Indian Maritime University

(A Central University, Govt of India)

September/October 2024 – Supplementary Examinations

Programme Name: M Tech (MT)

Semester: II

Subject Code: PG13T2201

Subject Name: Dynamics of Marine Vehicles

Date: 04.09.2024	Max Marks: 60
Duration: 03 Hrs	Pass Marks: 30

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. Hydrostatic restoring forces primarily act to

a) Counteract forces causing roll & pitch	b) Reduce the vessel's speed in high waves
c) Prevent the vessel from sinking	d) Dampen yaw motions

2. Which fundamental equations govern the fluid flow?

a) Maxwell's Equations	b) Newton's laws
c) Navier Stokes Equations	d) Kepler's laws

3. Which of the following describes rolling motion of a marine vessel?

a) Vertical up-and-down motion	b) Back and Forth Motion
c) Rotation around longitudinal axis	d) Side to side motion

4. Upto which sea state is normally considered as "calm" seas?

a) 1	b) 2
c) 3	d) 4

5. How does an irregular seaway differ from a regular wave pattern?

a) Irregular waves have a constant wavelength	b) Regular waves exhibit random amplitudes
c) Irregular waves have varying periods and amplitudes	d) Regular waves follow a predictable pattern

6. Which approach is commonly used to analyze vessel motion in an irregular seaway?

a) Analytical solutions	b) Model tests in a wave tank
c) Steady state simulations	d) Mooring analysis

7. What characteristic defines the amplitude of a sinusoidal water wave?

a) Waveform	b) Wavelength
c) Frequency	d) Peak to Trough height

8. Which mathematical model is commonly used to describe the propagation of linear ocean surface waves in deep water?

a) Airy wave theory	b) Stokes wave theory
c) Cnoidal wave theory	d) Solitary wave theory

9. What do dynamic effects refer to in marine dynamics?

a) The dynamic positioning of a vessel	b) The impact of vessel motion on onboard passengers
c) Effects caused by transient loads on the hull	d) Dynamic stability in rough seas

10. What is the primary factor leading to non-linearities in rolling motion?

a) Wind forces on the superstructure	b) Wave interactions with the hull
c) Hull geometry	d) Propeller design

Section B

Five Questions of 02 Marks each

11. What is a simple harmonic motion (SHM) in marine dynamics?
12. List the factors affecting the roll stability.
13. Differentiate between regular and irregular seaway conditions.
14. Give two methods of passive devices by which roll motion can be minimized.
15. State the Gaussian and the Rayleigh distribution.

Section C

Seven Questions of 8 Marks each of which any 05 questions to be answered.

16.

a) A Simple Harmonic Motion z = za Cos(wt) has an amplitude of 1.524m and a circular frequency of 0.5 rad/s. Show with the help of a diagram

how the displacement, velocity and acceleration of this simple harmonic motion should vary with time.

b) What is the meaning of the Phase difference in a simple harmonic motion, explain with the help of a sketch in a complex plane.

[4+4=8]

17. Discuss the motion of the water particles in a wave with an illustration.[8]

18. Discuss the classification of water waves based on their various characteristics, including but not limited to their generation mechanisms, propagation properties, and behaviour in different water depths. Provide examples and comparisons between different types of water waves to illustrate their distinctions and significance in marine environments. [8]

19. What are the four moments that act on a ship during pitching motion? Discuss these moments during the pitching motion of a ship. [8]

20. Define the following terms with regard to fundamental equations describing fluid flow: (2 marks each)
    a) Dilation
    b) Stream function
    c) Vorticity
    d) Angular velocity

21. Explain with sketches parameters that describe irregular waves. [8]

22. Explain the energy spectrum of a seaway using sketches to aid the explanation.

[8]