

**Indian Maritime University**  
**(A Central University, Govt of India)**

**Sep/Oct'25 SE**

**Programme Name: B Tech (ME)**

**Semester: VII**

**Subject Code: UG11T3702**

**Subject Name: Advanced Marine Control Engineering & Automation**

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Date: 22.09.2025

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

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General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective section.

**Section A**

**Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.**

1. What is the characteristic of a good control system?
  - a) Insensitive to the parameter variation but sensitive to the input commands
  - b) Neither sensitive to parameter variations nor sensitive to input commands
  - c) Insensitive to the input command
  - d) Sensitive to parameter variation
  
2. Which among the following are the elements of rotational motion?
  - a. Mass, Spring, Friction
  - b. Inertia, Damper, Spring
  - c. Work, Energy, Power
  - d. Force, Pressure, Viscosity
  
3. For the transfer function  $G(s) = \frac{5s - 1}{s^2 + 5s + 4}$ , where does the zero of the system lie?
  - a.  $s = -1$  &  $s = -1/4$
  - b.  $s = -4$  &  $s = -1$

- c.  $s = 1/5$
- d.  $s = -1/5$

4. According to the property of state transition method,  $e^0$  is equal to \_\_\_

- a. 1
- b. A
- c.  $e^{-At}$
- d.  $-e^{At}$

5. Which mechanism in control engineering implies an ability to measure the state by taking measurements at output?

- a. Controllability
- b. Observability
- c. Differentiability
- d. Adaptability

6. State model representation is possible using \_\_\_\_\_

- a. Physical variables
- b. Phase variables
- c. Canonical state variables
- d. All of the above

7. For Nyquist contour, the size of radius is \_\_\_\_\_

- a. 25
- b. 0
- c. 1
- d.  $\infty$

8. If poles are added to the system, where will the system tend to shift the root locus?

- a. To the left of an imaginary axis
- b. To the right of an imaginary axis
- c. At the centre
- d. No shifting takes place

9. On which factor does the steady state error of the system depend?

- a. Order
- b. Type
- c. Size
- d. Prototype

10. A valve positioner:

- a. Takes the place of a cascade control system

- b. provides more precise valve position
- c. makes a pneumatic controller in necessary
- d. provide a remote indication of valve position

### Section B

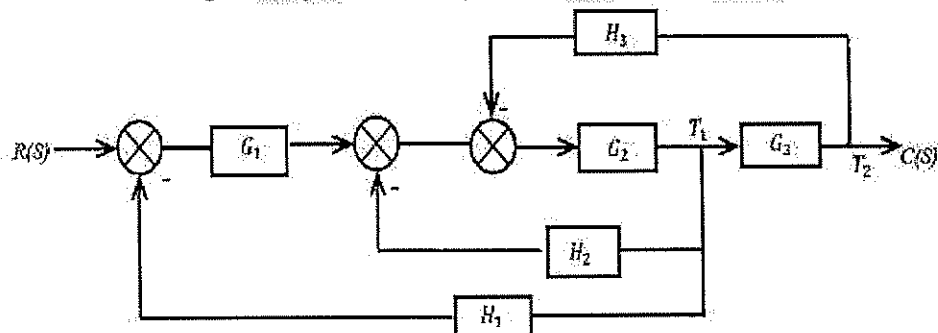
#### Five Questions of 02 Marks each

11. Why derivative controller is not used in control systems?
12. State Nyquist stability criterion
13. What are the three types of compensators?
14. What is swelling and shrinkage in boilers ?.
15. Define the term transfer function.

### Section C

#### Seven Questions of 10 Marks each of which any 05 questions to be answered.

- 16.A) Find the transfer function using block diagram reduction technique for below block diagram (05 marks)



- 16.B) Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system. (05 marks)

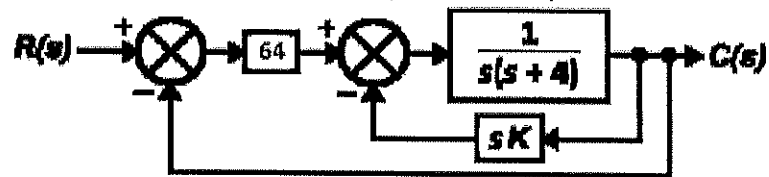
- 17.A) The open loop transfer function of a unity feedback system is  $\frac{K}{s(1+4s)(1+2.5s)}$ . Find the restriction on  $K$ , so that the close loop is stable. (05 marks)

- 17.B) Write advantage and disadvantage of transfer function technique. (05 marks)

- 18.A) What is gain margin, phase margin, gain crossover frequency, and phase cross frequency? (05 marks)

- 18.B) Explain Ratio Control and Cascade Control. (05 marks)

- 19.A) State and explain the types of common non-linearities. (05 marks)  
 19.B) The figure shows a unity feedback system. Calculate  $K$  when  $\xi = 0.56$ . Also determine  $T_p$ ,  $M_p$  and  $\omega_d$ . (05 marks)



- 20.A) What are the advantages of state space analysis. (05 marks)  
 20.B) What are the Essential Requirements for Unattended Machinery Space (UMS) Ship? (05 marks)
- 21.A) List the Alarms and trips in a Boiler Control Systems. (05 marks)  
 21.B) List the safety features in modern cranes. (05 marks)
22. Explain working of a three-element boiler water level controller with a help of neat labelled line diagram. (10 marks)