A   Reg. No. :

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The output is said to be zero state response because _____conditions are made   CO1- U
    equal to zero

    (a)Initial   (b) Final   (c) Steady state   (d) Impulse response

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

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

3. If an impulse response of a system is e^{-5t}, what would be its   CO2-App
    transfer function?

    (a) $1/ s – 5$ (b) $1/ s + 5$ (c) $(s+1) / (s+5)$ (d) $(s^2 - 5s)/ (s-5)$

4. Transfer function of a system is used to calculate which of the   CO2-U
    following?

    (a) The order of the system   (b) The time constant

    (c) The output for any given input   (d) The steady state gain

5. Phase margin of a system is used to specify which of the   CO2-R
    following?

    (a) Frequency response   (b) Absolute stability

    (c)Relative stability   (d) Time response

6. The frequency at which the two asymptotic meet in a magnitude plot is called_____   CO2- U

(a) Resonant peak.   (b) Band width   (c) corner frequency   (d) Resonant frequency

7. Technique is not applicable to nonlinear system?   CO3- R

(a) Nyquist Criterion   (b) Quasi linearization

(c) Functional analysis   (d) Phase-plane representation

8. Addition of zeros in transfer function causes which of the following?   CO3- U

(a) Lead-compensation   (b) Lag-compensation

(c)Lead-lag compensation   (d) None of the above

9. A set of variables describes the state of the system is called   CO4- U

(a) Input variables   (b) Output variables   (c) State variables   (d) None of these

10. State space analysis is applicable to   CO4- R

(a) Linear system   (b) Non linear system

(c) MIMO   (d) All of these

PART – B (5 x 2= 10 Marks)

11. What are the electrical and mechanical time constants of an electric motor?   CO1- U

12. Explain the effect of PI controller on the system performance.   CO2- U

13. What is gain cross over frequency   CO2- R

14. Explain the necessary and sufficient condition for stability.   CO2- U

15. Consider system given by Y(s) / U(s) = (s+3) / (s^3+3s+2). Obtain state space representation in controllable form.   CO4 -App

PART – C (5 x 16= 80Marks)

16. (a)   A packing crate was designed to protect a fragile instrument   CO1- App   (16)
during shipment. Assuming that thepacking material can be
modeled as an ideal linear spring of stiffness, *k*, in parallel with an
ideallinear damper, *b*, and that the instrument of mass, *m*, the
system can be modeled as shown in Figure.
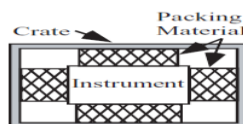
(a) Develop the free body diagram of the above system
(b) Derive the differential equation for the system.

Or

94302

(b) Write the differential equations governing the mechanical system CO1- App (16)
shown in figure. Construct the force – voltage and force – current
electrical analogous circuits and verify by writing mesh and node
equations.
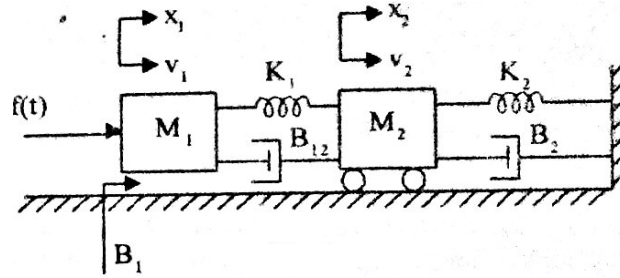
17. (a) The Unity feedback system is characterized by a open loop CO2- App (16)
transfer function G(s)=K/S(S+10). Determine the gain K. So that
this system will have a damping ratio of 0.5 for this value of K,
settling time, peak overshoot, peak time of the system for unit step
input.

Or

(b) The open loop transfer function of a unity feedback system is CO2- App (16)
given by $G(s) = \frac{K(s+9)}{s(s^2+4s+11)}$. Sketch the root locus of the system.

18. (a) Construct the Bode plot for the following transfer function and CO2- App (16)
obtain the gain and phase cross over frequencies whose

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

Or

(b) Construct the Polar plot for the following transfer function and CO2- App (16)
obtain the gain margin and phase margin whose

$$G(s) = \frac{1}{s(1+s)(1+2s)}$$

19. (a) Construct Routh array and Analyze the stability of the system CO2- App (16)
whose characteristic equation is
$S^6+2S^5+8S^4+12S^3+20S^2+16S+16=0$. Also determine the number
of roots lying on right half of S-plane, left half of s-plane and on
imaginary axis.

Or

(b) For a certain system, $G(s) = \frac{0.025}{s(1+0.5s)(1+0.05s)}$. Design a suitable lag CO3- C (16)
compensator to give, velocity error constant = $20sec^{-1}$ and phase
margin = 40°.

3

94302

20. (a) Examine whether the system described by the following state   CO4- Ana   (16)
    equation is completely state controllable and observable.

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Or

(b) The transfer function of a control system is given by   CO4- App   (16)

$$\frac{Y(s)}{U(s)} = \frac{(s+2)}{(s^3 + 9s^2 + 26s + 4)}$$

Develop state space representation of a system