5th Semester Back Examination: 2025-26
SUBJECT: CONTROL SYSTEM
BRANCH(S): AEIE, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ETC
Time: 3 Hours
Max Marks: 100
Q.Code: U280
Answer Q1 (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 open loop control systems?	
b)	What are the time domain specification parameter?	
c)	Define Transfer function of a system.	
d)	What are the standard test signals employed for time domain studies?	
e)	Give the expression for rise time and settling time for a second order system.	
f)	How is a system classified based on damping factor?	
g)	What are breakaway points? State the rule for obtaining the breakaway points on the root locus?	
h)	Define Bandwidth of a system.	
i)	Define Phase 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
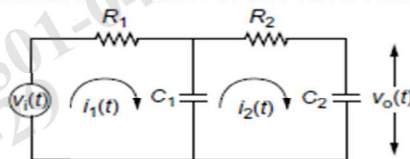
b)   For the Block diagram of the system shown in Fig. 2, determine the overall Transfer function using block diagram reduction technique.

Fig. 2
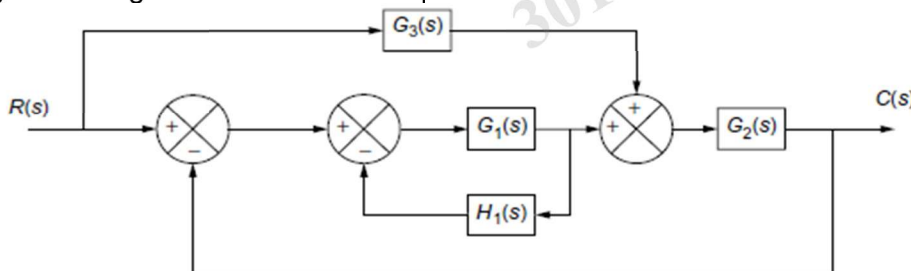
c) Use Routh's criterion to find the stability of the system having the characteristics equation
   $q(s) = S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$

d) Find the steady state error of a unit feedback control system having open loop Transfer function $G(s) = 100 / s(s + 2)$ for a unit step input.

e) A closed loop system has open loop Transfer function $G(s) = K(s + 4)/ s(s + 2)$ and $H(s) = 1$. Determine the range of K, so that the characteristic equation of the system, will have roots with real part more negative than (–2).

f) Sketch the polar plot for a Type 0 and Order 2 system.

g) Sketch the Bode plot for $G(s) = 10 / s (1 + 0.5 s) (1 + 0.2 s)$.

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,
   $e_o (s) / e_i (s) = 6S / S^3 + 6S^2 + 11S + 6$

k) Develop the Transfer function of Armature controlled DC servo motor

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 $F(s) = K / S (S + 4) (S^2 + 4S + 8)$, $K \geq 0$.   **(16)**

Q4   Test the stability of the closed loop system whose open loop transfer function is $G(s) H(s) = K / S (1 + ST_1)$, using Nyquist Stability criterion.   **(16)**

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)**
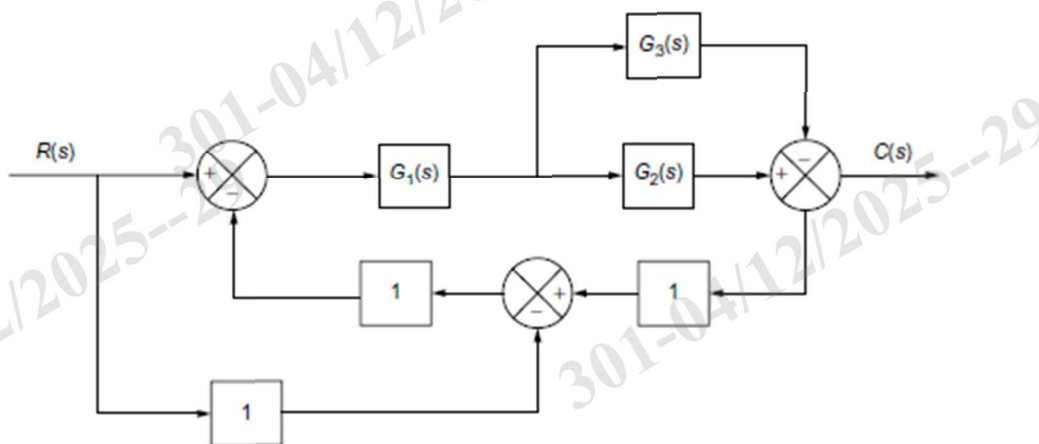

Fig. 3

Q6   Write short notes on: **(8 x 2)**
(i)   AC servo motor
(ii) Synchros