

Indian Maritime University
(A Central University, Govt. of India)
End Semester Examinations – December 2022
Programme Name: B Tech (NAOE)
Semester: V
Subject Code: UG12T2501
Subject Name: Ship Structures

Date: 12.12.2022

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

(Answer all. Each question carries 1 mark)

1. In simple beam bending theory, the cross-section where the bending moment attains the maximum value, the shear force at that location equals _____.
 - A. Maximum value
 - B. Zero
 - C. Depends on the loading
 - D. Cannot be said for sure
2. Which of these is NOT measurable?
 - A. Stress
 - B. Longitudinal strain
 - C. Lateral strain
 - D. Angular strain
3. The unit of flexural rigidity of a plate is:
 - A. Pa*m
 - B. Pa*m²
 - C. Pa*m³
 - D. Pa*m⁴
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. Shear flow has the units of:
- A. $N \cdot m$
 - B. $N \cdot m^2$
 - C. N/m^2
 - D. N/m
6. In buckling of columns, critical stress is directly proportional to the:
- A. Reciprocal of the flexural rigidity of the column member
 - B. Reciprocal of the length of the column
 - C. Reciprocal of the square of the length of the column
 - D. Reciprocal of the square of the flexural rigidity of the column member
7. A simply supported beam of span "L" carries a point load "W" at the centre of the beam. The bending moment diagram would be a:
- A. Rectangle
 - B. Parabolic curve
 - C. Triangular
 - D. Cubic curve
8. In the shear stress distribution profile of a beam of I-section subjected to a transverse loading, the shear stress would be a maximum at:
- A. Top fibre
 - B. Bottom fibre
 - C. Neutral fibre
 - D. Depends on the loading condition
9. 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
10. 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

Section B

(Answer all. Each question carries 2 marks)

11. What is the significance of "flexural rigidity of a plate"? Write the expression for the same with the meanings of symbols used.

12. Explain the term: Superstructure efficiency. Write the expression for it and the meanings of the symbols used.
13. Write the equation of the standard normal distribution curve with the meanings of the symbols used. Draw a sample of such a curve.
14. Define the term: Reliability.
15. What is the significance of von-Mises stress? Write the expression for the same.

Section C

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

16. A rectangular cross-section beam of breadth, $b=10$ cm and depth, $d = 20$ cm is subjected to a shear force of 1000 N. Draw the shear stress distribution profile for the section indicating the values of the stress at any five locations on the cross-section.
17. a. With an example, discuss Monte Carlo simulation. (5 marks)
 b. The Cornell safety index for a hull girder is found to be 2.23. Assuming that the applied bending moment and the ultimate moment capacity of the hull follow normal distribution, find the standard deviation of the applied load, given the following data: (5 marks)
 Mean applied load=100 MN-m
 Mean moment capacity = 150 MN-m, and
 Standard deviation of the moment capacity=10 MN-m.
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. 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)

21. For a circular cross-section, evaluate the ratio of the elastic modulus to the plastic modulus about the centroidal axis.

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