6E6055

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6E6055

B.Tech. VI Semester (Main/Back) Examination, April/May - 2017

Electronics & Communication Engg.

6EC5A Control Systems

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable 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. Semilogarithmic paper

Unit - I

1. a) Explain following terminologies in relation to control system :- **(4×2)**

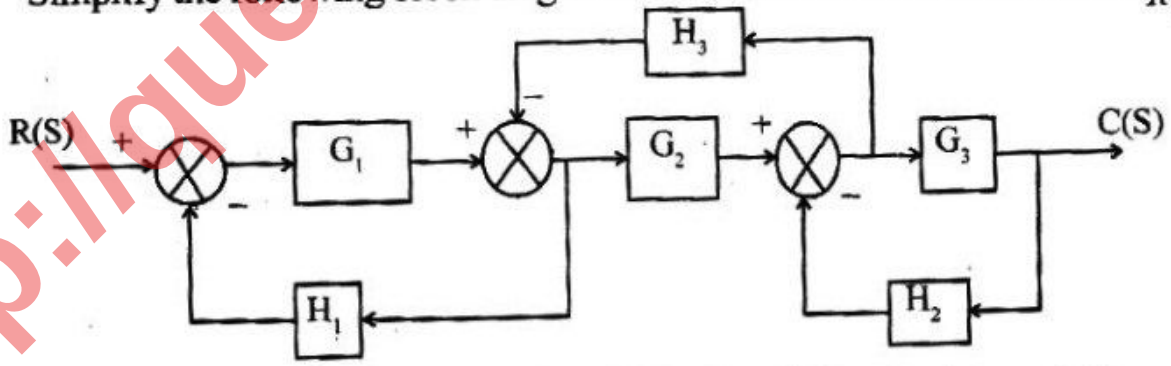
i) Open - loop control system

ii) Controller

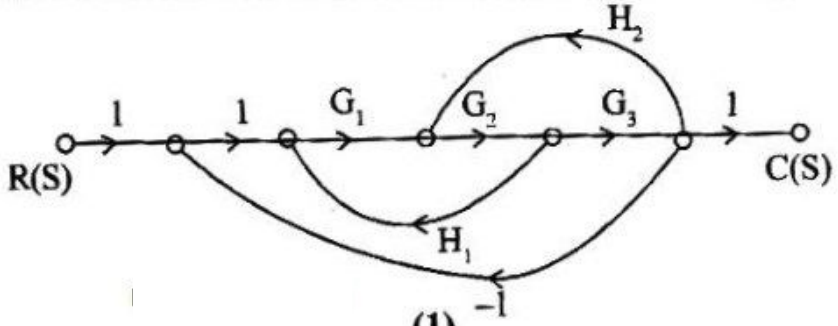
iii) Feedback control system

iv) Disturbance

b) Simplify the following block diagram to calculate the transfer function $\frac{C(s)}{R(s)}$. **(4)**



c) Calculate the transfer function of the following SFG using Mason's formula. **(4)**



OR

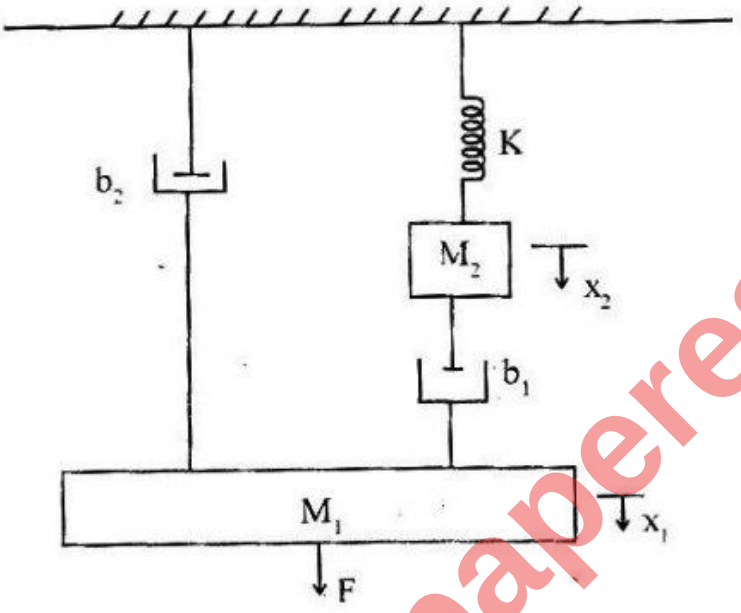
1. a) Define the following in relation to control system :- **(4×2)**

   i) Servomechanism iii) Regulatory systems

   ii) Electromechanical systems iv) Transfer function.

   b) Draw the electrical analog of the following mechanical system using. **(2×4)**

   i) Force-voltage Analogy ii) Force-current Analogy



Unit - II

2. a) Derive the response of a second order Underdamped system given by

$$\frac{C(S)}{R(S)} = \frac{W_n^2}{s^2 + 2\xi W_n s + W_n^2}$$; for unit step input. **(10)**

   b) Briefly explain the concept of stable, unstable and marginally stable system. **(6)**

OR

2. a) Define peak time, settling time and maximum overshoot and also calculate them for a unity feedback system whose forward transfer function is given by

$$G(s) = \frac{25}{s(s+6)}.$$ **(1.5×6)**

   b) Consider a sixth order system with the characteristics equation given by : **(7)**

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

   Comment on the Location of roots of this system.

Unit - III

3. Sketch the root Locus plot of the transfer function given by $G(s)H(s)=\frac{K(s+1)}{s(s-3)}$. Showing all the salient points and also explain all the rules associated. **(16)**

OR

3. Explain following terms in relation to control system. **(4×4)**
   i) Polar plot
   ii) Mapping
   iii) Nyquist stability Criteria
   iv) Effect of adding pole & zero on Root locus.

Unit - IV

4. Construct the Bode plot for the given open loop transfer function with unity feedback

$$G(s)=\frac{1}{s(1+0.2s)(1+0.02s)}.$$ **(16)**

OR

4. a) Define the following terms with respect to frequency response analysis: **(3×2)**
   i) Gain Margin
   ii) Phase Margin
   iii) Nicholas Chart
   b) Derive any two frequency domain specifications. **(5×2)**

Unit - V

5. a) Determine the transfer function of the system whose state model is given by **(8)**

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -6 & -5\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u$$

$$y=\begin{bmatrix}1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$

b) Convert $\frac{8}{(s+1)(s+2)}$ into state model. **(8)**

OR

5. Write short note on : **(4 × 4)**
   a) Compensator
   b) Controllability
   c) State Model
   d) Canonical Representation.

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