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Seat No.	

T.E. (Electrical) (Semester – V) Examination, 2010
FEEDBACK CONTROL SYSTEMS
(New Course)

Day and Date : Thursday, 13-5-2010 Total Marks : 100
Time: 10.00 a.m. to 1.00 p.m.

*Instructions : 1) Solve **any three** questions from Section – **I** and **any three** questions from Section – **II**.*
*2) Assume suitable data **wherever** necessary.*
*3) Figures to the **right** indicate **full** marks.*

SECTION – I

1. a) Simplify the block diagram shown in Fig. 1 to obtain the closed loop transfer function C (s) / R (s). 8

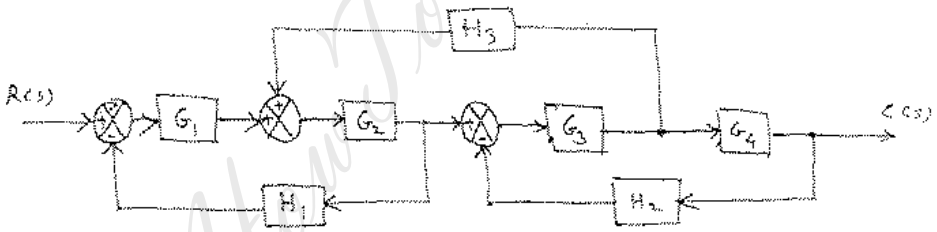

Fig. 1

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b) Obtain the transfer function of the circuit shown in Fig. 2. 10

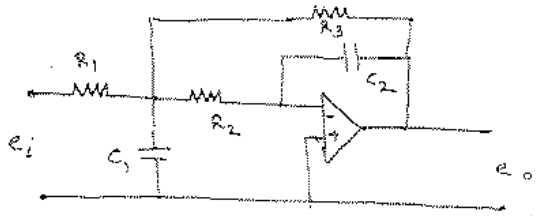

Fig. 2

2. a) Obtain a state-space model for a system shown in fig. 3. 10

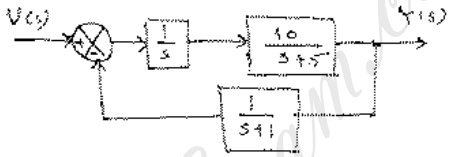

Fig. 3

b) Obtain a state-space model for a system defined by

$$\frac{Y(s)}{U(s)} = \frac{2s^3+s^2+s+2}{s^3+4s^2+5s+2}$$ 6

3. For a second order system $\frac{C(s)}{R(s)} = \frac{W_n^2}{s^2+2\zeta W_n s+W_n^2}$, with $\zeta < 1$.

Obtain the expressions for

i) Delay time

ii) Rise time

iii) Peak time

iv) Maximum peak overshoot. 16

4. a) Draw a neat schematic of hydraulic PI controller and obtain its transfer function. 8

b) Obtain a transfer function of field controlled DC servo mechanism. 8

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SECTION – II

5. a) What is stability of control system ? Explain the responses contributed by various types of roots such as

   i) Single root at $s = \sigma$

   ii) Roots of multiplicity k at $s = \sigma$

   iii) Complex conjugate root pair at $s = \sigma \pm j\omega$

   iv) Complex conjugate root pair of multiplicity K at $s = \sigma \pm j\omega$

   v) Single complex conjugate root pair at $s = \pm j\omega$

   vi) Complex conjugate root pair of multiplicity K at $s = \pm j\omega$. 12

   b) A unity feedback system has open loop transfer function

   $$G(s) = \frac{k(s+1)(s+2)}{(s+0.1)(s-1)}$$

   Determine value of k for which system is stable. 6

6. a) Obtain a root locus plot of a feedback system with the characteristic equation.

   $$1 + \frac{k}{s(s+1)(s+2)} = 0.$$ 12

   b) What is transportation lag ? How the systems with transportation lag are approximated ? 4

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7. a) With a suitable example state and explain the procedure to draw the bode diagram. 8

b) Obtain the phase margin and gain margin of a system shown in Fig. 4

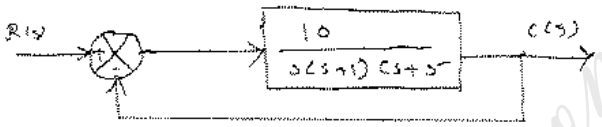

Fig. 4 8

8. a) Explain the basic concepts of 'describing function' method to analyze non-linear control systems. 6

b) Obtain a describing function of relay with deadzone. 10

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