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

Question Paper Code: 59404

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

Elective

Electronics and Communication Engineering

15UEC904–LINEAR CONTROL ENGINEERING

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Spring constant in force-voltage analogy is analogous to __________. CO1- R

 (a) capacitance (b) reciprocal of capacitance

 (c)current (d) resistance

2. In signal flow graph, function points are called __________. CO1- R

 (a) joints (b) nodes (c) functional points (d) blocks

3. The time required for the response to reach half the final value for the first time is __________. CO2- R

 (a) decay time (b) pick up time (c)delay time (d) rise time

4. The type 2 system has _______. CO2- R

 (a) no net pole at origin (b) net pole at the origin

 (c) simple pole at the origin (d) two poles at the origin

5. _______ is used for Nyquist plot. CO3 R

 (a) characteristics equation (b) open loop function

 (c) closed loop function (d) nonlinear function

6. The function 1/jωT has slope of ________. CO3 R

(a) -20 db/decade (b)+20 db/decade (c)+6db/decade (d)+40db/decade

7. The system with characteristics equations (s+1)(s+2)(s-3)=0 is _____. CO4 R

(a) stable (b) marginally stable

(c) not necessarily stable (d) unstable

8. For root locus which of the following are the starting points? CO4 R

(a) open loop zeros (b) closed loop zeros

(c) closed loop poles (d) open loop poles

9. Presence of non-linearity in a control system tends to introduce CO5 R

(a) transient error (b) instability (c) steady state error (d) all of the above

10. For a linear time invariant system, an optimum controller can be designed if_________. CO5 R

(a) The system is controllable and observable (b)The system is uncontrollable and stable

(c)The system is unstable and observable (d)The system is stable and unobservable

PART – B (5 x 2= 10Marks)

11. Define transfer function. CO1- R

12. Why compensation is necessary in feedback control system? CO2- R

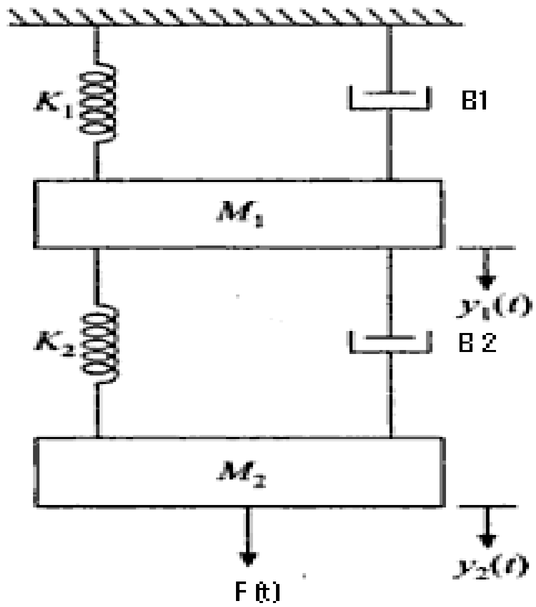
13. List the frequency domain specifications. CO3- R

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

15. What is meant by state variable? CO5- R

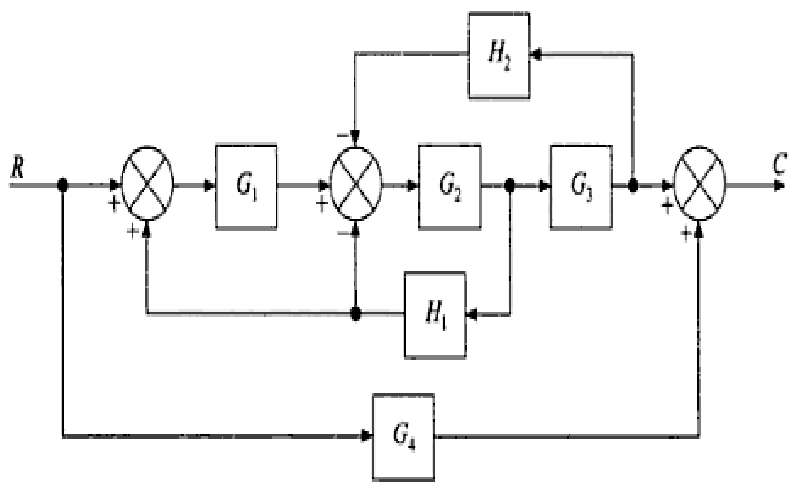
PART – C (5 x 16= 80Marks)

16. (a) Write the differential equations governing the mechanical system shown in figure. Draw the force-voltage and force-current electrical analogous circuits and verify by writing mesh and node equations. CO1- App (16)



Or

(b) Determine the overall transfer function C(S)/R(S) for the system shown in figure. CO1- App (16)



17. (a) Derive an expression for response of under damped second order system for unit step input. CO2- App (16)

Or

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

(i) the position, velocity and acceleration error constants

(ii) the steady state error when input is R(s),where

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

18. (a) Plot the bode diagram for the following transfer function and obtain the gain and phase cross over frequencies. CO3- Ana (16)

$G(s) = \frac{10}{s(1+0.4s)(1+0.1s)}$

Or

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

19. (a) Using Routhcriterion, determine the stability of the system. CO4- U (8)

(i) $S^4 + 8s^3 + 18s^2 + 16s + 5 = 0$

(ii) $S^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$ CO4- U (8)

Or

(b) Sketch the root locus of the system whose open loop transfer function is $G(s)=\frac{k}{s(s+2)(s+4)}$. CO4- Ana (16)

20. (a) Consider the system given by $\frac{Y(s)}{U(s)} = \frac{s+3}{s^2+3s+2}$. Obtain state space representation in diagonal canonical form. CO5- U (16)

Or

(b) Evaluate controllability and observability of the given system. CO5- U (16)

$$A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 0 \\ 1 & 2 \\ 1 & 1 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 1 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$