GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-VI • EXAMINATION – WINTER 2013

Subject Code: 160304

Date: 06-12-2013

Total Marks: 70

- Instructions:
 - 1. Attempt all questions.

Time: 02:30 pm to 05:00 pm

- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.

Subject Name: Bio Medical Control Theory

- Q.1 (a) What is Control System? Enlist and Explain the different types of control 07 system in detail.
 - (b) Explain the closed loop and open loop system with suitable example. 07
- Q.2 (a) Derive the transfer function of the system shown in Fig. the amplifier gain is 10. 07



(b) Use block diagram reduction methods to obtain the equivalent transfer function 07 from R to C.



OR

(b) What is analogous system? Establish force-current and force-voltage analogy. 07

Q.3 (a) Find the transfer function from given signal flow graph.



(b) What do you understand by time response of any control system. Explain the 07 effect of input on steady state error.

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- **Q.3** (a) Write a short note on "Effect of ξ on second order system performance"
 - (b) A system has the following transfer function

$$\frac{C(s)}{R(s)} = \frac{20}{s+10}$$

Determine its unit impulse, step and ramp response with zero initial condition. Sketch the response.

- Q.4 (a) Derive an equation of unit step response of a second order system for an 07 underdamped case.
 - (b) State and explain the Hurwitz's and Routh's criterion. Explain the significance 07 of an auxiliary equation.

OR

- Q.4 (a) Apply Routh criterion to check the stability of $s^8 + 5s^6 + 2s^4 + 3s^2 + 1 = 0$ 07
 - (b) For a unity feedback system,

$$G(s) = \frac{K(s+10)(s+20)}{s^2(s+2)}$$
. Apply Routh's criterion and find range of value of K

for stability. Find marginal K and corresponding frequency of oscillations.

- **Q.5** (a) A unity feedback control system has $G(s) = \frac{80}{s(s+2)(s+20)}$. Draw the Bode plot. determine G.M. P.M. w_{gc} and w_{pc}. Comment on stability.
 - (b) Sketch the complete root locus for the system having $G(s)H(s) = \frac{K}{s(s+3)(s^2+3s+4.5)}$. 07

Q.5 (a) Consider a system with open loop transfer function as

 $G(s)H(s) = \frac{1}{(1+T_1s)(1+T_2s)}, \text{ obtain its polar plot.}$

(b) A unity feedback control system has $G(s) = \frac{K}{s(s+6)(s+9)}$. Draw its root locus. 07

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