Code No.: R22EC504PC

R22	H.T.No.			8	R					

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

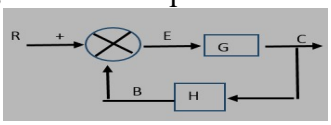
[Time: 3 Hours] **[Max. Marks: 60]**

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) The three blocks having transfer functions $G_1(s) = 1/(s+2)$, $G_2(s) = 1/(s+5)$ and $G_3(s) = (s+1)/(s+3)$. These three blocks are connected in cascaded, then derive the equivalent transfer function. [1M]

b) The block diagram of the canonical feedback control system is given in figure, draw its corresponding Signal Flow Graph



[1M]

c) A system has a transfer function $\frac{s+2}{s(s^2+7s+12)}$ Determine the poles and zeroes. [1M]

d) The closed loop transfer function of second order system is

$$\frac{C(S)}{R(S)} = \frac{10}{s^2+6s+10}$$

What is the type of damping in the system? [1M]

e) Define the significance of PM (Phase Marin) to find the system stability. [1M]

f) The damping ratio and natural frequency of oscillation of a second order system is 0.5 and 8 rad/sec respectively. Calculate the resonant peak. [1M]

g) Why derivative controller is not used in control systems? [1M]

h) Outline the effect of the sampling period on the performance of a digital controller. [1M]

i) Give the condition for a system to be observable. [1M]

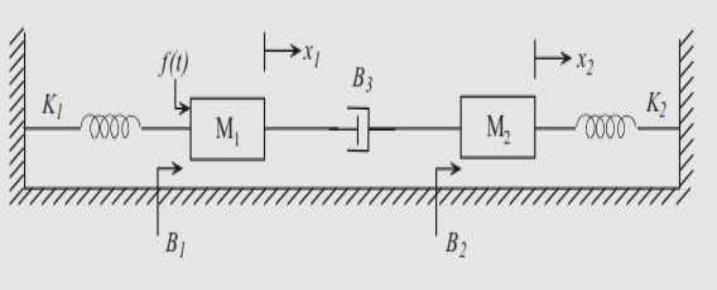
j) Give the properties of State Transition Matrix. [1M]

PART-B (50 Marks)

2. Explain the effect of feedback on the overall gain and sensitivity of the system. [10M]

OR

3. For the mechanical system as shown in the figure, find the transfer function $X_1(S) / F(S)$ [10M]



4. What are the standard test inputs used in the time response analysis and derive the mathematical expressions? [10M]

OR

5. Construct the Routh array and determine the stability of the system whose characteristic equation is $s^4 + 8s^3 + 18s^2 + 16s + 5 = 0$. Comment on the location of the roots of the characteristic equation. [10M]

6. Draw the Nyquist Plot for the system whose open loop transfer function is [10M]

$$G(s) = \frac{k}{s(s+2)(s+10)}.$$

Determine the range of '*k*' for which the closed-loop system is stable.

OR

7. The open loop T.F of a unity feedback system G(S) is [10M]

$$\frac{1+4s}{s^2(1+s)(1+2s)}.$$

Determine Gain Margin & Phase Margin .

8. Explain in detail about lag compensation design procedure. [10M]

OR

9. Compare the applications of proportional, integral and derivative controllers used in control systems. [10M]

10. Explain in detail about Diagonalization of state matrix with an example. [10M]

OR

11. Obtain the state space representation of the following differential equation [10M]
$\dddot{Y} + 6\ddot{Y} + 11\dot{Y} + 2Y = 4U$, where Y is the output and U is the input.

****