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**Reg. No.:**

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**Question Paper Code: 55B03**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

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)

- Electrical analogous quantity for dash-pot in force-current analogy is CO1- R  
(a) Resistance                      (b) Conductance                      (c) Inductance                      (d) Capacitance
- In a signal flow graph, nodes are represented by small \_\_\_\_\_ CO1- R  
(a) Circles                      (b) Squares                      (c) Arrows                      (d) Pointers
- The steady state error due to ramp input for a type two system is equal to CO2- R  
(a) Zero                      (b) Infinite                      (c) Non-zero number                      (d) Constant
- The type number of the control system with  $G(s) = k(s+2)/(s^2+2s+3)$  CO2- R  
(a) 0                      (b) 1                      (c) 2                      (d) 3
- The magnitude & phase relationship between \_\_\_\_\_ input and the steady state output is called as frequency domain. CO3- R  
(a) Step                      (b) Ramp                      (c) Sinusoidal                      (d) Parabolic
- Which unit is adopted for magnitude measurement in Bode plots? CO3- R  
(a) Degree                      (b) Decimal                      (c) Decibel                      (d) Deviation
- 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)  $|G(s)H(s)| = \infty$

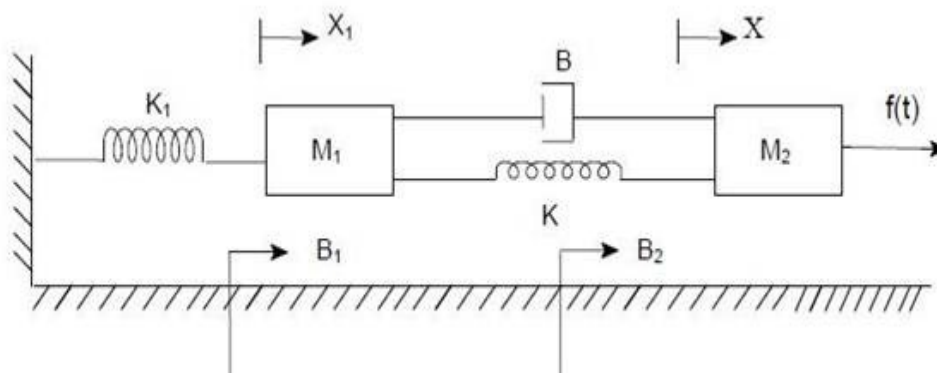
8. Which point on root locus specifies the meeting or collision of two poles? CO4 R
- (a) Centroid (b) Break away point  
(c) Stability point (d) Anti-break point
9. Physiological control systems, in general, are \_\_\_\_\_ CO5- R
- (a) Optimal (b) Adaptive (c) Linear (d) Parametric
10. \_\_\_\_\_ feedback is highly common in physiological control system. CO5- R
- (a) Positive (b) Negative (c) Embedded (d) Segregated

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 reflex. CO5- R

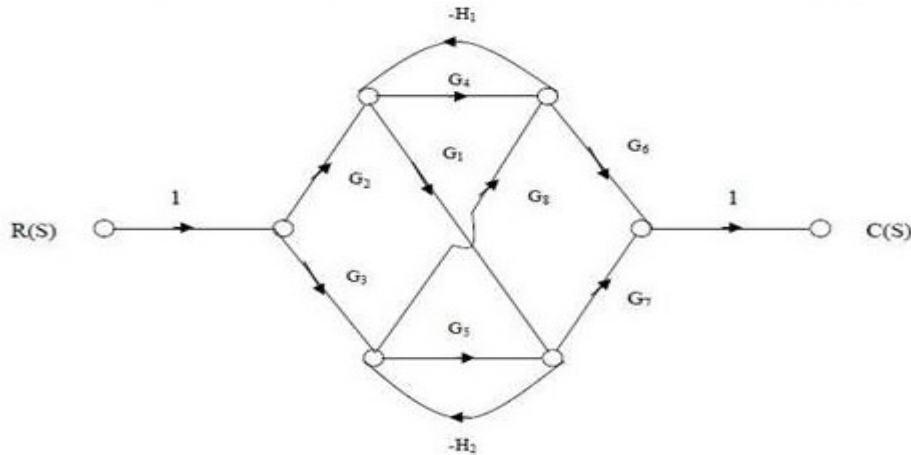
PART – C (5 x 16= 80Marks)

16. (a) Write the differential equations governing the Mechanical system and determine the transfer function. CO1- App (16)



Or

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



17. (a) An open loop transfer function of unity feedback system is  $G(S) = K/S(S+10)$ . Determine the gain  $k$ , so that the system will have a damping ratio of 0.5. Determine the time domain specifications for a unit step input. CO2- App (16)

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) Construct the polar plot for the function  $G(S) = 1/S(1+S)^2$ . find Gain margin 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) Sketch the root locus of the system whose open loop transfer function is  $G(S) = K/S(S+4)(S^2+4S+20)$ . CO4- Ana (16)

20. (a) Explain the linear model of cardiovascular system with neat diagram. CO5- U (16)

Or

(b) Explain the block diagram model of the following. CO5- U (16)

(i) Adaptive characteristics of the muscle stretch reflex

(ii) Muscle mechanics