Code No.: R22EC504PC | R22 | H.T.No. | | | 8 | R | | | | | |

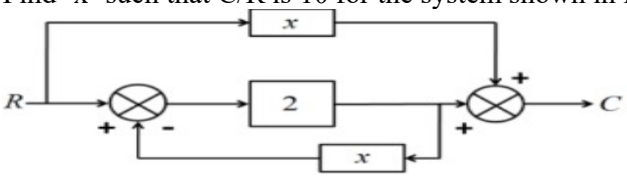
CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
III–B.TECH–I–Semester End Examinations (Regular) - December- 2025
CONTROL SYSTEMS
(ECE)

[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) Calculate the poles and zeros of the given transfer function C/R =S+9/(S+5)(S+20)(S+1). [1M]
   b) Find 'x' such that C/R is 10 for the system shown in figure. [1M]



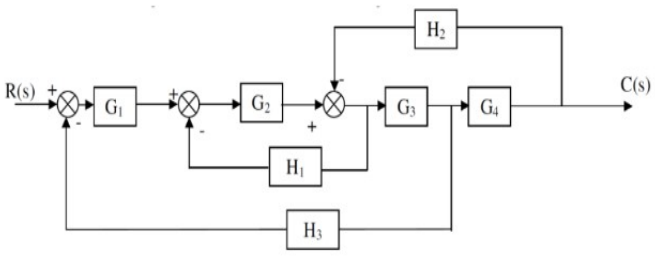
   c) Define rise time. [1M]
   d) What is the necessary and sufficient condition for stability in Routh's stability criterion? [1M]
   e) Compare on correlation between time and frequency response. [1M]
   f) Define phase margin in Bode plot. [1M]
   g) Draw the S-Plane representation of compensator. [1M]
   h) What is the effect of P, PI controller on the system performance? [1M]
   i) Define state variable. [1M]
   j) Define Controllability. [1M]

PART-B **(50 Marks)**

2.a) Define Control System. Derive transfer functions for closed loop as well as open loop control systems. [5M]
   b) Discuss the characteristics of feedback in control systems. [5M]

OR

3. Find the transfer function C/R using the block diagram reduction technique shown for the block diagram. [10M]



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4.a) The characteristic equation of a system is given below. Determine the stability of the system $4s^4+ 8s^3+ 2s^2+ 10s + 3 = 0$ using RH criteria. [6M]

b) Elaborate the standard test signals (Step, Ramp signals) of control systems. [4M]

OR

5. A unity feedback system has an open loop transfer function [10M]

$$G(S) = 25/S(S+8).$$

Determine its damping ratio, peak overshoot and time required to reach the peak output.

6. The open loop transfer function of a certain unity feedback system is [10M]

$$G(s) = 1/S(1+0.1S)(1+0.01S).$$

Construct bode plot and calculate i) Gain Margin ii) Phase Margin

OR

7. Sketch the Nyquist plot and comment on the stability of the closed loop system whose open loop transfer function is [10M]

$$G(S)H(S)= k(S-4)/(S+1)^2.$$

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

OR

9. Briefly explain the lag compensator network. Also explain the procedure for the design of lag compensator using root locus. [10M]

10.a) Compute the state transition matrix if the system matrix [8M]

$$A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$$

b) Discuss the concept of controllability with an example. [2M]

OR

11.a) Define the following terms i) state ii) State space representation. [2M]

b) Obtain the state model of the system for the given transfer function of [8M]
$Y(s)/U(s) = 10/s^3+4s^2+2s+1.$

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