ME/Sem I/MECH CAD-CAM/CE/07-12-2017

Q.P. Code : 25869

(3 Hours) [Total Marks : 80

N.B. : (1) Attempt **any four** questions.
(2) **Figures** to the **right** indicate **full marks**.
(3) Assume suitable **data** if **necessary**.

1. (a) Explain the rules for the reduction of Block Diagram. 10
(b) Sketch the root locus for 10

$$G(s)\,H(s) = \frac{K}{s(s+2)(s+4)}.$$

2. (a) Sketch the polar plot for function 08

$$G(s)\,H(s) = \frac{6}{(s+1)(s+2)}.$$

(b) Consider a unity feedback system with a closed loop transfer function 07

$$\frac{C(s)}{R(s)} = \frac{10(s+1)}{S(S+2)(S+5)}$$

Determine the error coefficients for the step, ramp and parabolic inputs and steady state error when $r(t) = 5 + 10t$.

(c) What are lead, lag and lag-lead compensators? When it is preferred? 05

3. (a) A system has 30% overshoot and setting time of5 seconds, for a unit step input. Determine the transfer function. Calculate peak time and output response. Assume $e_{ss} = 20\%$. 10
(b) Compute STM for the state model whose A matrix is given by 05

$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}.$$

(c) Discuss the advantages and limitations of the Routh's criteria. 05

4. (a) Sketch the Bode plot for the open loop transfer function for the unity feedback system given below and assess the stability 10

$$G(s) = \frac{80}{S(S+2)(s+20)}.$$

(b) Explain : 10
(1) PID controller.
(2) Classification of control system.

TURN OVER

5. (a) Obtain a state model of the system described by the transfer function 10

$$\frac{V(s)}{U(s)} = \frac{8}{s^3 + 6S + 7}.$$

(b) Determine the range of values of K for the system to be stable. Can the system be marginally stable? If so, find the required value of K and the frequency of sustained oscillations : 10

(i) $S^3 + 3K\,S^2 + (K + 2)\,S + 4 = 0$.

(ii) $S^4 + 4S^3 + 13S^2 + 36\,S + K = 0$

6. Write short notes on : 20

(a) Mathematical Modeling for R-L-C.
(b) Correlation between time and frequency response.
(c) Signal flow graph.
(d) Stepper Motor.
