5E1393

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B. Tech. V - Sem. (Main / Back) Exam., Feb.-March - 2021
PCC/PEC Electronics & Communication Engineering
5EC 4–03 Control System

Time: 2 Hours **[To be converted as per scheme]**

Max. Marks: 82

Min. Marks: 29

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. **Units of** quantities used /calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Explain Digital control system. [2]

Q.2 Write difference between transient and steady state response. [2]

Q.3 What is Tachogenerator? [2]

Q.4 Define Insensitivity and Robustness. [2]

Q.5 Define lead compensation. [2]

Q.6 Define state, state variable. [2]

Q.7 Define Phase margin and Gain margin. [2]

Q.8 Explain the multivariable control system. [2]

Q.9 Define relative stability. [2]

Q.10 Explain PID controller. [2]

PART – B

(Analytical/Problem solving questions) [4×8=32]

Attempt any four questions

Q.1 Define the open loop and closed loop systems. Draw the block diagram representation of open loop & closed loop system by assuming suitable example. Compare the advantages & disadvantages. [8]

Q.2 How an armature controlled DC motor is used in control system applications? Give a schematic diagram, derive the transfer function and draw a block for the system. [8]

Q.3 The block diagram of a simple servo system shown in given fig 1. Find - [1×8=8]

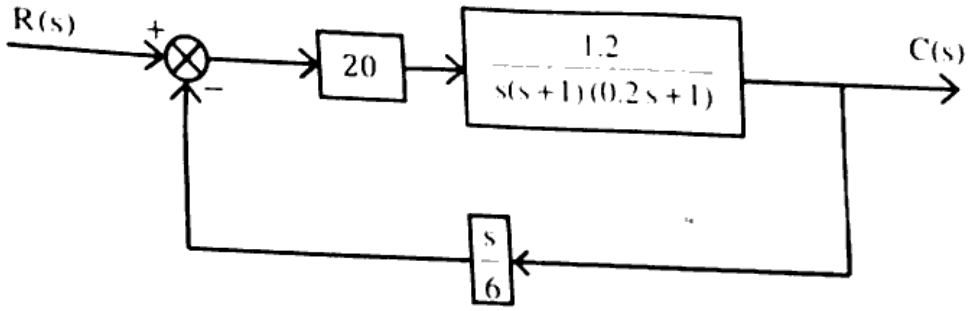

Fig.1

(a) The characteristics equation of the system

(b) Undamped frequency of oscillations

(c) Damped frequency of oscillations

(d) Damping Ratio

(e) Damping factor

(f) Maximum overshoot

(g) First undershoot

(h) Settling time

Q.4 With the help of Routh – Hurwitz criterion, comment upon the stability of the system having the following characteristic equation - [8]

$$s^6 + s^5 + 8\,s^4 + 6\,s^3 + 20\,s^2 + 8\,s + 10 = 0$$

Q.5 Using Nyquist criterion find out whether the system given below is stable –

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

Q.6 Write short notes on –

(a) Optimal control system

(b) Nonlinear control system [4]

Q.7 Diagonalize the system whose state model is given below. [4]

$$\dot{x} = \begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

and $y = [8 \quad 1]x$ [8]

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30]**

Attempt any two questions

Q.1 For the feedback control system shown in the fig.2 – [3×5=15]

(a) Find $\frac{C}{R}$ using block diagram reduction method

(b) Find $\frac{C}{R}$ using Mason's gain formula

(c) If $G_1 = 10$, $G_2 = 5$, $G_3 = 8$, $H_1 = 1$, $H_2 = 0.25$, $H_3 = 0.2$ and $R = 10.1$, find the input to block G_2.

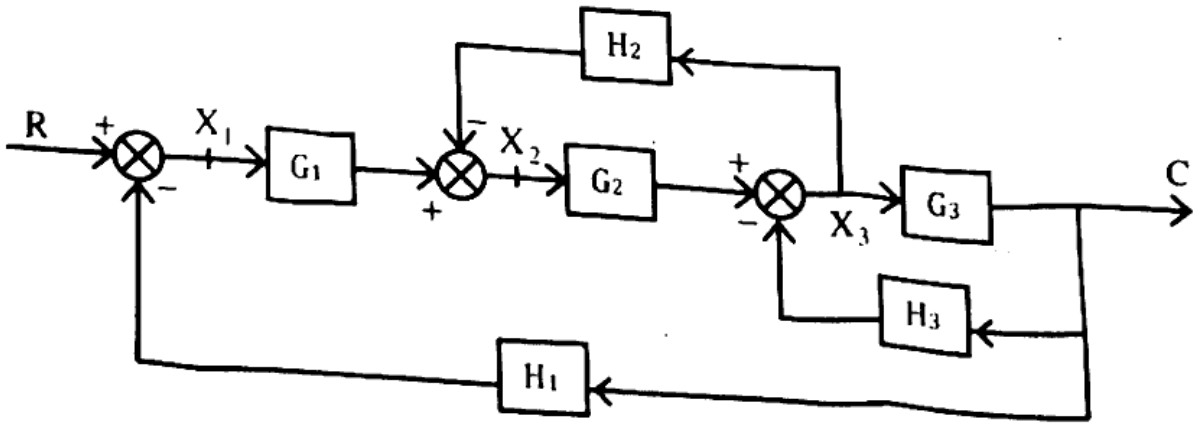

Fig.2

Q.2 Find out the time response of second order system in time domain with a unit step input. [15]

Q.3 The open loop transfer function of a control system is given by – [15]

$$G(s) = \frac{K}{s(s+6)(s^2+4s+13)}$$

Sketch the root locus and determine -

(a) The break-away point

(b) The angle of departure from complex poles

(c) The stability condition

Q.4 The state equation of system are given below. Determine if the system is completely controllable and observable – [15]

$$\dot{x} = \begin{bmatrix} -6 & 2 & -4 \\ -18 & 3 & -8 \\ -6 & 1 & -3 \end{bmatrix} x + \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix} u$$

$$y = [1 \ -1 \ 2]\, x$$

Q.5 Construct the Bode plot on a semi log graph sheet for a unity feedback system whose open loop transfer function is given by – [15]

$$G(s) = \frac{50}{s(1+s)(1+0.5s)}$$

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