Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI (OLD).EXAMINATION – WINTER 2016

Subject Code: 160304 **Date: 25/10/2016**

Subject Name: Bio-Medical Control Theory

Time: 10:30 AM to 01:00 PM **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 open loop and closed loop system with suitable example of each. **07**

(b) Compare Transfer function approach with state space approach. **07**

Q.2 **(a)** What is analogous system? Establish force-current and force-voltage analogy. **07**

(b) Determine the transfer function for the following signal flow graph using the Mason's gain formula. **07**

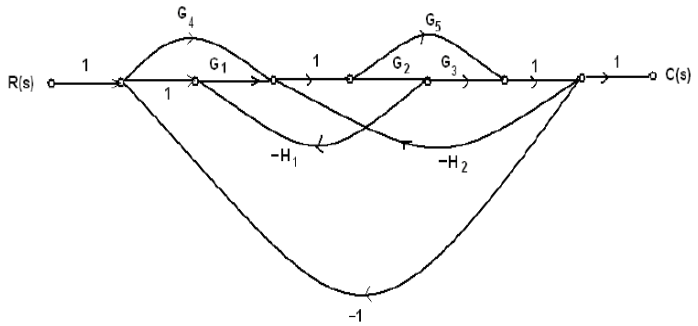

fig. 2(a)

OR

(b) Determine the transfer function T(s)=C(s)/R(s) of the following system using block reduction technique. **07**

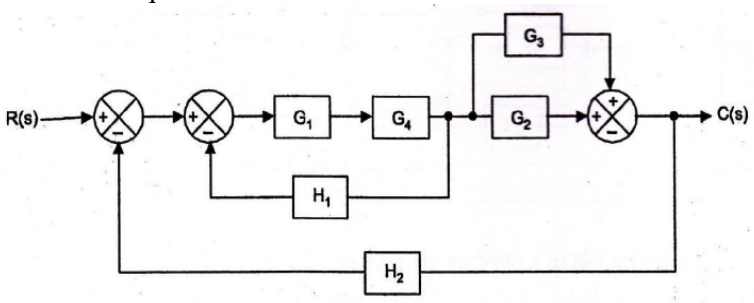

fig. 2 (b)

Q.3 **(a)** For unity feedback system having open loop transfer function **07**

$$G(s)=\frac{k(s+2)}{s(s3+7s2+12s)}$$

Find i) Type of System ii) All error coefficients iii) Steady state error for input r(t) = $R/2.t^2$

(b) Consider sixth order system with characteristic equation **07**

$$S^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$$

Determine stability of the system using Routh's criterion.

OR

Q.3 **(a)** A system is given by differential equation **07**

$$\frac{d2y}{dx2} + 4\frac{dy}{dx} + 8y = 8x$$

Where y is output and x is input. Determine time domain specification. i) Rise Time ii) Peak Time iii) Settling Time iv) Peak overshoot.

(b) The characteristic equation of a closed loop control system is given by **07**

$$S^4+10s^3+35s^2+50s+24=0$$

For this system determine the number of roots to the right of the vertical axis located at s = - 2.

Q.4 **(a)** A unity-feedback system has open-loop transfer function **07**

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

Sketch the bode plot of G(jw) & determine the phase margin & gain margin of the system.

(b) Sketch the root-Locus & comment on the stability of a unity-feedback control system having the open-loop transfer function as follow **07**

$$G(s)=\frac{10}{s(s-1)(2s+3)}$$

OR

Q.4 **(a)** The open-loop transfer function of a control system is **07**

$$G(s)H(s)=\frac{10}{s(1+0.5s)(1+0.1s)}$$

Draw the bode plot and determine phase margin and gain margin.

(b) Consider a system with open loop transfer function as **07**

$$G(s)=\frac{10}{s(s-2)(s+4)}$$

Obtain its polar plot.

Q.5 **(a)** State the output time response relationship for a second order system for a step input with suitable diagram. Give the meaning of different terms associated with it. Show the effect of damping on time response of a second order system with waveforms. **10**

(b) Explain in detail Nyquist stability criteria. **04**

OR

Q.5 **(a)** Explain the following terms in brief: **10**

(1) Sensitivity
(2) Regulating system
(3) Servomechanism
(4) Bandwidth
(5) Gain margin
(6) Transfer function
(7) Phase margin
(8) Resonant frequency
(9) State space
(10) State variables

(b) Explain in brief M circles & N circles. **04**

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