D 40799 (Pages : 2)

SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2007

EE 2K 703/PTEE 2K 701—CONTROL SYSTEMS—II

(New Scheme)

Time : Three Hours

Maximum : 100 Marks

Part A

Answer all questions.

I. (a) What is lag-lead compensation ? Discuss briefly.

(b) Explain the concept of root-locus method of stability analysis.

(c) Why linearisation of non-linear systems are essential for analysis purpose ? Explain.

(d) What do you meant by classifications of singular points ? Illustrate with examples.

(e) Explain the basic concept of Liapunov stability analysis.

(f) Discuss the issues in the stability analysis of linear systems with that of non-linear systems.

(g) What is quadratic optimal control ? Explain with an example.

(h) With an example, discuss the controllability issue of a control system.
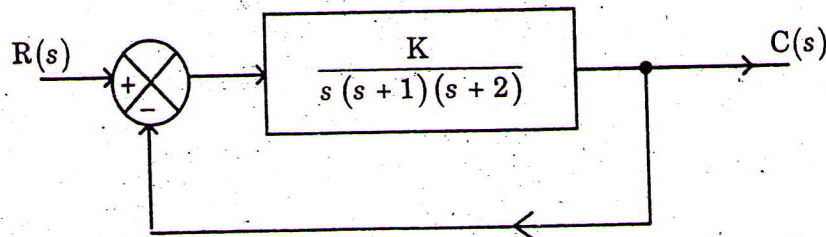
(8 × 5 = 40 marks)

Part B

Answer one question from each module.

MODULE 1

II. (a) With suitable examples discuss about the tuning rules for PID controllers.

Or

(b) Sketch the root-locus plot for the control system shown below, where K is non-negative.

Turn over

MODULE 2

III. (a) Consider a system defined by the following state-space equations :—

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} -5 & -1 \\ 3 & -1 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 2 \\ 5 \end{bmatrix} U$$

$$Y = \begin{bmatrix} 1 & 2 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$$

Obtain the transfer function G(s) of the system.

Or

(b) Linearise the nonlinear equation

$$Z = x^2 + 4xy + 6y^2$$

in the region defined by

$$8 \le x \le 10, 2 \le y \le 4.$$

(15 marks)

MODULE 3

IV. (a) Using Liapunov method determine the stability of the equilibrium state of the following system :—

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & (-1-j) \\ (-1+j) & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Or

(b) With appropriate examples, discuss about the approach of Liapunov's stability analysis of linear time invariant systems.

(15 marks)

MODULE 4

V. (a) In connection with quadratic optimal control, what is the importance of Riccati equation ? Discuss with appropriate examples.

Or

(b) What is pole-placement method ? Discuss its importance in the design of control systems.

(15 marks)

[4 × 15 = 60 marks]