



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

(Common to ECE and EIE)

Time: 3 hours

1

PART – A

Max. Marks: 70

(Compulsory Question)

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

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

OR

2 Derive the transfer function of DC servomotor.

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 $r(t) = a_0 + a_1t + a_2t^2/2$.

Contd. in page 2

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UNIT – III 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)]

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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.

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OR

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.

10 Consider a system with state model given below:

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

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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