Indian Maritime University

(A Central University, Govt. of India)

End Semester Examinations – December 2023

Programme Name: B Tech (NAOE)

Semester: 5

Subject Code: UG12T2501

Subject Name: SHIP STRUCTURES

Date: 05.12.2023	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 sections.

Section A
(Answer all. Each question carries 1 mark)

1. Which of these is NOT a term used in context of studies in reliability?
   A. Transformation ratio
   B. Monte Carlo simulation
   C. FORM
   D. SORM

2. For a ship, floating in still water, which one of these boundary conditions best suits for longitudinal strength analysis?
   A. Free-Free
   B. Fixed-Free
   C. Hinged- Hinged
   D. Fixed-Hinged

3. Shear flow has the units of:
   A. N*m
   B. $N*m^2$
   C. N/m^2
   D. N/m

4. For a vessel encountering a head-on wave with wavelength equal to the length of the ship, when the trough of the wave is amidships and the crests are at the fore and aft, the vessel will usually be:
   A. Sagging

B. Hogging
C. Severe list to the port side
D. Severe list to the starboard side

5. Which of these is NOT measurable?
   A. Stress
   B. Longitudinal strain
   C. Lateral strain
   D. Angular strain

6. In context of structural analysis, LRFD stands for: _____.

7. The evaluation of Cornell safety index can be done only if the distribution of the random variables is: _____
   A. Binomial
   B. Normal
   C. Poisson
   D. Gumbel

8. State true or false: For the purpose of bending stress computation, the neutral axis of a composite material section will be the same as the one with single material section.

9. The units of section modulus: _____.

10. In context of ships, Murray's method is used for calculating_____.

Section B
(Answer all. Each question carries 2 marks)

11. Define the term: Reliability.

12. What is the significance of von-Mises stress? Write the expression for the same.

13. Name four types of uncertainties.

14. Evaluate the ratio of the second moment of area of a square cross-section of side "d" to that of a circle of diameter "d".

15. Explain the term superstructure efficiency. Write the relevant expression.

Section C
(Answer any FIVE questions. Each question carries 10 marks)

16. Draw a neat and labelled flow diagram indicating the essence of Formal Safety Assessment.

17. A beam of length L is simply supported and a single concentrated transverse load P is acting at the midpoint of the beam. Given the data: L=6 m; P=1000 N evaluate the following:

a. Draw the SF diagram and indicate the maximum value. (5 marks)
b. Draw the BM diagram and indicate the maximum value. (5 marks)

18. Derive an expression for evaluating the critical stress for buckling in plates. State the boundary and loading conditions.

19. A vessel is inclined at an angle of 20 degrees with respect to the normal upright axis. In the normal upright condition the mid-ship section was subjected to a bending moment of 100 MN-m. For the inclined condition, calculate the following:

a. Horizontal bending moment.
b. Vertical bending moment.
c. Given, $I_{CL} = 2*I_{NA,,}$ find the angle which the new neutral axis makes with respect to the original one.
d. At what angle of inclination will the bending stress reach the maximum, if the coordinates of the corner point are (20,8)?

20. In connection with combination of statistical loads:

a. Explain Turkstra's rule. (5 marks)
b. Explain Ferry Borges Castenheta model (5 marks)

21. A steel plate of dimensions of side 2meters X 1meter is simply supported and is subjected to loading given by the expression:

$$P=0.5*\sin(n*x/a)*\sin(n*y/b)$$

The thickness of the plate is 10 mm and Young's modulus, E = 200 GPa. Take Poisson's ratio, v=0.3. Compute the deflection at the mid-point of the plate.

22. A simply supported steel plate of length 4 meters and breadth 1 meter is subjected to compressive loading along its longitudinal direction so as to initiate buckling of the plate. The thickness of the plate is 5 mm and the Young's modulus, E = 200 GPa. Take Poisson's ratio, v=0.3. If it is given that the number of half buckles along the longitudinal direction is to be 4 and those along the transverse direction is to be 2, evaluate the critical stress for buckling. (10 marks)