* R N - 7 4 2 5 / 1 0 0 *

# RN-7425

## B. E. - IV (Sem. VII) (Instrumentation & Control) Examination

### May / June – 2010

## Transducer & Signal Processing

Time : 3 Hours] [Total Marks : 100

**Instructions :**

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ B. E. - 4 (Sem. 7) (I & C)

Name of the Subject :

☛ Transducer & Signal Processing

☛ Subject Code No. : 7 4 2 5 ☛ Section No. (1, 2,.....) : 1&2

Seat No. :

Student's Signature

(2) Answer to each section must be written in separate answer books.
(3) Figures to the right indicate maximum marks.
(4) Draw neat figure wherever required.

**SECTION I**

**Q-1 Answer the short questions.**

i. **List the main requirements of strain gauge and mention the type of gauge which meets most of these requirements** (2)

ii. **A resistance strain gauge experiences 1% change in resistance when subjected to a uniaxial strain of 4000 μ-strain. Determine the gauge factor. What would be the sense and magnitude of error if a value of 1.9 is assumed for the gauge factor?** (2)

iii. **"For a steady state mechanical force, the piezo-electric transducer does not provide an output." Comment upon the validity of this statement.** (2)

iv. **Define i) Creep ii) Fatigue.** (3)

v. **Schematically show the use of electrical displacement transducer in vibration measurement.** (3)

**Q-2(a) Explain the following strain gauge circuits.** (8)
**1.) Potentiometric circuits.**
**2.) Balancing circuits.**

**OR**

**(a) ( i ) Name the various types of Strain gauges for different applications.** (8)
**( ii ) Distinguish between bonded and unbonded type of resistance strain gauge.**
**( iii ) List the main advantage of semi -conductor strain gauges.**

(b) A 120 Ω resistance strain gauge having a gauge factor of 2.0 has been mounted on a steel bar, and it forms one arm of a symmetrical wheatstone bridge circuit. When the steel bar is subjected to a tensile load, the galvanometer indicates an output voltage equivalent to 5 mV. Workout the mechanical strain if the gauge specifications supplied by the manufacturers indicate an operating current of 15mA. (6)

(c) Describe the different means normally used for torque measurement. (8)

OR

(c) Explain following: (8)

i) Piezo-electric accelerometer

ii) Displacement sensing (seismic) accelerometer.

Q-3 Attempt any two. (16)

(a) Describe the principle of operation of linear variable differential transformer. Why it is necessary to connect the secondary in a differential mode? Identify the input and output of the system and sketch the typical input-output graph.

(b) Explain the various physical principles involved in the operation of various categories of inductive transducers. Give the essential features of inductive transducers when used for the measurement of the displacement.

(c) Explain the use of wire wound potentiometers for the measurement of linear and rotary motions. Point out the advantages and limitations of such transducers.

## SECTION II

Q-4 Answer the short questions.

i. Describe following amplifier input circuits (2)
i) Single-ended amplifier, ii) differential input amplifier, iii) single-ended, floating and shielded, and iv) differential input, shielded, floating and guarded.

ii. How Hall-Effect device work? (2)

iii. Draw circuit of Antilog amplifier. (2)

iv. Why single ended sensor cannot be connected to differential input amplifier? (2)

v. Give comparison of CMR versus IMR (2)

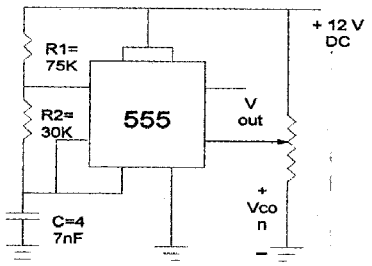
Q-5 (a) Explain Absolute value circuit. Compare it with other types of rectifiers. (8)

OR

(a) What is an isolation amplifier? Why it is used? List four different types of isolation amplifier. Draw the block diagram of carrier type isolation amplifier and describe the operation of it. (8)

(b) Derive the transfer function for instrumentation amplifier. How linear gain control is achieved with instrumentation amplifier? (6)

(c) For a VCO (Voltage Controlled Oscillator) has R1=75 KΩ, R2=30 KΩ and C=47nF. What are frequency and duty cycle when Vcon is 11V and 1V respectively. (6)
Assume Vcc=12 V dc.




(d) Draw block diagram of Phase locked loop. Describe function of each component of PLL. (8)

OR

(d) Explain following two circuits with reasonable detail: (8)
i) Schmitt trigger
ii) Sample and Hold Circuit

Q-6 Attempt any two. (12)

(a) Explain Principle, operation, and installation requirement of I /P Converter.

(b) Give comparison between electronic weighing system and mechanical weighing system. Also highlight the some of the factors to be considered in applying load cell to weighing problem

(c) Brief about i) V/I converter and ii) V/F converter.