Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– • EXAMINATION – SUMMER 2015

Subject Code: 160304 **Date: 14/05/2015**

Subject Name: Bio-Medical Control Theory

Time: 10.30AM-01.00PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

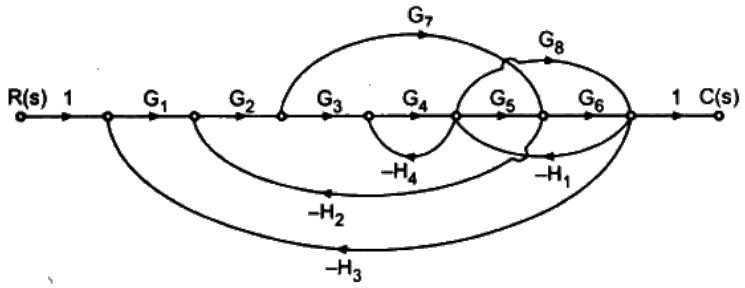
Q.1 (a) Explain classification of control system with necessary examples. **07**

Q.1 (b) Enlist advantages and disadvantages of open-loop control system with real time applications. **07**

Q.2 (a) Obtain the inverse Laplace transform of given F(s). **07**

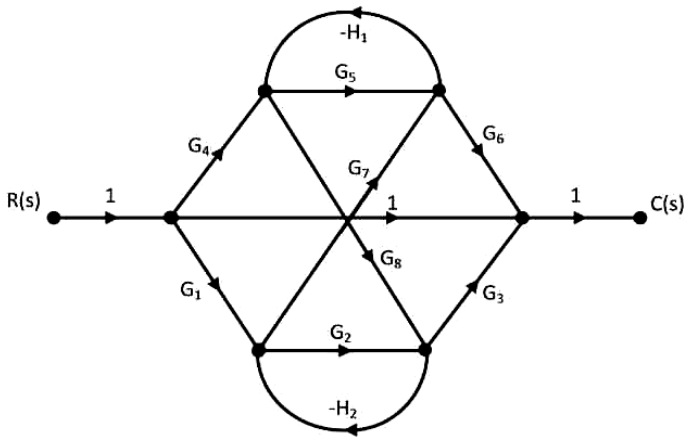
$$F(s) = \frac{(s-2)}{s(s+1)^3}$$

Q.2 (b) Obtain the transfer function C(s)/R(s) of below given signal flow graph by using mason's gain formula. **07**

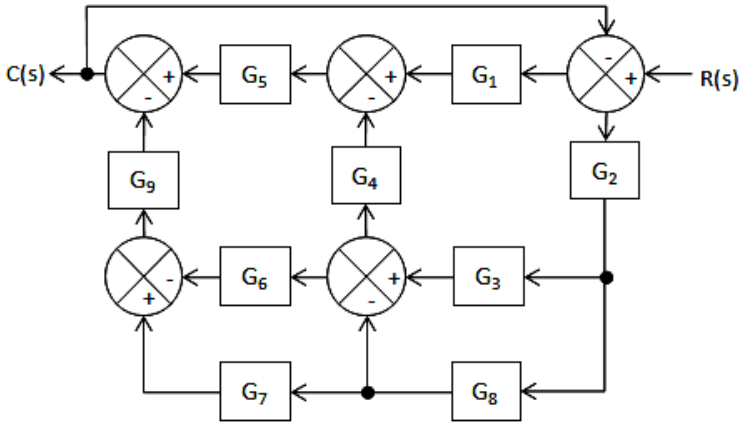


OR

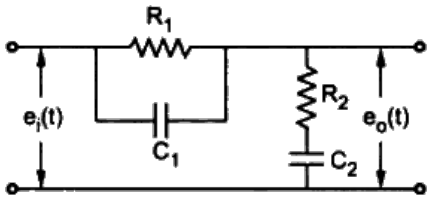
Q.2 (b) Obtain the transfer function C(s)/R(s) of below given signal flow graph by using mason's gain formula. **07**



Q.3 (a) Obtain the close-loop transfer function C(s)/R(s) of given block diagram by reduction technique. **07**

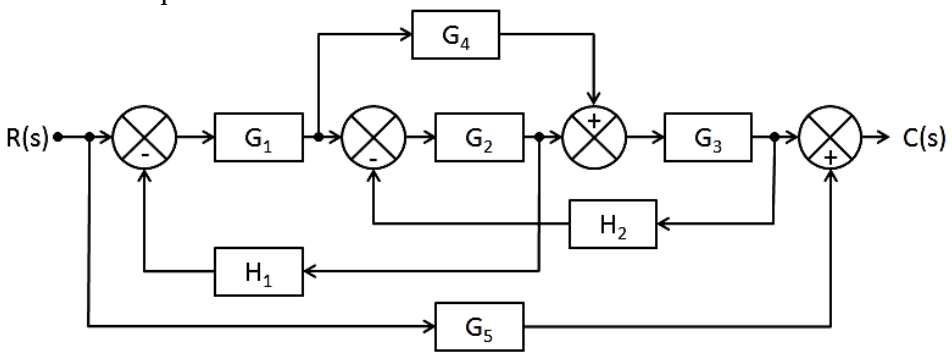


Q.3 (b) Derive a transfer function for a lag-lead network. **07**

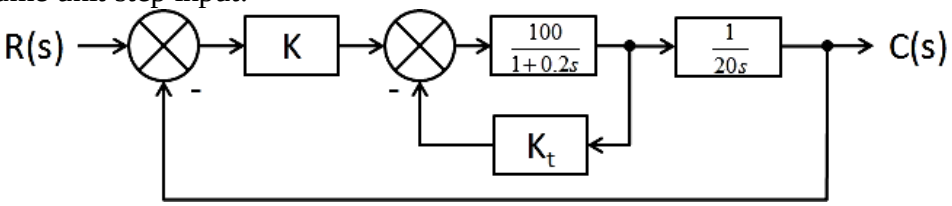


OR

Q.3 (a) Obtain the close-loop transfer function C(s)/R(s) of given block diagram by reduction technique. **07**



Q.3 (b) For a control system shown in figure, find the values of K and K_t so that the damping ratio of system is 0.6 and settling time is 0.1 sec. Use $T_s = \frac{3.2}{\xi \omega_n}$. Assume unit step input. **07**



Q.4 (a) A system has 30% overshoot and settling time of 5 sec, for a unit step input. Determine the transfer function. Calculate peak time and output response. Assume e_{ss} as 2%. **07**

Q.4 (b) Find the range of K and K_{mar} for which the system given below is stable. **07**

$$S^4 + 2s^3 + 2s^2 + (3+K)s + K=0$$

OR

Q.4 (a) Draw the nyquist plot and comment on stability for below given system. **07**

$$G(s)H(s) = \frac{100(1+5s)}{s^4(1+s)}$$

Q.4 (b) Find K_{mar} and frequency of oscillations for a unity feedback system, **07**

$$G(s) = \frac{K}{s(s^2+2s+2)(s^2+6s+10)}$$

Q.5 (a) Find the loci of roots for a unity feedback system and comment on stability. **07**

$$G(s) = \frac{K}{s(s+3)(s^2+3s+11.25)}$$

(b) Draw the bode plot for the transfer function, **07**

$$G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}$$

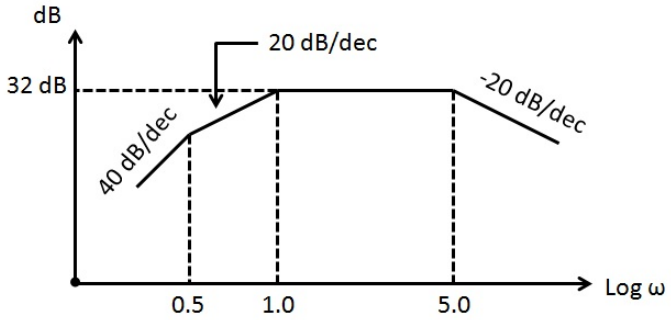
Determine the value of K for the gain cross-over frequency to be 5 rad/sec.

OR

Q.5 **(a)** Draw the root locus of unity feedback system as given below. Also, find the damping ratio (ζ) and point on root locus for K=1.33. **07**

$$G(s) = \frac{k(s+2)}{(s^2+2s+3)}$$

(b) Determine the transfer function for the bode plot shown below. **07**



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