Total No. of Questions : 10] [Total No. of Printed Pages : 4

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EX–602

B. E. (Sixth Semester) EXAMINATION, June, 2012

(Electrical & Electronics Engg. Branch)

CONTROL SYSTEMS

(EX–602)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt *one* question from each Unit. Provide graph and log papers. Assume suitable data if any missing.

Unit–I

1. (a) Determine the transfer function C (*s*)/R (*s*) for the block diagram shown in Fig. 1. 10

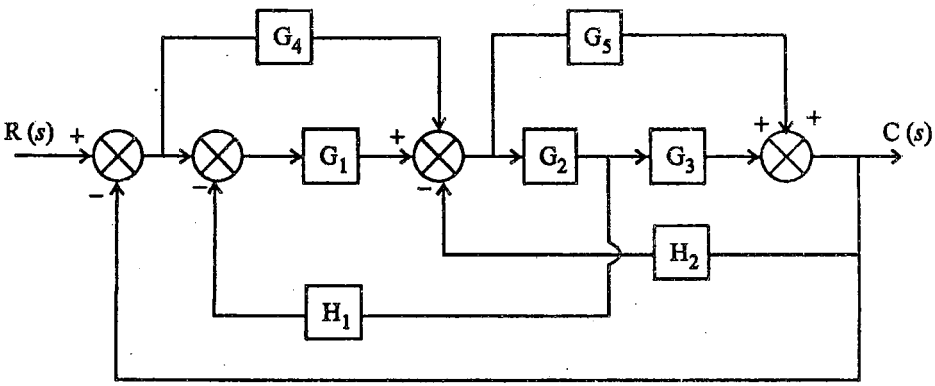

Fig. 1

P. T. O.

(b) Obtain the transfer function $X_1(s)/F(s)$ of the mechanical system shown in Fig. 2. 10

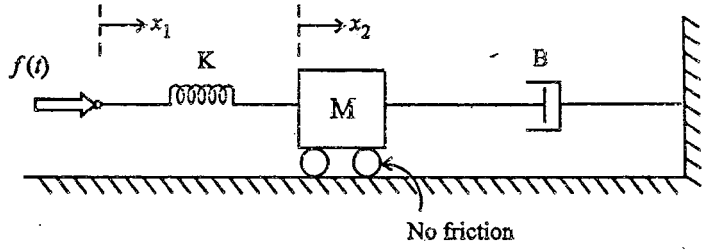

Fig. 2

Or

2. (a) Using Mason's rule, find the transfer function, $T(s) = C(s)/R(s)$, for the system represented by Fig. 3. 10

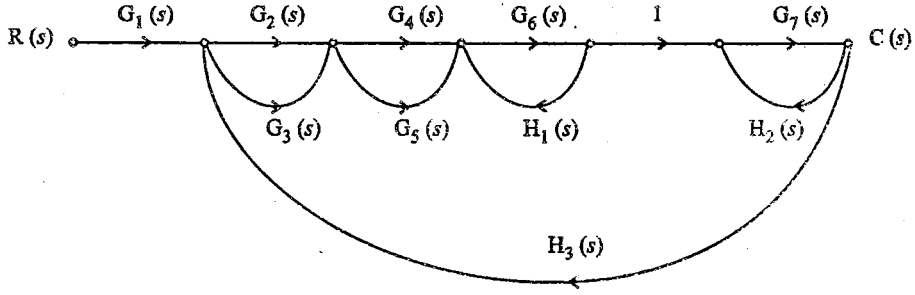

Fig. 3

(b) Describe the construction and functioning of a. c. servomotor with diagrams. 10

Unit – II

3. (a) For a second order system, derive the expression for peak overshoot for a unit step input and the peak time. 10

(b) Determine the stability of a closed loop control system whose characteristic equation is : 10

$$s^5 + s^4 + 2s^3 + 2s^2 + 11s + 10 = 0$$

Or

4. (a) Find the error coefficients (k_p, k_v and k_a) of the system whose transfer function is given in Fig. 4. 10

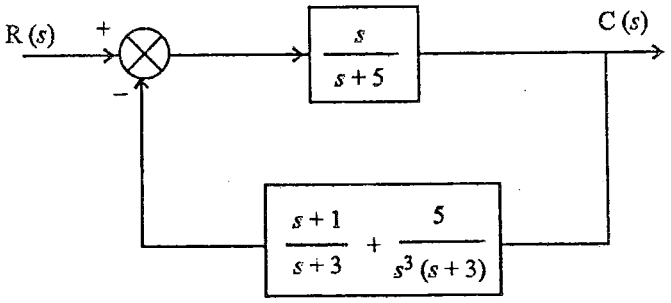

Fig. 4

(b) Sketch the transient response of second order system with unit step input. Define and explain various specifications. 10

Unit – III

5. (a) $G(s)H(s) = \dfrac{K}{s(s+3)(s+5)}$

Draw root locus. Determine for damping ratio = 0·6 :

(i) Closed loop dominant poles

(ii) Damped natural frequency

(iii) Gain K 10

(b) Describe the concept of angle of arrival and angle of departure in root locus. 10

Or

6. Draw the root locus of the system whose open loop transfer function : 20

$$G(s)H(s) = \frac{K}{s(s+3)(s^2+3s+11{\cdot}25)}$$

P. T. O.

Unit – IV

7. (a) Sketch the Bode plot of the transfer function : 10

$$G(s) = \frac{4}{s(1+s)(2+s)}$$

Determine G. M. and P. M.

(b) Draw the complete Nyquist plot for the system : 10

$$G(s)H(s) = \frac{60}{(s+1)(s+2)(s+5)}$$

Or

8. (a) Draw the polar plot for : 10

$$G(s)H(s) = \frac{1}{s(1+T_1 s)(1+T_2 s)}$$

(b) Describe the various frequency domain specifications and how are they used to design the system. 10

Unit – V

9. (a) Explain the lag-lead compensator. Discuss its pole zero plot and Bode plot. 10

(b) Design a lag compensator for a system with open loop transfer function as : 10

$$G(s) = \frac{K}{s(s+1)(s+4)}$$

to meet the following specifications :

(i) Damping ratio = 0·5

(ii) Velocity error constant $\geq 5\ \text{sec}^{-1}$

(iii) Settling time = 10 sec.

Or

10. (a) Describe the types of compensation. 5

(b) Draw the block diagram and characteristic curve for the PI, PD and PID control action. Also find out the transfer functions. 15