

SCT 262-2 Engineering Physics

Number of questions: Four (04)

Answer all questions

Time allocation: Two (02) hours

Total marks allocated: 100

- a. A Newtonian fluid flows between a parallel plate arrangements as shown in Fig. Q1.1. At a distance (y) of 2 mm between plates, a shearing stress of 150 Pa develops at the upper plate when it is pulled at a velocity (u) of 1 m/s. Determine the viscosity of the fluid between the plates in standard SI units.

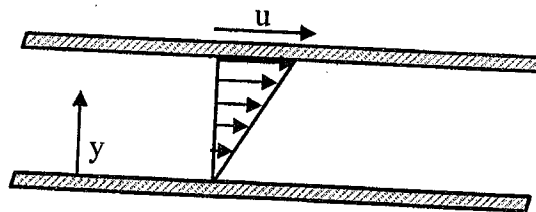


Fig.Q1.1

(13 marks)

- A vertical plane area having the shape shown in Fig. Q1.2 is immersed in an oil bath (specific weight = 8.75 kN/m^3). Determine the magnitude of the resultant force acting on one side of the area as a result of the oil.

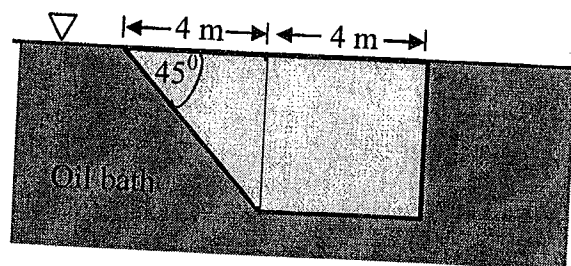


Fig.Q1.2

Note: The centroid (h_c) of the trapezoid is given by,

$$h_c = h \left[\frac{(b + 2a)}{3(a + b)} \right]$$

(12 marks)

2.

a. Complete the following table for water.

T, °C	P, kPa	h, kJ/kg	x	Phase description
	200		0.7	
140		1800		
	950		0.0	
80	500			
	800	3162.2		

(15 marks)

b. Air enters a diffuser of a jet engine steadily at 0.6 kg/m^3 and 200 m/s and leaves at 2.2 kg/m^3 and 30 m/s . If the inlet area of the diffuser is 60 cm^2 , determine

- i. the mass flow rate through the diffuser.
- ii. the exit area of the diffuser.

(10 marks)

3.

a. Two forces are applied to the bracket BCD as shown in Fig Q3.1. The control rod AB is made of steel having an ultimate normal stress of 600 MPa . If the factor of safety of rod AB with respect to failure will be 3.3 . Determine

- i. the resultant force due to applied load at point C
- ii. the diameter of the rod AB (d_{AB}).

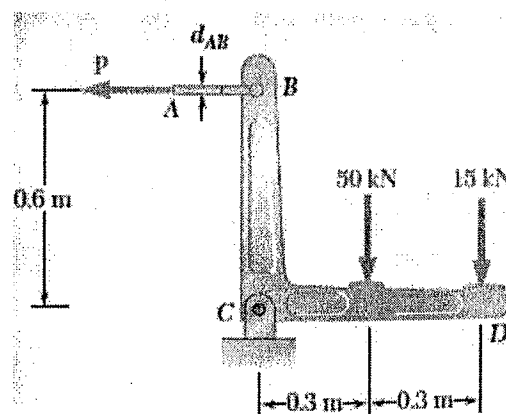
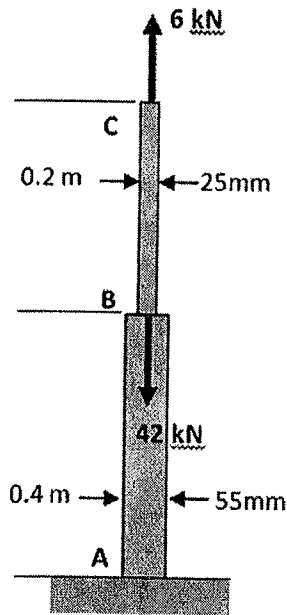


Fig.Q3.1

(10 marks)

b. The rod ABC is made of brass for which $E = 105 \text{ GPa}$. Determine the deflection at

- i. point B.
- ii. point C.



(15 marks)

a. Briefly describe the stress-strain diagram of brittle and ductile material using a suitable sketch.

(10 marks)

b. A 2.5 m length of a steel rod of 300 mm diameter is used as a column to carry a 700kN centric axial load. If the modulus of elasticity (E) is 200 GPa and Poisson's ratio (ν) is 0.30, determine

- i. the change in length of the pipe
- ii. the change in its diameter

(15 marks)