Registration No.: | | | | | | | | | | |

Total Number of Pages: 03 **Course: B.Tech/IDD**
Sub_Code: EEPC3001

5th Semester Regular Examination: 2025-26
SUBJECT: CONTROL SYSTEM
BRANCH(S): EEE, ELECTRICAL, ELECTRICAL & C.E, MMEAM, EE
Time: 3 Hours
Max Marks: 100
Q.Code: U279

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What are the advantages and disadvantages of closed loop control systems?
b) Define Transfer function of a system.
c) Write Mason's gain formula.
d) What are the standard test signals employed for time domain studies?
e) Give the expression for maximum peak overshoot for a second order system.
f) What is the difference between type and order of a system?
g) What are breakaway points? State the rule for obtaining the breakaway points on the root locus?
h) Define resonant frequency and resonant peak.
i) Define gain Margin.
j) State two properties of State Transition Matrix.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Determine the Transfer function of the RLC network shown in Fig.1

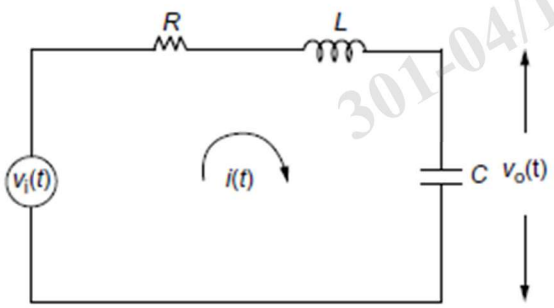

Fig. 1

b) For the Block diagram of the system shown in Fig. 2, determine the overall Transfer function using block diagram reduction technique.

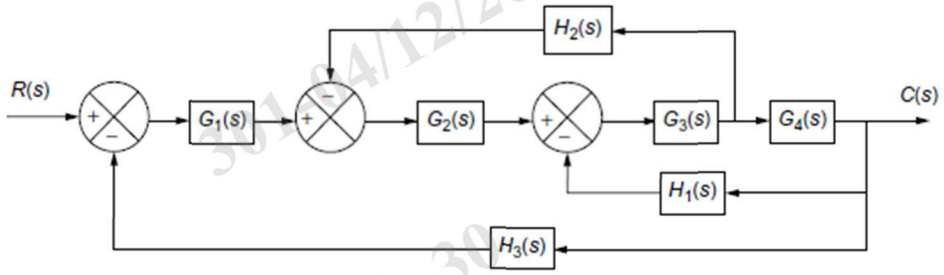

Fig. 2

c) Use Routh's criterion to determine the number of roots of the following equation which lie in the right half of s-plane

$S^6 + S^5 + 2S^4 + S^3 + 2S^2 + 5S + 6 = 0$

d) The open loop Transfer function of a servo system with unit feedback is given by $G(s) = 500 / s(1 + 0.1s)$. Determine the steady state error of the system if the input is I. $r(t) = 1 + 2t$, II. $r(t) = t^2 / 3$

e) Measurement conducted on a servo-mechanism shown that system response to be $C(t) = 1 + 0.2\ e^{-60t} - 1.2\ e^{-10t}$, when subjected to a step input. Obtain an expression for the closed loop Transfer function. Determine the un-damped natural frequency and damping ratio.

f) Sketch the polar plot for a Type 1 and Order 3 system.

g) Sketch the Bode plot for $G(s) = 10 / s\ (1 + 0.1\ s)\ (1 + 0.05\ s)$.

h) The damping ratio and natural frequency of oscillation of a second order system is 0.5 and 8 rad/sec respectively. Determine the resonant peak and resonant frequency.

i) What are the effects of adding poles and zeros to the existing system?

j) Develop a state model for the linear system having Transfer function,

$e_o\ (s) / e_i\ (s) = 4 / S^2 + 4S + 3$

k) For the system having the state model, obtain the Transfer function, where

$$A = \begin{bmatrix} 0 & 1 \\ -5 & -3 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad C = [7\ \ 3] \quad D = [0]$$

l) Explain the step-by-step procedure for finding Gain Margin and Phase Margin in a Polar Plot.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Sketch the root locus plot for $1 + F(s) = 0$, where $F(s) = K / S\ (S + 2)\ (S^2 + 2S + 5)$, $K \geq 0$. **(16)**

Q4 The open loop Transfer function of a unity feedback system is given by G(s) = K / S (1 + T S), where K & T are positive constant. By what factor should the amplifier gain be reduced so that, **(16)**

a) The peak overshoot of a unit step response of the system is reduced from 75 % to 25%.
b) The damping ratio increases from 0.1 to 0.6

Q5 The block diagram of the system is shown in Fig. 3. Determine the transfer function by using block diagram reduction technique and verify it using Signal Flow Graph technique. **(16)**

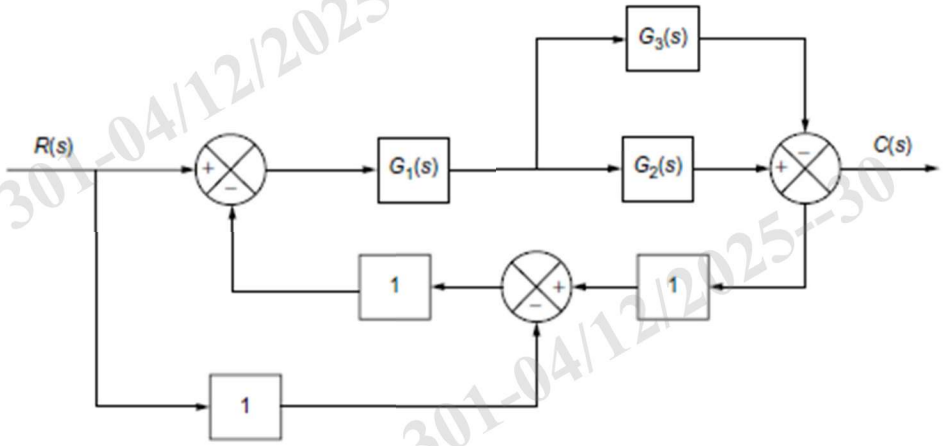

Fig. 3

Q6 Write short notes on: **(16)**

(i) Transfer function of Armature controlled DC servo motor
(ii) AC servo motor