

**Indian Maritime University**  
**(A Central University, Govt of India)**

Sep/Oct'25 SE

**Programme Name: B. Tech Marine Engineering**

**Semester: V**

**Subject Code: UG11T4507**

**Subject Name: MARINE DESIGN: PRESSURE VESSELS, MACHINERY  
COMPONENTS AND VIBRATIONS**

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Date: 14.10.2025

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

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General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective section.
- (iii) Use Design data book if necessary.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. The standard series of preferred numbers are -----
  - (a) R5, R10, R20, R40 and R80
  - (b) R10, R20, R30, R40 and R50
  - (c) R5, R10, R15, R20 and R25
  - (d) none of the above
2. Corrosion resistance of steel is increased by adding
  - (a) Nickel
  - (b) Chromium
  - (c) Nickel and Chromium
  - (d) Sulphur, lead and phosphorus
3. Aesthetic design deals with -----
  - (a) design of Outer appearance
  - (b) design of displays
  - (c) energy expenditure in hand and foot operations
  - (d) all the three

4. At a certain speed revolving shafts tend to vibrate violently in transverse direction this speed is known

- (a) Critical speed only
- (b) Whipping speed only
- (c) Critical or whirling or whipping speed
- (d) Whirling speed only

5. Stress concentration factor is defined as the ratio of

- (a) maximum stress to the endurance limit
- (b) nominal stress to the endurance limit
- (c) maximum stress to the nominal stress
- (d) nominal stress to the maximum stress

6. In clearance fit, -----

- (a) tolerance zones of hole and shaft overlap
- (b) tolerance zone of hole is completely below that of shaft
- (c) tolerance zone of hole is entirely above that of shaft
- (d) none of the above

7. A rivet is specified by

- (a) Shank diameter
- (b) Length of rivet
- (c) Type of head
- (d) Length of tail

8. The type of stresses developed in the key is/are

- (a) shear stress alone
- (b) bearing stress alone
- (c) both shear and bearing stresses
- (d) shearing, bearing and bending stresses

9. The wire ropes make contact at

- (a) bottom of groove of the pulley
- (b) sides of groove of the pulley
- (c) sides and bottom of groove of the pulley
- (d) anywhere in the groove of the pulley

10. The rolling contact bearings are known as

- (a) thick lubricated bearings
- (b) plastic bearings
- (c) thin lubricated bearings
- (d) antifriction bearings

## Section B

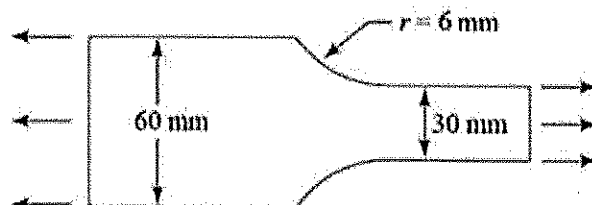
Five Questions of 02 Marks each

11. List some design Standards and its advantages.
12. State the relation between stress concentration factor, fatigue stress concentration factor and notch sensitivity.
13. What are the properties required for selection of bearing materials?
14. Explain the word resonance and its effect.
15. What are the different types of shafts and state their importance.

## Section C

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

16. Explain the General procedure and factors considered in design. (10)
17. A flat rectangular key of size 10 x 8 mm is used on a shaft of 35 mm diameter. If the key has a yield strength of 300 N/mm<sup>2</sup>, calculate the maximum power the key can transmit at 1440 rpm. Assume key length as 55 mm and the factor of safety as 3. (10)
18. a). A Stepped shaft of diameter 60mm and 30mm with a fillet radius of 6mm is subjected to a tensile load of 20 kN as shown in figure. Taking stress concentration into account, calculate the maximum stress induced. (5)



- b) Define stress concentration factor? What are the different methods to reduce the stress concentration factor? Explain with neat sketches. (5)
19. A deep groove ball bearing having bore diameter of 60 mm and rotating at 1440 rpm is subjected to a radial force of 2500 N and an axial force of 1200 N. The radial and thrust

factors are 0.56 and 2.0 respectively. The load factor is 1.2. If the expected rating life of the bearing is 25000 hours, calculate the required dynamic capacity of the bearing.

(10)

20. Find the efficiency of the following riveted joints:

1. Single riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 50 mm.

2. Double riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 65 mm. Assume

Permissible tensile stress in plate = 120 MPa

Permissible shearing stress in rivets = 90 MPa

Permissible crushing stress in rivets = 180 MPa

(10)

21. Design a clamp coupling to transmit 30 kW at 100 r.p.m. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3. (10)

22. Consider system of Rotors and Shafts as shown in the figure and the data provided there of as,

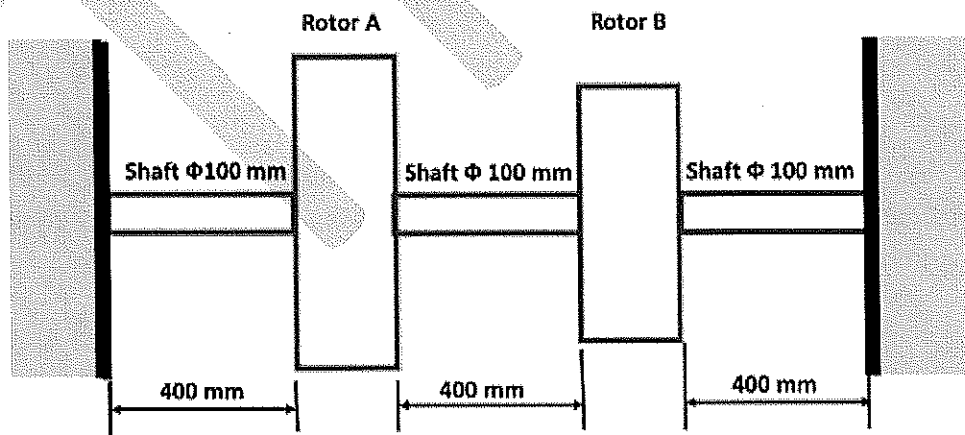
Shaft Diameter = 100 mm, Modulus of rigidity of the shaft material = 84 GPa.

Rotor A: Mass = 160 kg, Diameter = 800 mm

Rotor B: Mass = 120 kg, Diameter = 600 mm

Calculate:

- 1) The natural frequencies of all modes of torsional vibrations of the system.
- 2) Ratio of amplitude of Rotor A and Rotor B for all modes of torsional vibrations



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