**A** **Reg. No.:** | | | | | | | | | | |

## Question Paper Code: 55B03

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fifth Semester

Biomedical Engineering

15UBM503 - BIO CONTROL SYSTEM

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Zero initial condition for a system means _____ CO1- R

   (a) input reference signal is zero

   (b) zero stored energy

   (c) initial movement of moving parts

   (d) system is at rest and no energy is stored in any of its components

2. In a signal flow graph, nodes are represented by small _____ CO1- R

   (a) Circles (b) Squares (c) Arrows (d) Pointers

3. The transient response of a system is mainly due to _____ CO2- R

   (a) inertia forces (b) internal forces (c) stored energy (d) friction

4. The type number of the control system with $G(s) = k(s+2)/(s(s^2+2s+3)$ CO2- R

   (a) 0 (b) 1 (c) 2 (d) 3

5. At which frequency does the magnitude of the system becomes zero dB? CO3- R

   (a) Resonant frequency (b) Cut-off frequency

   (c) Gain crossover frequency (d) Phase crossover frequency

6. The polar plot of a transfer function passes through the critical point (-1, 0). Gain margin is _____ CO3- R

   (a) Zero (b) -1dB (c) 1dB (d) Infinity

7. The magnitude condition for root locus is _____ CO4- R

(a) $|G(s)H(s)| = 0$ (b) $|G(s)H(s)| = 2$ (c) $|G(s)H(s)| = 1$ (d) $|G(s)H(s)| = \infty$

8. According to Nyquist stability criterion, where should be the position of all zeros of q(s) corresponding to s-plane? CO4 R

(a) On left half (b) At the center (c) On right half (d) Random

9. Physiological control systems, in general, are_____ CO5- R

(a) Optimal (b) Adaptive (c) Linear (d) Parametric

10. _____ Feedback is highly common in physiological systems.. CO5- R

(a) Embedded (b) segregated (c) Positive (d) None of the above

PART – B (5 x 2= 10Marks)

11. Define Transfer Function CO1- R

12. Define Damping ratio CO2- R

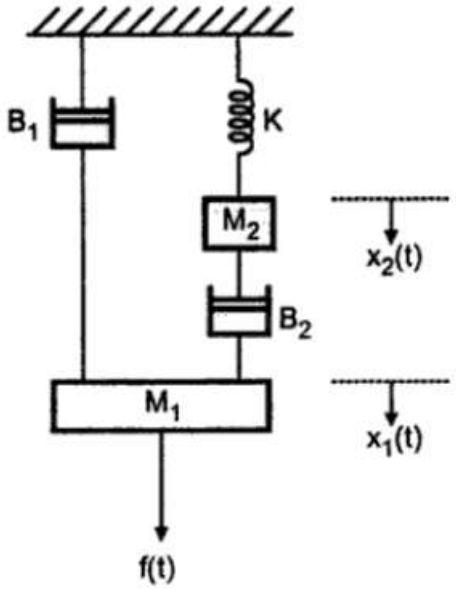
13. What are the main advantages of Bode plot? CO3- R

14. Mention the necessary and sufficient condition for stability. CO4- R

15. Draw the block diagram representation of muscle stretch reflux. CO5- R

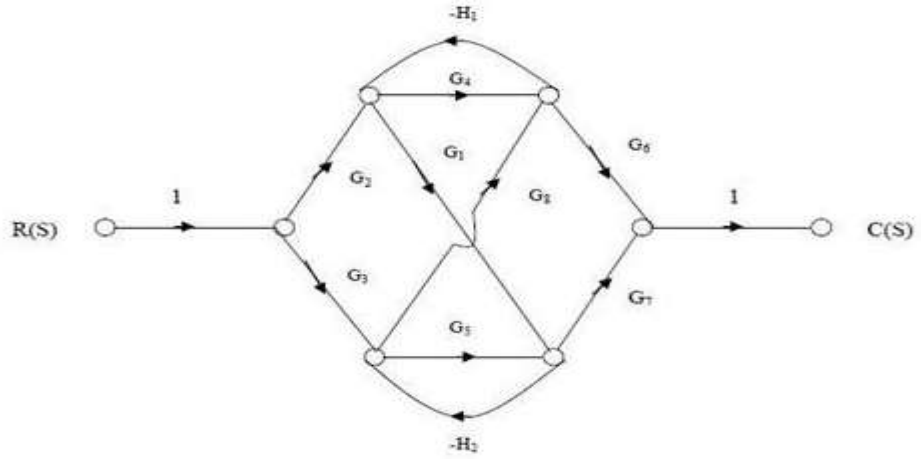
PART – C (5 x 16= 80Marks)

16. (a) Draw the equivalent mechanical system of the given system. Write the set of equilibrium equations for it and obtain electrical analogous circuits using F-V Analogy and F-I Analogy. CO1- App (16)



Or

(b) Determine the overall gain of the system for the given signal flow graph. CO1- App (16)




17. (a) Determine the time response specifications and expression for output for unit step input to a system having the system equation as follows. Assume zero initial conditions. CO2- App (16)

$$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 16y = 9x$$

Or

(b) For a unity feedback control system, the open loop transfer function $G(S) = 10(S+2)/ S^2 (S+1)$. Find CO2- Ana (16)

(a) Position, velocity and acceleration error constants.

(b) The steady state error when the input is R(S) where

$R(S) = 3/S - 2/S^2 + 1/3S^3$.

18. (a) Plot the Bode diagram for the following transfer function and obtain the gain and phase cross over frequencies. $G(S) = 10/ S(1+0.4S) (1+0.1S)$. CO3- Ana (16)

Or

(b) The open loop transfer function of a unity feedback system is given by $G(s) = 1 / s(1+s)^2$, Sketch the polar plot and determine the gain and determine the gain and phase margin. CO3- Ana (16)

19. (a) Using Routh criterion determine the stability of the system whose characteristics equation is $S^4+8S^3+18S^2+16S+5 =0$. CO4- App (16)

Or

(b) The characteristic polynomial of a system is, CO4- Ana (16)

$s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 24s^2 + 23s + 15 = 0$. Determine the location of roots on s-plane and hence the stability of the system.

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| 20. | (a) | Explain the need for modeling in physiological system. Illustrate with suitable examples. | CO5- U | (16) |
| | | Or | | |
| | (b) | With neat diagram explain the linear model of Cardiovascular System. | CO5- U | (16) |