Printed Page:- 05 **Subject Code:- AEC0501**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B. Tech

SEM: V - THEORY EXAMINATION (2023-2024)

Subject: Control System

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. When a human being tries to approach an object, his brain acts as? (CO1) 1

(a) An error measuring device

(b) A controller

(c) An actuator

(d) An amplifier

1-b. Loop which does not possess any common node are said to be _____ loops. (CO1) 1

(a) Self loop

(b) Feedback loop

(c) Nontouching loops

(d) Touching loop

1-c. When the damping ratio equal to zero, the damping frequency of a system will be? (CO2) 1

(a) Equal to natural frequency

(b) Zero

(c) More than natural frequency

(d) Less than natural frequency

1-d. In a time domain system, which response has its existence even after the existence of a transient response? (CO2) 1

(a) Step response
(b) Impulse response
(c) Steady-state response
(d) All of the above

1-e. The Routh-Hurwitz criterion cannot be applied when the characteristic equation of the system contains any coefficients which is (CO3) 1

(a) negative real and exponential functions of s
(b) Negative real, both exponential and sinusoidal functions of s
(c) Both exponential and sinusoidal functions of s.
(d) Complex, both exponential and sinusoidal functions of s

1-f. The number of individual loci in root locus plot is equal to _____. (CO3) 1

(a) The number of open loop poles
(b) The number of open loop zeros.
(c) The difference between the number of open loop poles and the number of open loop zeros.
(d) The number of open loop poles or zeros whichever is greater

1-g. The state variable approach is applicable to… (CO4) 1

(a) Only linear time-invariant systems
(b) linear time-invariant as well as time-varying systems
(c) linear as well as nonlinear systems
(d) all system

1-h. In state space analysis,Matrix D is called the _____. (CO4) 1

(a) System matrix
(b) Input matrix
(c) Output matrix
(d) Data transmission matrix

1-i. A discrete-data system is described by… (CO5) 1

(a) Exponential equations
(b) difference or discrete state equations
(c) differential equations
(d) None of the above

1-j. The relation between Laplace transforms and Z transform is _____form. (CO5) 1

(a) Exponential
(b) Sinusoidal
(c) Linear
(d) None of the above

2. Attempt all parts:-

2.a.	What is Control System? (CO1)	2
2.b.	Define order and type related to transfer function for a control system. (CO2)	2
2.c.	Explain absolute stability and Relative stability with a suitable example. (CO3)	2
2.d.	Explain the limitations of classical theory of system analysis. (CO4)	2
2.e.	Draw the transient response of discrete control systems. (CO5)	2

SECTION-B 30

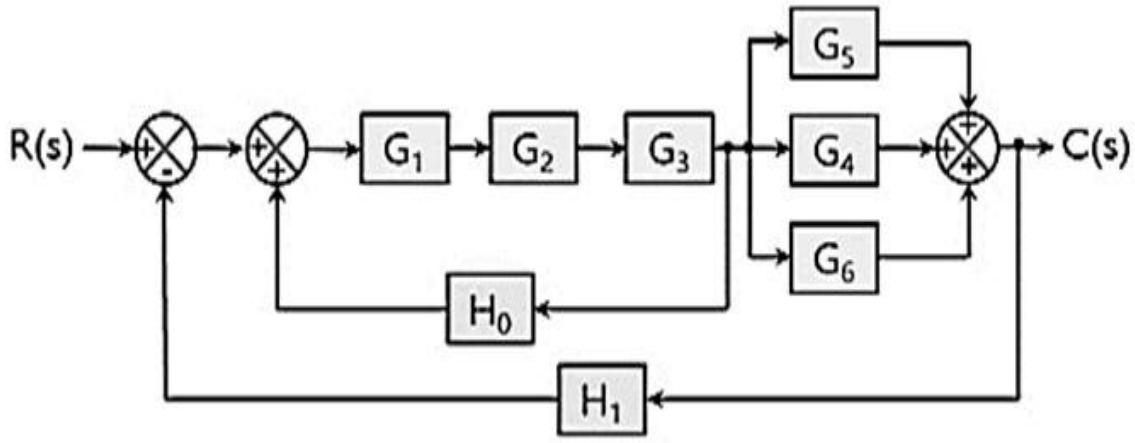
3. Answer any five of the following:-

3-a.	Explain open loop and closed loop control system with suitable diagram. Also discuss advantages and disadvantages of both type of system. (CO1)	6
3-b.	What do you mean by analogous system? Explain Force-Voltage analogy with suitable example. (CO1)	6
3-c.	Define time response of a control system? Derive the expressions and draw the response of first order system for unit impulse input. (CO2)	6
3-d.	Derive the expression for transfer function of PI controller with block diagram. (CO2)	6
3.e.	Find the frequency domain specification with a unity feedback system having G(s)=36/s(s+8).(CO3)	6
3.f.	Derive the expression for the solution of homogeneous and non-homogeneous state equations. (CO4)	6
3.g.	Derive the expression for the transfer function of zero order hold system with a suitable diagram.(CO5)	6

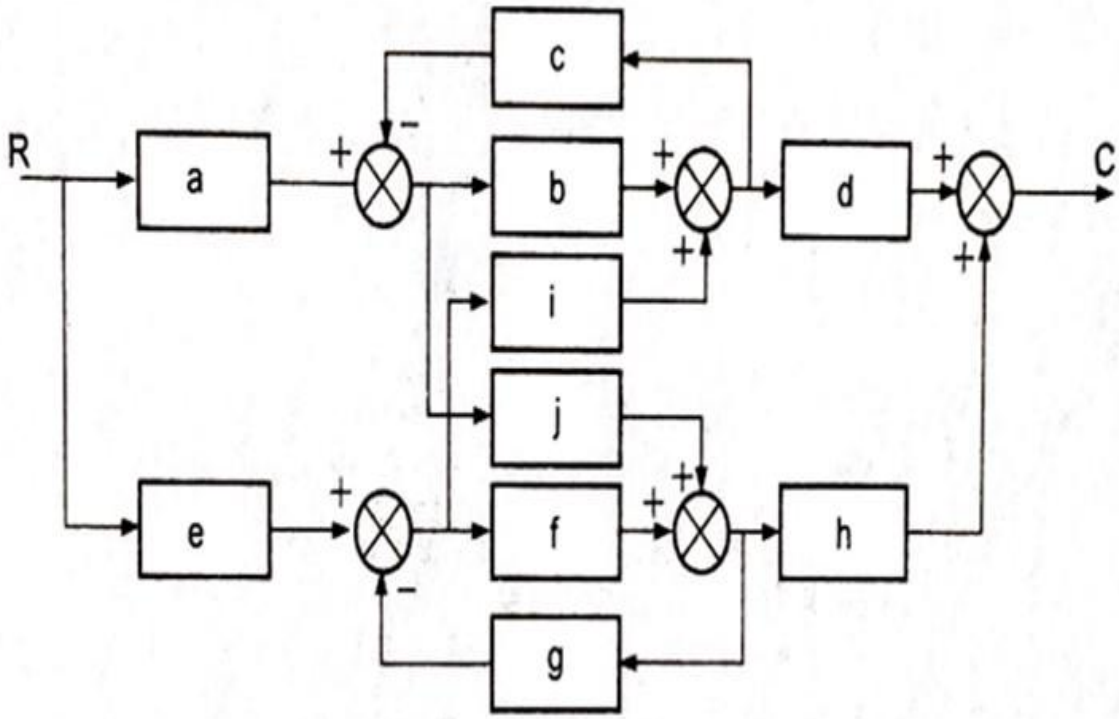
SECTION-C 50

4. Answer any one of the following:-

4-a.	What is BDR technique? Find the overall transfer function from the given block diagram using block diagram reduction technique. (CO1)	10



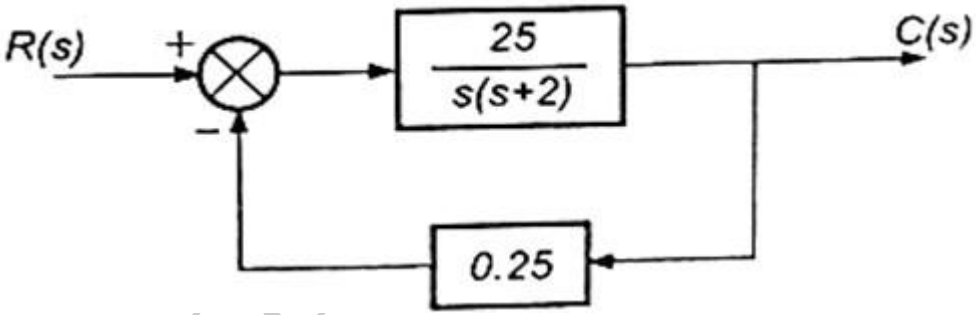
4-b.	Define mason's gain formula. Determine the overall transfer function C(s)/ R(s) of a given block diagram using SFG.(CO1)	10



5. Answer any <u>one</u> of the following:-

5-a. Derive the expression and draw the time response of second order system for underdamped case subjected to unit step input. (CO2) 10

5-b. Determine the sensitivity of the overall closed-loop transfer function for the system shown in the figure at $\omega=1$ rad/s with respect to (a) forward path transfer function (b) feedback path transfer function.(CO2) 10



6. Answer any <u>one</u> of the following:-

6-a. Sketch the bode plot for the system with TF, 10

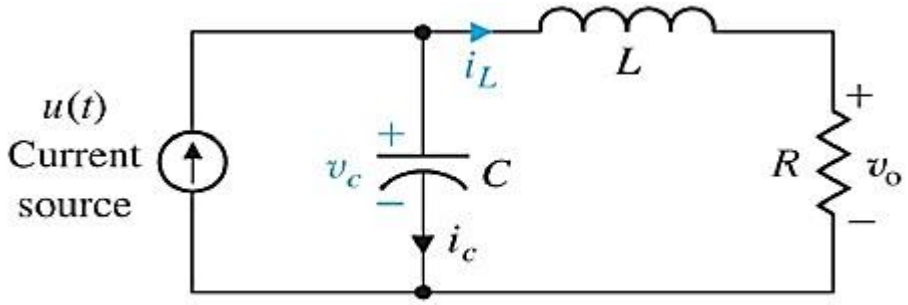
$$G(s)H(s)=1000/(1+0.1s)(1+0.001s)$$

Determine Gain Margin, Phase margin, and system stability. (CO3)

6-b. What is the need for a compensator in the control system? Define various types of compensation techniques in the control system with suitable diagram.(CO3) 10

7. Answer any <u>one</u> of the following:-

7-a. Derive the dynamic equation for the electric circuit shown in the below figure. (CO4) 10



7-b. The transfer function of a control system is given by (CO4) 10

$$\frac{Y(s)}{U(s)} = \frac{s+2}{s^3+9s^2+26s+24}$$

Check for controllability and observability.

8. Answer any <u>one</u> of the following:-

8-a. Describe the Block diagram of a closed-loop discrete data control system. Also derive the expression for the transfer function of the closed-loop discrete data control system. (CO5) 10

8-b. Determine the pulse transfer function and stability of sampled data control system shown in the below figure for sampling time (a) T=0.5 sec (b) T=1 sec. (CO5) 10