



RM-7841

B. E. IV (Sem. VIII) (Mech.) Examination

May / June – 2010

Instrumentation & Control

Time : 3 Hours]

[Total Marks : 100

**Instruction :**

(1)

નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
<input type="text" value="B. E. 4 (Sem. 8) (Mech.)"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="Instrumentation &amp; Control"/>	<input type="text"/>
Subject Code No. : <input type="text" value="7"/> <input type="text" value="8"/> <input type="text" value="4"/> <input type="text" value="1"/>	<input type="text" value="Student's Signature"/>
Section No. (1, 2,.....) : <input type="text" value="1&amp;2"/>	

- (2) Answer **all** questions.
- (3) Use **separate** answer book for each section.
- (4) Figure to the **right** indicate full marks.
- (5) Use of graph paper and Laplace transform table is allowed.
- (6) Assume suitable data, if required.

**SECTION - I**

**Q.1 A) Answer the following:**

**(05)**

- i) Define rise time.
- ii) If damping ratio,  $\xi$  is greater than unity at that time both the roots are \_\_\_\_\_ and \_\_\_\_\_.
- iii) Define Deviation.
- iv) Define Hall Effect.
- v) \_\_\_\_\_ transducer converts electrical energy to any form of energy.

**B) Define a digital transducer and explain its applications for measurement of linear and angular displacements. (07)**

**OR**

**B) Advantages and disadvantages of LVDT with suitable justification. (07)**

**C) A piezo – electric transducer has a capacitance of 2000 pF and a charge sensitivity of  $100 \times 10^{-12}$  C/N. the resistance of transducer is  $10^6 \text{M}\Omega$  and the impedance of the measuring system consists of a capacitance of 500 pF in parallel with a resistance of 1 M $\Omega$ . Find the response if the applied forces is;** **(08)**

$$F = 0.1 \text{ N for } 0 < t < 2 \text{ ms and } F = 0 \text{ N for } 2 \text{ ms} < t < \infty$$

Find the value if voltage just before and just after the impulse is terminated.

Also find the voltage after 10 ms of application of the pulse.

- Q.2 A)** Define Second order instrument. Discuss the Second order instrument to sinusoidal input in details with suitable figure. **(10)**
- B)** A temperature measuring system having a time constant of 5 sec is used to measure temperature if furnace fluctuating sinusoidally between 350 °C and 300 °C with a period of 40 sec. Determine the maximum and minimum values of temperature indicated and the time lag between input and output signals. **(05)**

**Q.3 Answer any Three:** **(15)**

- A)** Discuss the importance of data transmission in the context of modern measurements.
- B)** Write a short note on A to D and D to A conversion.
- C)** A laboratory experiment is conducted to measure the viscosity of a specimen of oil. A series of tests given the values as  $5.30 \times 10^{-3}$ ,  $5.73 \times 10^{-3}$ ,  $6.77 \times 10^{-3}$ ,  $5.26 \times 10^{-3}$ ,  $4.33 \times 10^{-3}$ ,  $5.45 \times 10^{-3}$ ,  $6.09 \times 10^{-3}$ ,  $5.64 \times 10^{-3}$ ,  $5.81 \times 10^{-3}$  and  $5.75 \times 10^{-3}$  m<sup>2</sup>/sec. point out any reading that can be rejected by applying Chauvenet's criterion. The ratio of maximum deviation to standard deviation should not exceed 1.96.
- D)** A resistor has a nominal value of  $10 \Omega \pm 1 \%$ . A voltage is applied across the resistor and the power consumed in the resistor is calculated in two ways (i) from  $P = E^2/R$  and (ii) from  $P = EI$ . Calculate the uncertainty in the power determination in each case when the measured values of E and I are  $100 \text{ V} \pm 1 \%$  and  $10 \text{ Amp} \pm 1 \%$  respectively. Comment upon the result.

## SECTION - II

- 4 (a) Answer the following : **4**
- (1) State Massion's gain formula.
  - (2) Define non-touching loop for signal flow graphs.
  - (3) What is control system ?
  - (4) What are the different types of mathematical models ?
- (b) Write short notes : **6**
- (1) Speed control of diesel engine.
  - (2) Merits and demerits of hydraulic control system.
- (c) Explain PI controller. Also write down its merits and drawbacks. **10**

- 5 (a) Determine the range of  $k$  such that feedback system having characteristic equation. 5

$$s(s^2 + s + 1)(s + 4) + k = 0.$$

- (b) Obtain the root locus for the system  $\frac{\theta_0}{\theta_i} = \frac{k}{D^2 + 3D + k}$ . 10

OR

- (b) Sketch the root locus for open loop transfer function of a unit feedback control. 10

(i) The value of  $k$  for ineqoginal stability.

(ii) The value of  $k$  for  $\rho = 0.5$

(iii) The value of  $k$  at  $s = -4$ .

$$G(s) \cdot H(s) = \frac{k}{s(s+1)(s+3)}$$

- 6 (a) Find  $\frac{C}{R}$  using block diagram reduction technique : 7

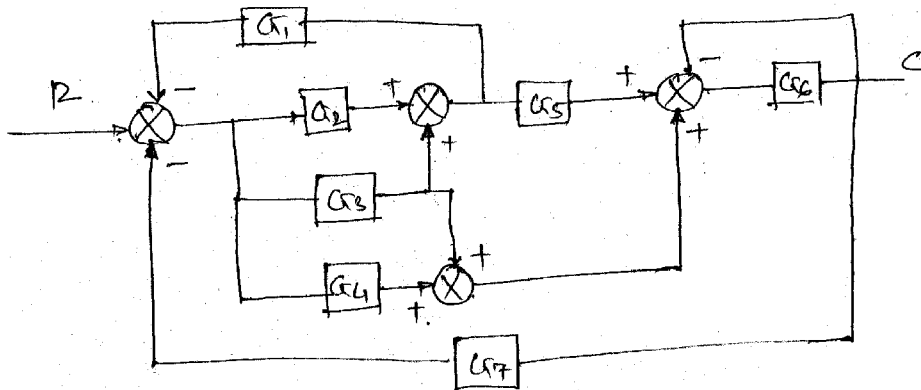


Fig. 1

- (b) Evaluate the transfer function using signal flow graph. 8

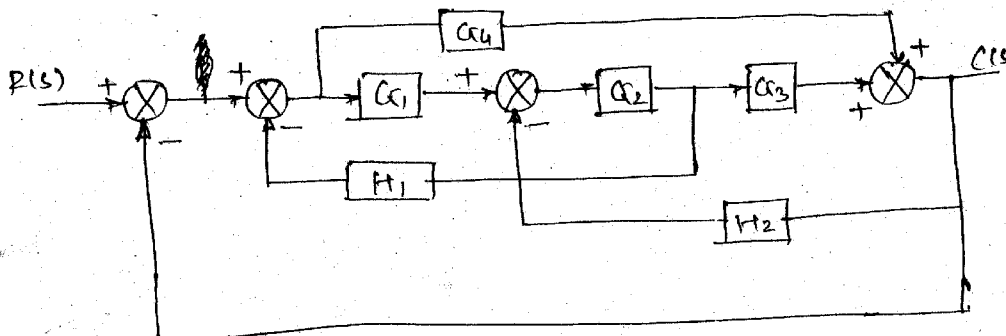


Fig. 2

OR

(b) Evaluate the transfer function using signal flow graph : 8

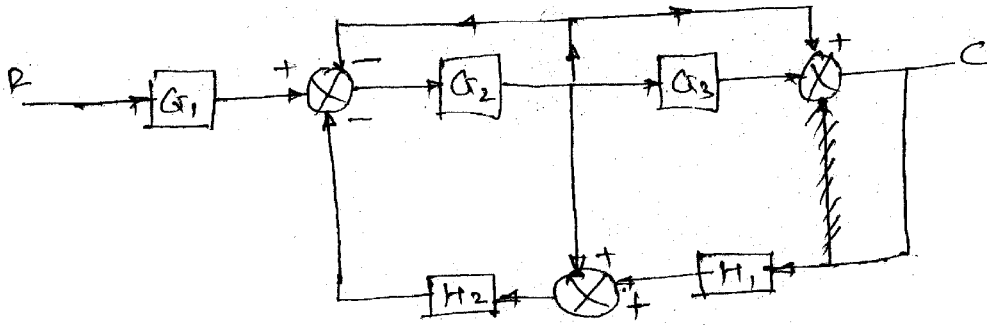


Fig. 3