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

Question Paper Code : 91449

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Electronics and Communication Engineering

EC 6405 – CONTROL SYSTEM ENGINEERING

(Common to Mechatronics Engineering and Medical Electronics)

(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Provide Semilog Sheet, Polar Graph and Ordinary Graph Sheet.

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. List the advantages of closed loop system.

2. What is block diagram ? What are its basic components ?

3. How do you find the type of a system ?

4. Find the unit impulse response of system $H(s) = 5s/(s + 2)$ with zero initial conditions.

5. What are the frequency domain specifications ?

6. What are M and N circles ?

7. What are the advantages of Routh Hurwitz stability criterion ?

8. Define Nyquist stability criterion.

9. List the main properties of a state transition matrix.

10. State sampling theorem.

PART – B (5×13=65 Marks)

11. a) i) Explain the features of closed loop feedback control system. (4)

ii) Derive the transfer function of system shown in Fig. 11 a) ii). (9)

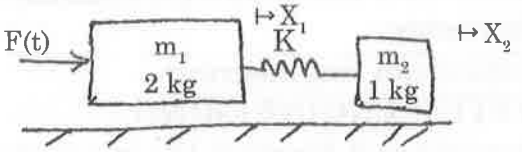

Fig. 11 a) ii)

(OR)

b) Find the transfer function of the system shown in Fig. 11 b) using block diagram reduction technique and signal flow graph technique.

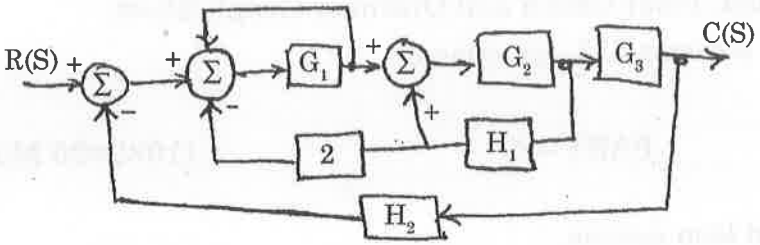

Fig. 11 b)

12. a) i) Derive the time response of a first order system for unit step input. (7)

ii) The unity feedback control system is characterized by an open loop transfer function G(s) = K/[s(s + 10)]. Determine the gain K, so that the system will have damping ratio of 0.5 for this value of K. Determine the peak overshoot and peak time for a unit step input. (6)

(OR)

b) With a neat block diagram and derivation, explain how PI, PD and PID compensation will improve the time response of a system.

13. a) Sketch the Bode plot for the following transfer function and determine the phase margin and gain margin :

$$G(S) = \frac{20}{S(1+3S)(1+4S)}.$$

(OR)

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

14. a) Determine the range of K for stability of unity feedback system using Routh stability criterion whose transfer function $\frac{C(s)}{R(s)} = \frac{K}{s(s^2+s+1)(s+2)+K}$.

(OR)

b) Explain briefly about the steps to be followed to construct a root locus plot of a given transfer function.

15. a) A discrete time system is described by the difference equation
$y(k+2) + 5y(k+1) + 6(yk) = u(k)$
$y(0) = y(1) = 0$ and $T = 1$ sec, Determine :
i) State model in canonical form. **(7)**
ii) State transition matrix. **(6)**

(OR)

b) i) Check the controllability of the system by Kalman's test whose state model is given as,

$$\begin{bmatrix} u_1 \\ u_2 \\ u_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & +2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} u;\ y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}.$$

ii) Write detailed notes on Sampler and hold circuits.

PART – C **(1×15=15 Marks)**

16. a) Examine the effectiveness of open loop and closed loop sampled data systems.

(OR)

b) Analyse the performance of lead, lag and lead lag compensators.
