**R16**

**Code No: 134AM**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B.Tech II Year II Semester Examinations, April - 2018**
**CONTROL SYSTEMS**
**(Common to EEE, ECE, EIE)**

**Time: 3 Hours** **Max. Marks: 75**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART- A**

**(25 Marks)**

1.a) Write the Manson's gain formula. [2]
b) What are the basic properties of SFG? [3]
c) What are the standard test signals used in control systems? [2]
d) Distinguish between type and order of a system. [3]
e) Define a stable system. [2]
f) Explain the basics of root locus plot. [3]
g) What is polar plot? [2]
h) Define gain and phase margins. [3]
i) What is state diagram? [2]
j) Mention any four advantages of state variable representation. [3]

**PART-B**

**(50 Marks)**

2.a) Compare the AC and DC servomotors.
b) For the system represented by the block diagram shown in figure 1. Find $\frac{C}{R}$. [4+6]

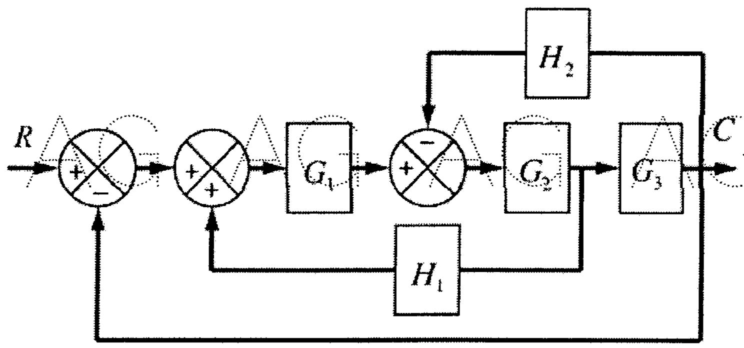


**Figure: 1**

**OR**

3.a) What are the characteristics of servomotors?

b) Find the overall gain $\frac{C(s)}{R(s)}$ for the signal flow graph shown in figure 2. [4+6]

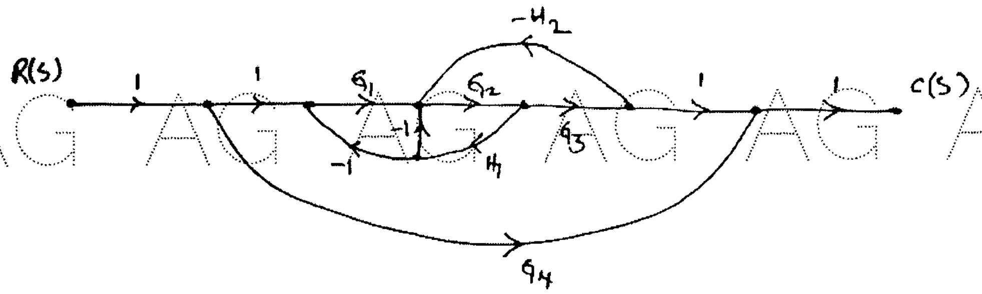


**Figure: 2**

4. The open-loop transfer function of a unity feedback control system is given by $G(s)=\frac{9}{s(s+3)}$. Find the natural frequency of response, damping ratio, damped frequency and time constant. [10]

**OR**

5. For unity feedback control system the open loop transfer function, $G(s)=\frac{10(s+2)}{s^2(s+4)}$. Find the $e_{ss}$ when the input is $r(t)=3-2t+3t^2$. And find $K_p$, $K_v$, and $K_a$. [10]

6.a) Determine the RH stability of given characteristic equation, $s^4+8s^3+18s^2+16s+5=0$.

b) Sketch the root locus of the system, whose open loop transfer function is,

$$G(s)=\frac{K(s+15)}{s(s+1)(s+5)}$$ [4+6]

**OR**

7. Given $G(s)=\frac{Ke^{-0.2s}}{s(s+2)(s+8)}$. Find K so that the system is stable with, a) GM=2db, b) PM=$45^0$ [10]

8. The open loop transfer function is given by $G(s)H(s)=\frac{K(1+4s)}{s^2(1+s)(1+2s)}$, Determine the stability of closed loop system. [10]

**OR**

9. The open-loop transfer function of a system is given by

$$G_p(s)=\frac{K}{s(1+0.1s)(1+0.2s)}$$

Design a lag-lead compensator to meet the $K_v$=100sec$^{-1}$ and Phase margin ≥ $30^0$. [10]

10.a) Define: i) State ii) State variables iii) State space representation.

b) Find the state transition matrix for the following matrix, $A = \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}$.

c) Obtain the state space representation for the following differential equation.
$\ddot{y} + 5\dot{y} + 7y = 114$
Where 'y' is the output and 'u' is the input. [10]

**OR**

11. The state equation of a linear-time invariant system is given as,

$$\dot{X} = \begin{bmatrix} 0 & 5 \\ -1 & -2 \end{bmatrix} X + \begin{bmatrix} 1 \\ 1 \end{bmatrix} r \text{ and } y = \begin{bmatrix} 1 & 1 \end{bmatrix} X,$$

Find the transfer function and draw the state diagram. [10]

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