A

UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION

OCTOBER 2025 SEMESTER

COURSE CODE	:	LGB22103 / LGB25103
COURSE TITLE	:	STRENGTH OF MATERIALS / MECHANICS OF MATERIALS
PROGRAMME NAME	:	BACHELOR OF ENGINEERING TECHNOLOGY (OFFSHORE) WITH HONOURS / BET (NAVAL ARCHITECTURE AND SHIPBUILDING)
DATE	:	27 JANUARY 2026
TIME	:	2:00PM - 5:00PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Answer ALL questions for Section A.
5. Section B consist of four questions. Answer THREE (3) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Please answer MCQ/EMQ questions using OMR sheet. ☐ *Tick if applicable*
9. Refer to the attached Formula/ Appendies. ☐ *Tick if applicable*

THERE ARE 10 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 40 marks)

Answer ALL questions.

Please use the answer booklet provided.

Question 1

The following questions relate to forces and stresses acting on the frame shown below with a suspended bucket of mass 150kg hanging from end E.

Refer Below - Figure1 : Frame with suspended load .

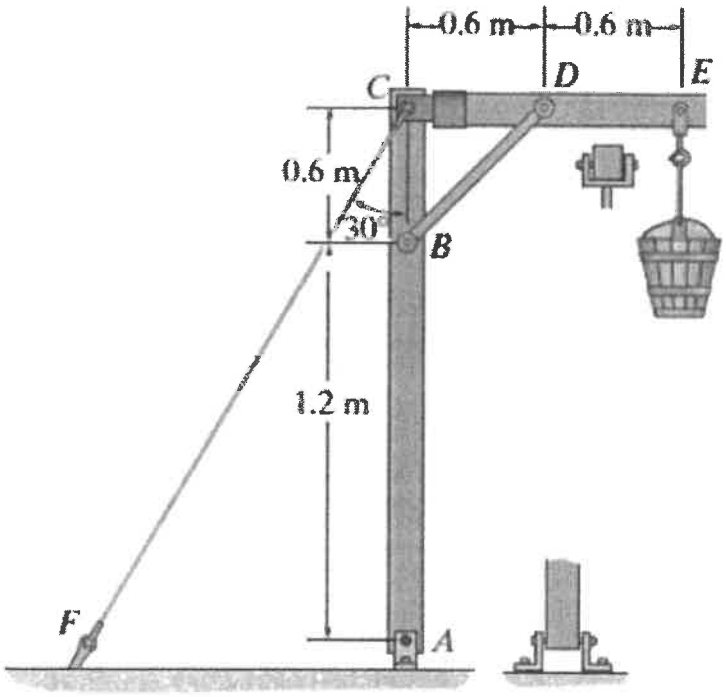

Figure 1: Frame with suspended load

(a) Determine the average normal stress in the 6 mm diameter wire CF and the 15 mm diameter short strut BD.

(12 marks)

(b) If the diameters of the pins at A and D are 6 mm and 10 mm, respectively, determine the average shear stress developed in these pins. Each pin is subjected to double shear.

(8 marks)

Question 2

The following questions relate to strain.

(a) Define the following terms.

i. Normal Strain

(2 marks)

ii. Shear Strain

(2 marks)

(b) The plate is deformed uniformly into the shape shown by the dashed lines. If at A, $\gamma_{xy} = 0.0075$ rad., while $\varepsilon_{AB} = \varepsilon_{AF} = 0$, determine the average shear strain at point G with respect to the x' and y' axes.
Refer Below - Figure2 : Deformation of 2-dimensional plate .

(16 marks)

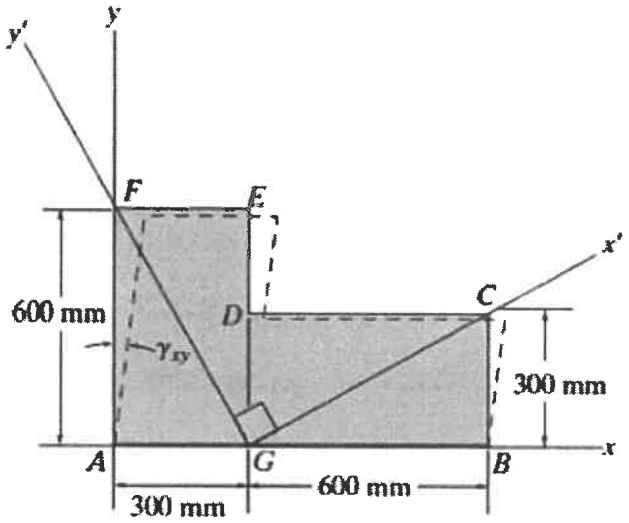

Figure 2: Deformation of 2-dimensional plate

SECTION B (Total: 60 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

The following questions relate to force and stress.

(a) The steel pipe is supported on the circular base plate and concrete pedestal. If the thickness of the pipe is 5 mm and the base plate has a radius of 150 mm, determine the factors of safety against failure of the steel and concrete. The applied force is 500 kN, and the normal failure stresses for steel and concrete are $(\sigma_{fail})_{steel}$ = 350 MPa and $(\sigma_{fail})_{concrete}$ = 25 MPa, respectively.

Refer Below - Figure3 : Loaded vertical pipe on steel base plate and concrete pedestal .

(6 marks)

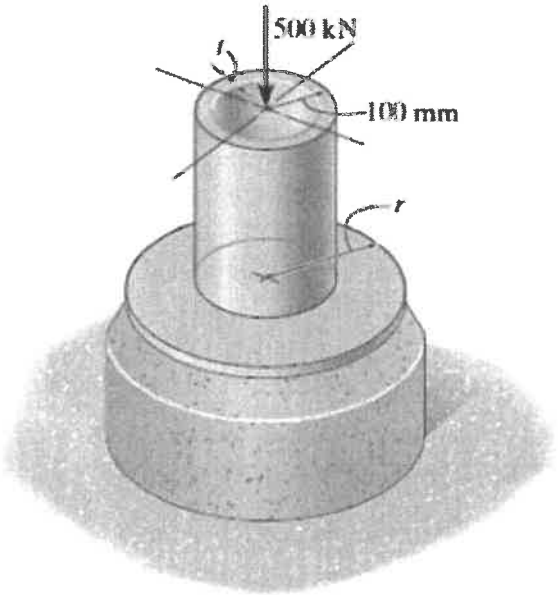

Figure 3: Loaded vertical pipe on steel base plate and concrete pedestal

(b) The frame is subjected to the load of 4 kN which acts on member ABD at D. Determine the required diameter of the pins at D and C if the allowable shear stress for the material is τ_{allow} = 40 MPa. Pin C is subjected to double shear, whereas pin D is subjected to single shear.

Refer Below - Figure4 : Frame subjected to external load .

(14 marks)

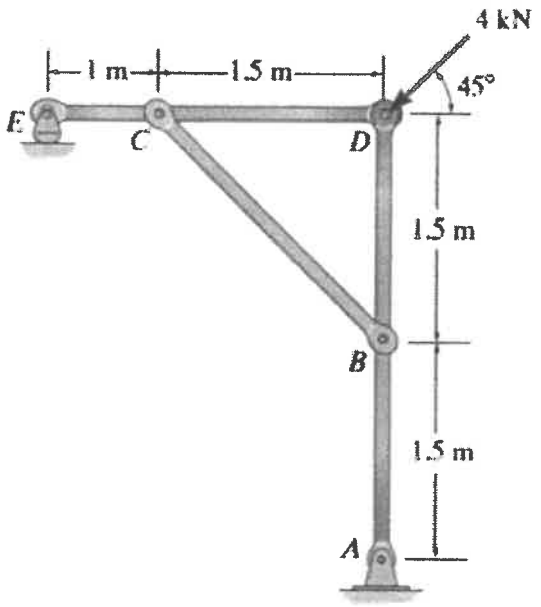

Figure 4: Frame subjected to external load

Question 2

The following questions relate to strain.

(a) The rubber band of unstretched length 2r is forced down the frustum of the cone. Determine the average normal strain in the band as a function of z.
Refer Below - Figure5 : Rubber Band Sliding Down a Cone .

(10 marks)

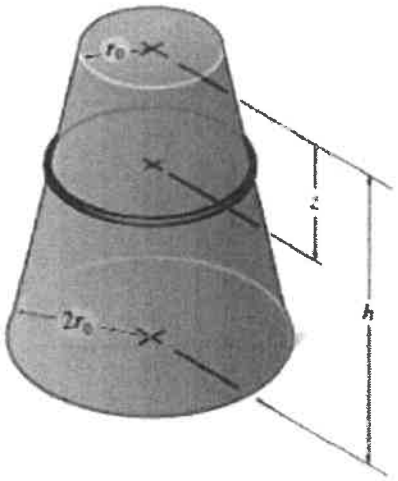

Figure 5: Rubber Band Sliding Down a Cone

(b) The triangular plate ABC is deformed into the shape shown by the dashed lines. If at A, $\varepsilon_{AB} = 0.0075$, $\varepsilon_{AC} = 0.01$ and $\gamma_{xy} = 0.005$rad, determine the average normal strain along edge BC.
Refer Below - Figure6 : Triangular Plate .

(10 marks)

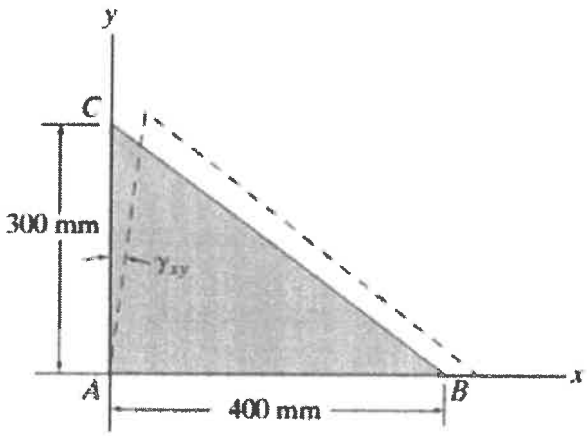

Figure 6: Triangular Plate

Question 3

The following questions relate to problems on bending.

(a) Sketch and name three (3) types of beams that are commonly subjected to bending.

(3 marks)

(b) From the beam shown below, determine the following:
Refer Below - Figure7 : Overhanging beam subjected to distributed loading .

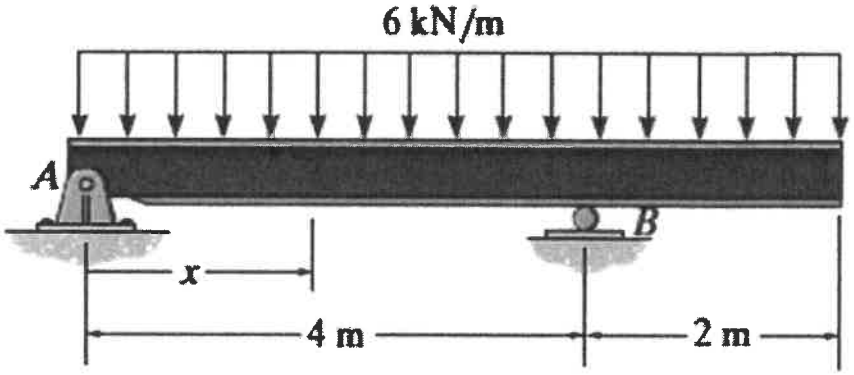

Figure 7: Overhanging beam subjected to distributed loading

i. Replace the distributed load by an equivalent resultant force.

(2 marks)

ii. Draw the free body diagram for each of the beam segment of length *x* using method of sections.

(2 marks)

iii. Determine the shear force and bending moment equations for each section.

(7 marks)

iv. Sketch the shear force and bending moment diagrams for the beam.

(6 marks)

Question 4

The following questions relate to problems on torsion.

(a) Describe in your own words with the aid of diagrams, the principle of superposition applied to shaft subjected to multiple torques to determine the total angle of twist (ϕ).
Hint: in addition to the definition, include diagrams on the application of method of sections and a total angle of twist equation as example.

(10 marks)

(b) The turbine develops 150kW of power, which is transmitted to the gears such that both C and D receive an equal amount. If the rotation of the 100mm diameter A-36 steel shaft is ω = 500rev/min., determine the absolute maximum shear stress in the shaft (τ_{max}) and the rotation of end B of the shaft relative to E (ϕ_{BE}) . The journal bearing at E allows the shaft to turn freely about its axis. Take G_{steel} = 75GPa.
Refer Below - Figure8 : Turbine with Output Gears .

(10 marks)

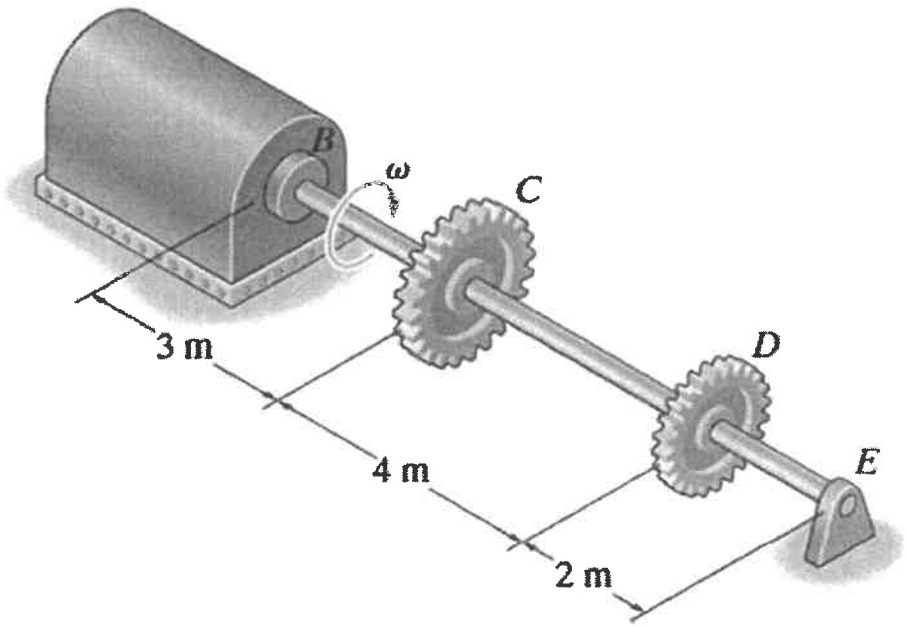

Figure 8: Turbine with Output Gears

END OF EXAMINATION PAPER