μA.

Calculate

(i) the detector deflection for 0.1 percent strain.

(ii) the change in effective strain indicated when the room temperature increases by 10°C.

(c) A parallel Plate capacitor transducer uses plates of area 500 mm^2 which are separated by a distance 0.2 mm. Calculate the value of capacitance when the dielectric is air having a permittivity of 8.85×10^{-12} F/m.

(i) Calculate the change in capacitance if a linear displacement reduces the distance between the plates to 0.18 mm. Also calculate the ratio of per unit change of capacitance to per unit change displacement.

(ii) Suppose a mica sheet 0.01 mm thick is inserted in the gap. Calculate the value of original capacitance and change in capacitance for the same displacement. Also calculate the ratio of per unit change in capacitance to per unit change in displacement. The dielectric constant of mica is 8.

(d) Define Piezo-Electric Effect. Describe the operation of Piezo-electric transducer and derive the expressions for voltage and charge sensitivities.

(e) Explain the land line telemetering system using a synchro transmitter-receiver pair used in torque transmission mode.

(f) How equalization is carried out in a magnetic tape recorder using direct recording techniques

(g) Discuss the various methods involved in realization of electronic controller.

(h) Explain the various types of head type flow meters. Also derive its flow rates.

Section-C

Note: Attempt any 2 questions from this section. (15×2=30)

Q.3. Describe the principle of working and block diagram of a Digital storage oscilloscope. State its advantages over CRO.

Q.4. Explain the construction and principle of working of a LVDT. Explain how the magnitude and direction of the displacement of core of an LVDT detected? Why is the frequency of excitation of primary winding kept very high as compared to the frequency of the signal being detected?

Q.5. Describe the basic circuit of a spectrum analyser. Explain how the spectra of the following is displayed:

(i) Continuous wave signals

(ii) Amplitude modulated signals

(iii) Frequency modulated signals

(iv) Pulse modulated signals