

INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

Supplementary Examinations – September/October 2024

Programme: B Tech (Marine Engineering)

Subject Code: UG11T3702

Semester: VII

Subject Name: Advanced Marine Control Engineering & Automation

Date: 28.09.2024

Max Marks: 70

Time: 3 Hrs

Pass Marks: 35

Part - A

1. All questions are compulsory (10 x 1 = 10 Marks)

I. Transfer function assumes

- (A) Linear systems (B) Time-Invariant systems
(C) Zero initial conditions (D) All of the above

II. Identify the correct statement

- (A) Zeros decide stability
(B) Type number = order of system
(C) Transfer function is a mathematical model
(D) None of the above

III. A lag network

- (A) has a capacitor on output side (B) is an integrator
(C) is a low-pass filter (D) All of the above are true

IV. For a controllable system, Kalman's Controllability matrix has

- (A) rows are linearly independent (B) determinant equals zero
(C) less than full Rank (D) None of the above is true

V. Routh-Hurwitz criteria is used to find

- (A) accuracy (B) stability (C) bandwidth (D) value of the roots

VI.. Non-linear control systems analysis uses

- (A) Describing Function (B) Liapunov method
(C) Phase-plane method (D) All of the above methods

VII.. The sensor used for overcoming Boiler swell and shrink effect is

- (A) Boiler water level sensor
- (B) steam flow sensor
- (C) Feed water flow rate sensor
- (D) feed water temperature sensor

VIII. Integral Control

- (A) removes offset
- (B) reduces oscillations
- (C) is also known as rate control
- (D) is used along with on-off control

IX. The root locus

- (A) starts from open loop poles
- (B) starts always at infinity
- (C) terminates always at infinity
- (D) None of the above is true

X. The stable region in z-plane for discrete time systems is

- (A) portion above real axis
- (B) portion below real axis
- (C) inside unit circle
- (D) left hand side of imaginary axis

Part - B

**All questions are compulsory
Marks)**

(5 x 2 = 10

2.(I). Define Gain Margin of a system

II. What is the importance of Type number of a system?

III. List the various non-linearities found in systems.

IV. What are the standard test signals?

V. State Mason's Gain formula.

Part - C

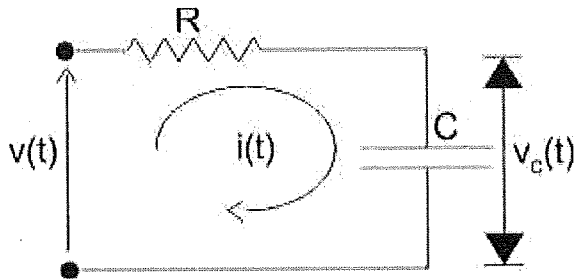
Answer any 5 questions

(5 x 10 = 50 Marks)

3. For the following unity feedback system find error coefficients. Also find steady state errors for step, ramp and parabola inputs (5+5)

$$G(s) = (s + 2) / (s^2 + 3s + 2)$$

4. (a) Explain how to obtain the mathematical model of a system (5)
 (b) Find the Mathematical Model of RC circuit shown below (5)



- 5.(a) What is Time constant of a first order system? (3)
 (b) Explain first order system response with a neat sketch. (3)
 (c) Show the effect of gain change on the damping of a second order system with a neat diagram. (4)
- 6.(a) Explain is benefit of using Root Locus technique (3)
 (b) Explain how the draw the Root Locus (7)
- 7.(a) Explain Bode plots (5)
 (b) Find the stability for the system using Routh-Hurwitz criteria.
 The system characteristic equation is $(s^3+18s^2+77s+K) = 0$ (5)
- 8.(a) Explain State Space Modelling (4)
 (b) Explain how to get observability of a system (3)
 (c) What is the importance of controllability and observability? (3)
- 9.(a) Explain Describing Function method of analysis of non-linear control systems. (5)
 (b) Explain Boiler combustion control (5)

