

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – June 2023
Programme Name: B Tech (ME)
Semester: Seventh
Subject Code: UG11T3702
Subject Name: ADVANCED MARINE CONTROL ENGINEERING AND
AUTOMATION

Date: 14.06.2023

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

General Instructions

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

Section A

Answer all the questions (10x1=10)

1. What is a traffic light system?
 - (A) Open loop system
 - (B) Close loop system
 - (C) Both (A) and (B)
 - (D) None

2. What is the gain margin of the second-order system?
 - (A) Infinite
 - (B) 0
 - (C) 1
 - (D) 2

3. Among the following, identify the controller which can handle fast process load changes.
 - (A) PI controller
 - (B) PD controller
 - (C) PID controller
 - (D) Both (A) & (B)

4. Identify the element among the following which is not used in an automatic control system?
 - (A) Oscillator
 - (B) Sensor
 - (C) Finite control element

(D) Error detector

5. In a nonlinear control system, limit cycle is self-sustained oscillation of

- (A) Variable amplitude
- (B) Variable frequency
- (C) Fixed frequency
- (D) Fixed frequency and amplitude

6. The transfer function for the state variable representation

$$\dot{x} = Ax + Bu \text{ and } Y = Cx + Du \text{ is given by}$$

- (A) $C(sI - A)^{-1} D + B$
- (B) $D(sI - A)^{-1} B + C$
- (C) $D(sI - A)^{-1} C + B$
- (D) $C(sI - A)^{-1} B + D$

7. Consider the following statements:

Phase lead:

- 1) Increases the bandwidth of the system
- 2) Improves the damping
- 3) Reduces steady-state error
- 4) Increases gain at high frequency

Which of the following statements are true?

- (A) 1 & 2
- (B) 2 & 3
- (C) 1, 2 & 3
- (D) 1 & 4

8. What is the function of feed water pumps?

- (A) to pump steam to the boiler
- (B) to circulate feed water through the exhaust boiler
- (C) to supply pressure to the boiler
- (D) to pump feed water to the boiler

9. The primary advantage of a central cooling system is

- (A) A more simplified cooling circuit
- (B) Most part of the cooling system being fresh water based, corrosion is minimized

- (C) It allows better control of temperatures by using fewer controllers
- (D) All of the above

10. A If the Lyapunov's function cannot be found then the system is
- (A) Stable
 - (B) Unstable
 - (C) Marginally stable
 - (D) Conditionally stable

Section B

Answer all the questions (5x2=10)

- 11. What are the standard test signals used in control systems?
- 12. Explain Controllability and Observability.
- 13. Find the function f(t) for the following function

$$F(s) = \frac{1}{s(s+1)(s+5)}$$

- 14. Find the z-transform of the system $h(n) = 3^n u(n)$.
- 15. Write short note on central cooling water system available on ship.

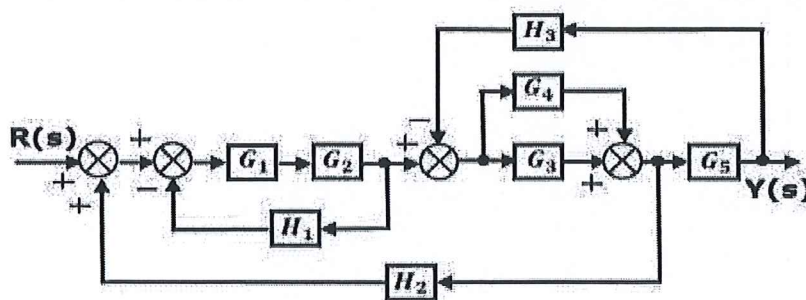
Section C

Answer any five questions (5x10=50)

- 16. (a) What do you mean by Auto Pilot? [3]
- (b) What are the advantages and limitations of Auto Pilot. [3]
- c) Sketch and Describe An Auto pilot system of a Bulk Carrier [4]

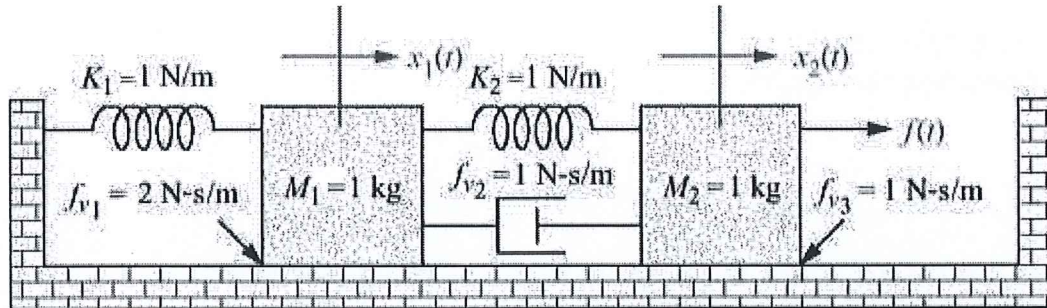
- 17. (a) What is the basic difference between 2 position control and 2 element control system? [4]
- (b) Write the advantages and disadvantages of an open-loop & closed loop system. [3]
- (c) Write effect of feedback in a system. [3]

- 18. A Determine the transfer function $[Y(s)/R(s)]$ for the block diagram shown in Figure given below [10]



19. A system is described by $y(n) = 3x(n) + 4x(n-1) - 2y(n-1)$, calculate the inverse of the given system. [10]

20. Find the transfer function, $G(s) = X_1(s)/F(s)$ as figure below. [10]



21. Sketch the root locus of the transfer function given below [10]

$$G(s)H(s) = \frac{k}{s(s^2 + 2s + 2)}$$

22. Explain detailed operation of dual-fuel boiler combustion control system with neat and clean diagram. [10]