Indian Maritime University

(A Central University, Govt of India)

Sep/Oct'25 SE

Programme Name: B Tech (ME)

Semester: IV

Subject Code: UG11T4407

Subject Name: Automation, Control Engineering and Safety Devices

Date: 04.10.2025	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

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

1.What is the primary function of an actuator in an automatic control system?
(a) Sensing the process variable
(b) Converting one form of signal to another
(c) Physically moving a control element
(d) Displaying control information

2. What is the function of a pressure switch in a ship's automation system?
(a) To regulate voltage fluctuations
(b) To detect and control pressure variations
(c) To increase system temperature
(d) To convert electrical signals into mechanical movement

3. Which of the following failures in a boiler will trigger an automatic shutdown?
(a) Superheater outlet temperature high (b) Low water level
(c) Heavy fuel high viscosity (d) Feed water high salinity

4. Overdamp system, damping ratio is:
(a) Equal to 1 (b) Less than 1 (c) Greater than 1 (d) None of them

5. The relationship between resistance and temperature in an RTD is typically:
(a) Linear (b) Exponential (c) Logarithmic (d) Sinusoidal

6. Which component in a control system detects changes in process variables?
(a) Actuator (b) Sensor (c) Controller (d) Relay

7. What is the function of a boiler flame eye?
   (a) To detect flame presence (b) To measure fuel pressure
   (c) To control water level (d) To regulate fuel viscosity
8. The derivative control action is typically used when controlling, but rarely used when controlling.
   (a) Temperature, Flow (b) Flow, Level
   (c) pH, Temperature (d) Level, Temperature
9. What type of data does a Shipboard Monitoring System typically collect?
   (a) Only engine temperatures
   (b) Environmental data such as wind speed and wave height
   (c) Navigation data such as speed and location
   (d) All of the above
10. Which of the following systems is used for monitoring the engine performance on a ship?
   (a) Engine Room Monitoring System (ERMS)
   (b) Global Positioning System (GPS)
   (c) Automatic Identification System (AIS)
   (d) Electronic Chart Display and Information System (ECDIS)

Section B

Five Questions of 02 Marks each

11. What is sequential control and mention it's important on ships?
12. What is the Ziegler-Nichols method?
13. What is the function of the alarm printer for a monitoring system?
14. Why need to calibrate the level sensor?
15. What is the function of an alarm system in a generator prime mover shutdown process?

Section C

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

16. (a) Explain the working principle of an automatic motor start/stop system used in shipboard applications. 5 Marks
(b) Explain with diagram the working principle of a pressure switch used in shipboard automatic control systems. 5 Marks

17. (a) Explain with diagram the working principle of a pneumatic PID controller used in marine control systems. 5 Marks
(b) Explain the working principle of a control valve in a ship's automatic system. 5 Marks

18. (a) Explain the working mechanism of the over speed shutdown protection in a ship's main engine. Why is it critical for engine safety? 5 Marks

(b) Explain the significance of alarms and display systems for high and low boiler pressure. What corrective actions are taken when such alarms are triggered? 5 Marks

19. Explain the concept, requirements and testing regime for Unattended Machinery Spaces (UMS) system. 10 Marks

20. (a) Draw the electronic circuit and find the transfer function for PID controller by using operational Amplifier. 5 Marks

(b) Describe the features of instrumentation and safety in generator and distribution system. 5 Marks

21. (a) Explain what is meant by mechatronics and how it is utilized in automatic control systems, give few examples. 5 Marks

(b) For a second order closed loop system, G(s) function is $\frac{16}{s(s+0.8)}$ and negative feedback function H(s) is $(1+sK_d)$. Determine the value of K_d if the damping ratio is 0.5. Find the values of rise time and maximum overshoot in its step response. 5 Marks

22. Describe what is the procedure of testing a temperature sensor and transducer? 10 Marks