Code: 15A02303

R15

B.Tech II Year II Semester (R15) Regular Examinations May/June 2017

CONTROL SYSTEMS ENGINEERING

(Common to ECE and EIE)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

Use of polar chart, Bode graph sheet and Nyquist chart is allowed in examination hall.

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

(a) List the advantages of negative feedback in control system.
(b) Write the Mason's gain formula of signal flow graph.
(c) How do you find the type of a control system?
(d) Find the value of position error constant for second order system using ramp input.
(e) Write the necessary and sufficient condition for stability in Routh's stability criterion.
(f) Define BIBO stability.
(g) Write the expression for resonant peak in frequency response analysis.
(h) What is meant by lag compensation?
(i) Define state and state variable.
(j) What are the properties of state transition matrix?

PART – B

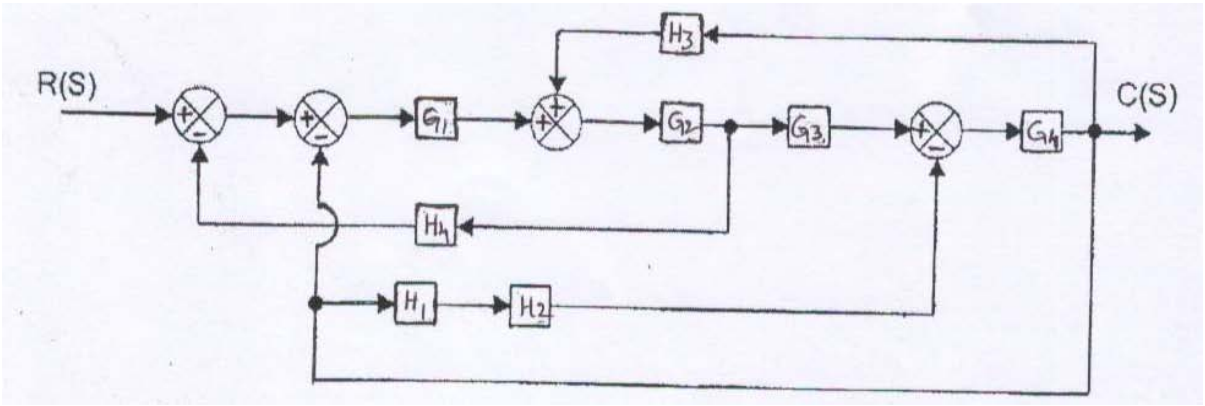
(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Derive the transfer function of DC servomotor.

OR

3 Find the transfer function C(S) / R(S) for the system using block diagram reduction technique.



UNIT – II

4 (a) Transfer function of unity feedback control system is $G(s) = \frac{25}{s(s+5)}$. Obtain the rise time, peak time, maximum overshoot and the settling time when the system is subjected to a unity step input.

(b) Derive the time response of first order system for step input.

OR

5 The open loop transfer function of a system with unity feedback $G(S) = 10/S\,(0.1S + 1)$. 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 $r(t) = a_0 + a_1 t + a_2 t^2/2$.

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UNIT – III

6 Draw the root locus plot for the system whose open loop transfer function is given by:

$G(S)H(S) = K / [S(S+4)(S2+4S+13)]$

OR

7 Obtain the Routh array for the system whose characteristic polynomial equation is:

$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$. Check the stability.

UNIT – IV

8 Explain in detail about lag-lead compensator technique.

OR

9 The open loop transfer function of a unity feedback system is given by:

$G(S) = 1/[S(1+S)(1+2S)]$

Sketch polar plot and determine the gain and phase margin.

UNIT – V

10 Consider a system with state model given below:

$$x = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -1 \end{bmatrix} X + \begin{bmatrix} 0 \\ 5 \\ -24 \end{bmatrix} u;\ y = [1 \quad 0 \quad 0]x + [0]u$$

Verify, the system is observable and controllable.

OR

11 (a) Obtain the state model of the system described by the following transfer function:

$Y(s)/U(S) = 5 / [(S^2 + 6S + 7)]$.

(b) Explain about diagonalization.

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