Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – December 2022

Programme Name: B Tech (NAOE)

Semester: VII

Subject Code: UG12E2709

Subject Name: HIGH PERFORMANCE MARINE VEHICLES

Date: 23.12.2022 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. Higher froude number requires
   A) High stability
   B) More power
   C) Higher efficiency
   D) Low cost

2. ACV can operate on water only & SES can operate on different types of surfaces. State whether is it true or false
   A) True
   B) B)false

3. WIG craft flies close to the ground or water surface, aerodynamic lift _____ significantly & lift indused drag _____.

4. Swath hullforms can't be operable in _____ conditions
   A) rough seas
   B) Deep sea
   C) Shallow sea
   D) high tides

5. Advanced Spray rail system is provided to reduce _____

6. The blade section of a super cavitating propeller typically has sharp leading edge which causes high velocities & low pressure. State whether the folowing statement true or false.

A) True
B) False

7. Over a certain speed, the drag of a displacement hull will rapidly _____ due to friction drag _____ as the square of speed.

8. A hull moving through the water will have several drag forces acting on it. The two principal forces are from:

A) friction and surface wave making
B) Speed and friction
C) Surface wave making and speed
D) None

9. Planing surfaces are more efficient:

A) when they have high wetted beam/length ratio
B) when they have Low wetted beam/length ratio
C) when they have Zero wetted beam/length ratio
D) Above all true

10. In catamarans, High transverse stability due to the space between hulls and GM, the transverse metacentric height will be about ten times higher than a monohull ship. True or false?

A) True
B) False

Section B

Five Questions of 02 Marks each

11. Derive the Froude number for which the main hump in wave resistance occurs.
12. Discuss Porpoising with neat sketches.
13. What is Stagnation pressure.
14. Formulate Equivalent lift-drag ratio with respect to the specific power.
15. Discuss Squat effect.

Section C

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

16. Discuss Refining the high performance Hull Shape & significance of Froude number with respect to attaining high speeds.

17.
(a) Derive the expression for the drag on a flat planing surface. [3Marks]

(b) When is a planing hull said to be in equilibrium? With the help of a neat sketch, write down the general equations for equilibrium of a planing craft. Derive the equilibrium equation for the case when the thrust axis is parallel to the keel. [7Marks]

18.
(a) What are the design considerations taken into account while designing propellers and propulsion fans for Air Cushion Vehicles? [5Marks]
(b) Discuss the working principle behind a hydrofoil craft. What could be a limiting case to its performance? [5Marks]

19.What are Hybrid crafts? List the different concepts of Hybrid craft and explain in detail the characteristics of any four crafts with neat sketches.

20.
a. Explain in detail about Hovercraft. What are the Types of air cushion and skirt types? [5Marks]
b. Explain about open water characteristics of surface piercing propeller [5Marks]

21. Determine the effective power of catamaran whose length on waterline is 45 m, breadth of demi-hull is 5 m, draft is 2.5 m, spacing between demi-hulls is 18 m, block coefficient being 0.397 & operating at a speed of 18 knots and the demi-hull form factor is 1.45. Take viscous interference factor as 1.6 & wave interference factor as 1.3. (Hint: Wetted surface area can be taken as $0.13xL^2$).

22. A hydrofoil craft has a weight of 1600 kN. The forward and aft foils are respectively 8 m forward and 4 m aft of the CG of the craft. Both the foils have a lift coefficient of 0.75 and a drag coefficient of 0.02 including the drag on the struts. The craft is to have a speed of 50 knots. Determine the areas of the two foils and the resistance of the craft. [Take density of water ρw as 1000 kg/m3]