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Code: 15A02303 **R15**

B.Tech II Year I Semester (R15) Regular & Supplementary Examinations November/December 2018

CONTROL SYSTEMS ENGINEERING

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is the effect of positive feedback on stability of the system?

(b) What is the basic rule used for block diagram reduction technique?

(c) What are test signals and write their significance?

(d) Define IAE, ITAE.

(e) Determine the stability of the system whose characteristic equation is given by: $S^4 + 6S^3 + 23S^2 + 40S + 50 = 0$ using Routh's stability criterion.

(f) Draw the Root-Locus plot of $G(S)\,H(S) = \frac{K}{S+P}$.

(g) Define gain margin and phase margin.

(h) Define state and state variable.

(i) What are the advantages of state space modeling using physical variables?

(j) What is similarity transformation?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

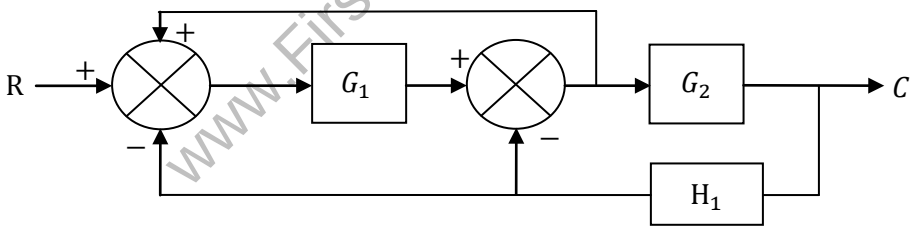
2 (a) Explain the operation of synchro transmitter and receiver.

(b) Write the block diagram reduction techniques in the analysis of control systems.

OR

3 (a) Write the analogy between mechanical systems and electrical systems.

(b) Determine C/R of the system shown in figure below by block diagram reduction technique.



UNIT – II

4 (a) For a unity feed-back system whose open-loop transfer function is $G(S) = \frac{100}{(1+0.2S)(1+2S)}$. Find the position, velocity and acceleration error constants.

(b) What will be the nature of response of a second order system with different types of damping?

OR

5 (a) Derive the expression for 2nd order system under damped system with unit step as input.

(b) The open loop, transfer function of a unity feedback system is $G(S) = \frac{1}{1+S}$. Using generalized error series determine the steady state error when the system is excited by $R(t) = 1 + t + t^2$.

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UNIT – III

6 (a) The open loop transfer function of a unity feedback system is given by $G(S) = \frac{K}{S(S+3)(S^2+S+1)}$. Determine the values of 'K' that will cause sustained oscillations in the closed loop system. Also find the oscillation frequency.

(b) What is centroid and how it is calculated?

OR

7 Sketch the root locus for the open loop transfer function of unity feedback control system given by $G(S)\,H(S) = \frac{K}{S(S+1)(S+2)}$. Also find K of breakaway point.

UNIT – IV

8 (a) Sketch polar plot of $G(S) = \frac{1}{(1+ST_1)(1+ST_2)}$.

(b) The open-loop transfer function of closed loop system is $G(S)\,H(S) = \frac{1+4S}{S^2(S+1)(2S+1)}$. Determine the stability using Nyquist criterion.

OR

9 Sketch the bode plot for the transfer function $G(S) = \frac{K\,S^2}{(1+0.2S)(1+0.2S)}$. Determine the system gain 'K' for the gain cross-over frequency to be 5 rad/sec.

UNIT – V

10 (a) Explain various methods of evaluation of state transition matrix.

(b) Given $\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x(t) = A.x(t)$. Find Eigen values, vectors and response when X(0) = $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$.

OR

11 (a) Discuss the merits and demerits of representing a state model into: (i) Phase variable form. (ii) Canonical form.

(b) Find the state transition matrix for $\dot{X} = \begin{bmatrix} -2 & 1 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -2 \end{bmatrix} x$.

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