Indian Maritime University

(A Central University, Govt of India)

Mar/Apr'26 SE

Programme Name: B Tech (Marine Engineering)

Semester: V

Subject Code: UG11T4507

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

Date: 11.03.2026	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. When a component is subjected to fluctuating or repeated loads, failure occurs due to:
   A) Impact loading
   B) Fatigue
   C) Static loading
   D) Overheating
2. The presence of a notch or hole in a machine component causes:
   A) Uniform stress distribution
   B) Stress relaxation
   C) Stress concentration
   D) Increase in ductility
3. The ASME code for the design of shafts primarily considers which of the following stresses?
   A) Only bending stress
   B) Only torsional stress
   C) Combined bending and torsional stresses
   D) Thermal stress
4. A knuckle joint is used to connect two rods:
   A) Under compressive load only
   B) Under tensile load only
   C) Under both tensile and compressive loads where minor angular movement is possible
   D) Rigidly without movement

5. In a flange coupling, the flanges are joined together by:
A) Welding
B) Screws
C) Bolts and nuts
D) Keys only

6. The main advantage of a belt drive over a chain drive is:
A) No slip
B) Quiet and smooth operation
C) More power transmission per unit area
D) Rigid connection

7. In thick shells, stresses are determined using:
A) Rankine's formula
B) Lame's equations
C) Euler's equation
D) Clapeyron's theorem

8. The design of pressure vessel is based on
A) Hoop Stress
B) Longitudinal Stress
C) Both A and B
D) None of these

9. At nodal point in a shaft, the amplitude of torsional vibration is

A) Zero
B) minimum
C) maximum
D) One

10. In longitudinal vibrations, the particles of the body move:
A) Perpendicular to the axis of the body
B) Parallel to the axis of the body
C) In a circular path
D) Randomly in all directions

Section B

Five Questions of 02 Marks each

11. Define the term BIS and ASME.

12. How do you connect two misaligned shafts?

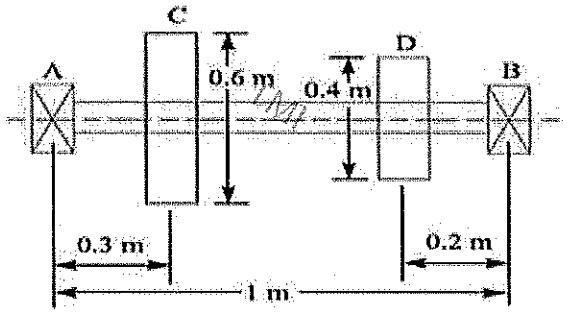
13. What is the function of a key in a shaft?.
14. Give practical examples of thin cylinder .

15. What is the effect of resonance and how does it occur?

Section C

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

16. A shaft is supported on two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 KN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulley is 180° and co-efficient of friction is 0.24. Determine the suitable diameter for the solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley

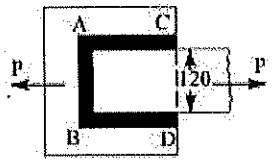


17. A hollow shaft of 0.5 m outside diameter and 0.3 m inside diameter is used to drive a propeller of a marine vessel. The shaft mounted on bearing 6 metre apart and it transmits 5600 kW at 150 r.p.m. The maximum axial propeller thrust (compressive) is 500 kN and the shaft weighs 70 KN. Determine:1. The maximum shear stress developed in the shaft, and 2. The angular twist between the bearings. Consider for gradually applied loading condition.

18. Design a belt drive to transmit 30 H.P. at 740 rpm to an aluminium rolling machine, the speed ratio being 3.0. The distance between the pulleys is 3 metre. Diameter of the rolling machine pulley is 1.2 metre.

19. Design a flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having allowable shear stress of 40 MPa. Shearing in bolts should not exceed 30 MPa and allowable crushing stress as 50 Mpa. Assume that a same material is used for shaft and key and crushing stress is twice the value of shearing stress. Maximum torque is 25% greater than full load torque. The shear stress for cast iron is 14 MPa.

20. Determine the length of the weld run for a plate of size 120 m wide and 15mm thick to be welded to another plate (as shown in the figure) by means of 1. A single transverse weld and 2. Double parallel fillet welds when the joint is subjected to variable loads.



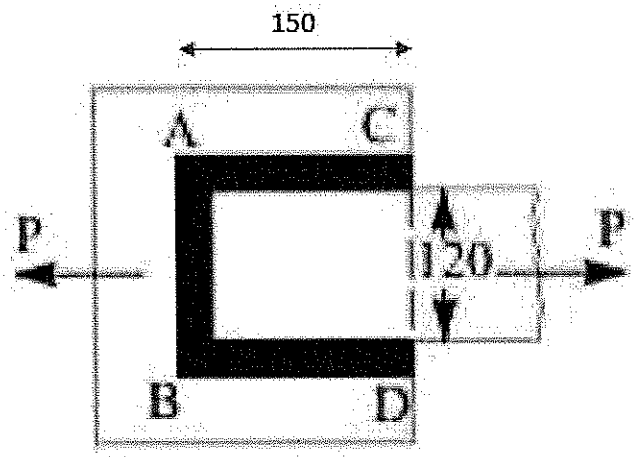
21. A thin cylinder pressure vessel of 500 mm diameter is subjected to an internal presure of 2 MPa. If the thickness of the vessel is 20 mm, find the hoop stress, longitudinal stres and the maximum shear stress.

22. Calculate the whirling speed of a shaft 20 mm diameters and 0.6 m long carrying a mass of 1 kg at its mid-point. The density of the shaft materials is 40 Mg/m^3, and young's modulus is 200 GN/m^2. Assume the shaft to be freely supported

---------- Forwarded message ---------
From: **ESE IMU HQ** <imuese@imu.ac.in>
Date: Wed, Mar 11, 2026 at 3:13 PM
Subject: Clarification - UG11T4507 - Section C - Q No 20 - 11.03.2026 - AN - reg.
To:

Sir/Madam,

With reference to the subject cited above, it is informed that for Q No. 20 please use the following image:



Kindly disseminate the same to the concerned students.
Thanks & Regards,

Cmde KD Joshi (IN) (Retd),
Controller of Examinations,
Indian Maritime University,
East Coast Road, Sholinganallur (PO),
Semmencherry, Chennai - 600119.
Phone: 044 - 2453 9023.

Subject: Fwd: 11.03.2026 - AN - QP - reg.
From: TMI IMU <tmi-imu@tmi.tolani.edu>
Date: 3/11/2026, 1:46 PM
To: TMI Exam Dept <exams@tmi.tolani.edu>

---------- Forwarded message ---------
From: **ESE IMU HQ** <imuese@imu.ac.in>
Date: Wed, Mar 11, 2026, 13:43
Subject: Re: 11.03.2026 - AN - QP - reg.
To: TMI IMU <tmi-imu@tmi.tolani.edu>

Sir,

Yes you may give Design Data Book for UG11T4507. This is for your kind information and necessary action please.

Thanks & Regards,

Cmde KD Joshi (IN) (Retd)
Controller of Examinations
Indian Maritime University
East Coast Road, Sholinganallur (PO),
Semmencherry, Chennai - 600119
Phone: 044 - 2453 9023

On Wed, Mar 11, 2026 at 1:40 PM TMI IMU <tmi-imu@tmi.tolani.edu> wrote:

> Dear Sir,
> Good day.
>
> Kindly confirm if the Design Data Book is to be given to students for UG11T4507- Marine Design- PV, MC & V.
>
> All QPs and PW well received.
> Regards
> Manoj Hirkane
>
> On Wed, Mar 11, 2026 at 1:31 PM ESE IMU HQ <imuese@imu.ac.in> wrote:
>
> > Sir/Madam,
> >
> > PFA the QP for the subject cited above. Password will be sent separately.

Thanks & Regards,

Cmde KD Joshi (IN) (Retd),
Controller of Examinations,
Indian Maritime University,
East Coast Road, Sholinganallur (PO),
Semmencherry, Chennai - 600119.
Phone: 044 - 2453 9023.