Reg. No. : | | | | | | | | | | |

Question Paper Code: 41547

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fourth Semester

Electronics and CommunicationEngineering

14UEI422 – LINEAR CONTROL ENGINEERING

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. An element which stores potential energy

   (a) mass (b) spring
   (c) damper (d) none of these

2. Rotational motion is the motion

   (a) along a straight line (b) about a fixed axis
   (c) along a random path (d) none of these

3. The damping ratio of a system having the characteristic equation $s^2+2s+8=0$ is

   (a) 0.353 (b) 0.330 (c) 0.300 (d) 0.250

4. The input to a controller is

   (a) sensed signal (b) desired value
   (c) error signal (d) servo-signal

5. Which of the following is the time domain method of determining stability of a control system

   (a) Bode plot (b) Nyquist plot
   (c) Root locus (d) Nichols chart

6. A system with gain margin close to unity or a phase margin close to zero is

(a) highly stable (b) oscillatory
(c) relatively stable compensation (d) unstable

7. As a root moves further away from imaginary axis, the stability

(a) increases (b) decreases
(c) not affected (d) none of these

8. The relative stability of a system is given by

(a) Gain margin alone (b) Phase margin alone
(c) Both gain and phase margin (d) Either gain or phase margin

9. The state space approach is applicable to the control systems which are

(a) Time variant (b) Time invariant
(c) Both (a) and (b) (d) None of these

10. The advantage of state space model is

(a) Applicable for linear and non-linear system
(b) Applicable for only linear system controllable
(c) Applicable for time invariant system only
(d) Applicable for continuous –time system only

PART - B (5 x 2 = 10 Marks)

11. Why negative feedback is invariably preferred in closed loop system?

12. Name the test signals used in control system.

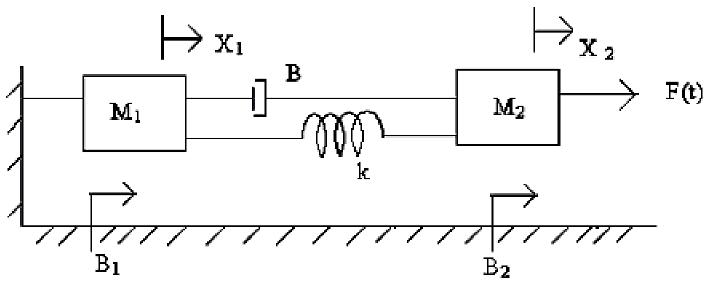
13. List out the different frequency domain specifications.

14. How the roots of characteristic are related to stability?

15. State the reason for using state space analysis rather than using transfer function method.

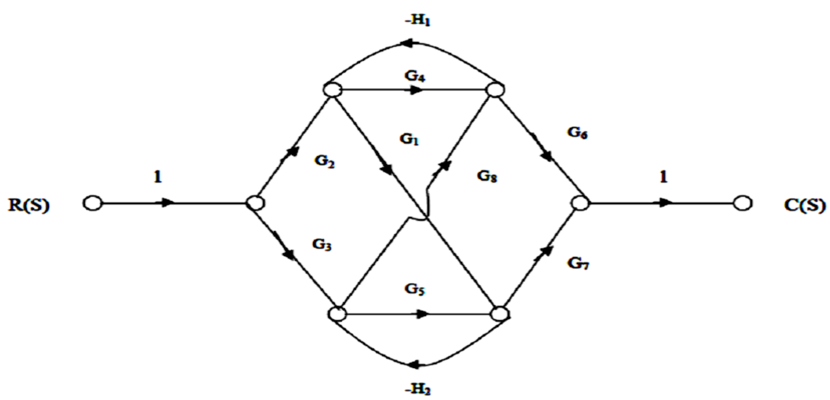
PART - C (5 x 16 = 80 Marks)

16. (a) Write the differential equations governing the Mechanical system shown in figure and determine the transfer function. (16)



Or

(b) Evaluate the overall gain of the system whose signal flow graph is shown in figure. (16)



17. (a) (i) Measurements conducted on a Servomechanism show the system response to be c(t)=1+0.2 $\hat{e}^{-60t}$+1.2 $\hat{e}^{-10t}$ when subjected to a unit step. Obtain an expression for closed loop transfer function and also determine the undamped natural frequency and the damping of the system. (8)

(ii) A unity feedback control system has an open loop transfer function G(S) = 10/S(S+2). Find the rise time, percentage over shoot, peak time and settling time. (8)

Or

(b) The open loop transfer function of a servo system with unity feedback system is $G(s) = \frac{10}{s(0.1s+1)}$ .Evaluate the static error constants of the system. Obtain the steady state error of the system when subjected to an input given by the polynomial r(t) = a0+a1t +a2 /2 t2. (16)

41547

18. (a) Sketch the Bode plot and hence find gain cross over frequency and phase cross over frequency $G(s) = \frac{10}{s(0.4s+1)(0.1s+1)}$. (16)

Or

(b) The open loop transfer function of a unity feedback system is $G(s) = \frac{400}{s(s+2)(s+10)}$. Sketch the Polar plot and determine the Gain margin and Phase margin. (16)

19. (a) Using Routh criterion determine the stability of the system whose characteristics equation is $s^6 + s^5 - 2s^4 - 3s^3 - 7s^2 - 4s - 4 = 0$. Find the number of roots falling in the RHS plane and LHS plane. (16)

Or

(b) A unity feedback control system has an open loop transfer function $G(s) = \frac{K}{s(s+2)(s+4)}$. Sketch the root locus. (16)

20. (a) Explain sampling theorem and Sample and Hold operation in detail. (16)

Or

(b) Find the state controllability for the systems represented by the state equation

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 1 \\ -1 \end{bmatrix} u .$$ (16)