BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.TECH **SEMESTER : VI**
BRANCH: ELECTRONICS & COMMUNICATION ENGINEERING **SESSION : SP/2024**

SUBJECT: EC353R2 CONTROL SYSTEMS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall: semi-log paper

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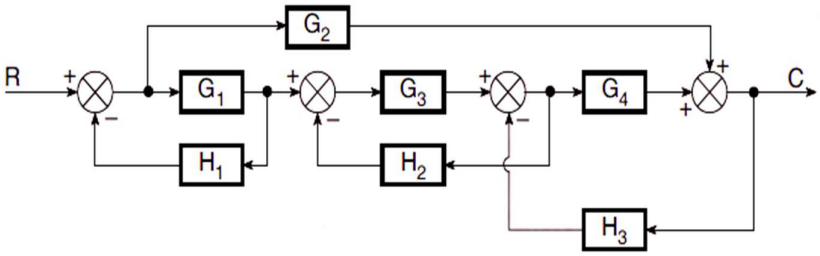
			CO	BL
Q.1(a)	Why is a negative feedback system preferred in the control system? Explain	[2]	1	1,2
Q.1(b)	What are the effects of feedback on overall gain, sensitivity, stability and noise?	[3]	1	1,2
Q.1(c)	Define minimum phase and non-minimum phase systems. How is it related to the stability of the system?	[5]	1	1
Q.2(a)	Obtain the overall transfer function for the block diagram	[5]	2	2,3



Q.2(b)	Represent the following set of equations by a signal flow graph and determine the overall gain relating to x_5 and x_1.	[5]	2	2

$$x_2 = Ax_1 + Fx_2$$
$$x_3 = Bx_2 + Ex_4$$
$$x_4 = Cx_3 + Hx_5$$
$$x_5 = Dx_4 + Gx_2$$

Q.3(a)	The open loop transfer function of a unity feedback control system is given by $G(s) = \frac{25}{s(s+5)}$ Calculate (i) The natural frequency of oscillations, damped frequency of oscillations, damping factor, damping ratio and maximum overshoot of a unit step input. (ii) The steady-state error for a unit ramp input.	[5]	3	2,3
Q.3(b)	Sketch the root locus for the open loop transfer function of a unity feedback control system given below and determine the value of K for marginal stability. $G(s) = \frac{K}{s\,(s+1)(s+3)}$	[5]	3	2,3
Q.4(a)	Explain (i) State Variable (ii) State (iii) State Vector and (iv) State Space with a suitable example	[2]	4	1
Q.4(b)	The state equations of a system are given below: $\dot{x_1} = x_1 + x_2 + u$ $\dot{x_2} = -x_2$ Check for controllability.	[3]	4	2
Q.4(c)	With a neat block diagram explain (i) Derivative Controller and (ii) Proportional-integral controller.	[5]	4	2

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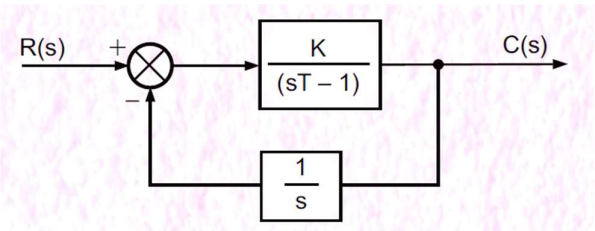
Q.5(a) A closed loop system is described by the block diagram determined below. Determine stability using Nyquist criterion. [5] 5 2,3



Q.5(b) Sketch the Bode plot for the open loop transfer function for the unity feedback system given below and assess stability. [5] 5 2,3

$$G(s) = \frac{50}{(s+1)(s+2)}$$

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