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CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
III–B.TECH–I–Semester End Examinations (Regular) - December- 2024
CONTROL SYSTEMS
(ECE)

[Time: 3 Hours] **[Max. Marks: 60]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 10 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.

PART-A **(10 Marks)**

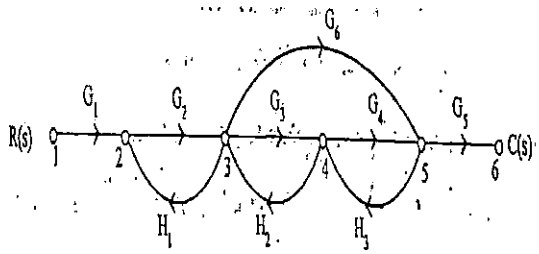
1. a) Define open loop control systems with an example. [1M]
   b) Define Transfer function. [1M]
   c) Define rise time for under damped system. [1M]
   d) Consider the loop transfer function K(s+6)/(s+3) (s+5) In the root locus diagram the centroid will be located at ---------- [1M]
   e) Define Resonant peak in frequency domain specifications. [1M]
   f) Define Gain margin. [1M]
   g) What is the effect of PI controller on the system performance? [1M]
   h) What are the different types of compensators? [1M]
   i) Define Controllability with an example. [1M]
   j) Mention any two advantages of state variable representation. [1M]

PART-B **(50 Marks)**

2.a) Explain any two examples of closed loop control systems. [5M]
   b) Explain the rules for block diagram of reduction technique. [5M]

OR

3.a) Find the overall gain C(s) / R(s) for the signal flow graph shown in Figure [6M]



   b) What do you mean by sensitivity of the control system and discuss the effect of feedback on sensitivity? [4M]
4.a) The open loop transfer function of a unity feedback system is given by G(S) = 10/S(S+2) . Find the natural frequency of response, damping ratio, damped frequency and time constant. [6M]
   b) Explain standard test signals with waveforms and mathematical equations. [4M]

OR

5.a) Construct Routh Array and determine the stability of the system represented by the characteristic equation $S^6+2S^5+8S^4+12S^3+20S^2+16S+16=0$. Comment on the location of the roots of characteristic equation. [6M]
   b) Determine the error coefficients for G(S)=1/S(S+1)(S+10), H(S)=S+2. [4M]

6. Sketch the Bode plot for G(S) = 10(1+0.1S)/ S(1+0.01S) (1+S). Find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin. [10M]

OR

7. Sketch the polar plot for G(s)= 1/ S(1+2S) (1+0.5S). [10M]

8. Explain the following control action with neat diagram and derive its necessary equations (i)Proportional (ii) Proportional plus Derivative(iii) Proportional plus Integral [10M]

OR

9. Explain Lag Compensator design procedure in frequency domain. [10M]

10.a) Discuss the concept of controllability and observability with an example. [6M]

b) Obtain the state Space representation for the following differential equation. $\ddot{y}+5\dot{y}+7y=114u$. Where 'y' is the output and 'u' is the input. [4M]

OR

11.a) Find the State Transition Matrix for the following matrix, [4M]

$$A=\begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}$$

b) Given the system dx(t)/dt = A x(t)+ B u(t), Y(t) = C x(t) Where [6M]

$$A=\begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 0 & 0 & -1 \end{bmatrix} \quad B=\begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix},$$

C = [1 0 1]. Determine the controllability, observability of the system.

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