Reg. No. :

Question Paper Code : 70011

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Aeronautical Engineering/Aerospace Engineering

AE 3352 — SOLID MECHANICS

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by Free Body Diagram?

2. Calculate the end reactions for the simply supported beam of length 6m carrying UDL of 2 kw/m throughout the beam.

3. What is meant by point of contraflexure?

4. Calculate centroid for the rectangular object whose width is 60cm and depth is 30cm.

5. Draw the stress – strain diagram for mild steel, material and indicate salient points.

6. State Hook's law.

7. A circular shaft is subjected to a torque of 10 kNm. The power transmitted by the shaft is 209.33kW. Find the speed of shaft in revolution per minute.

8. List the importance of pure bending.

9. Fixed beam is an indeterminate structure. Comment on the statement.

10. List the different column end conditions.

PART B — (5 × 13 = 65 marks)

11. (a) Three coplanar concurrent forces are acting at a point as shown in Fig Q11(a). Determine the resultant in magnitude and direction. (13)

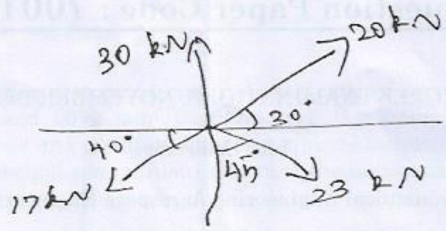
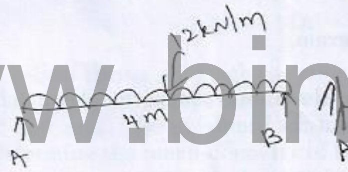


Fig.Q. 11(a)

Or

(b) Calculate the support reactions for the Figure Q.11(b)(i) and Q.11(b)(ii)(6+7)



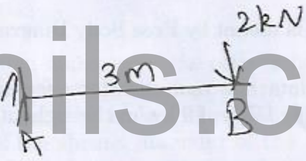


Fig.Q.11(b)(i) Fig.Q.11(b)(ii)

12. (a) Draw BMD and SFD for the beam Shown in Figure Q12(a). (13)

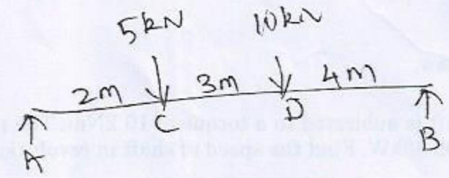


Fig.Q.12(a)

Or

(b) Calculate the moment of inertia about its centroidals xx and yy axes as for the sections Shown in Figure. Q 12(b). (13)

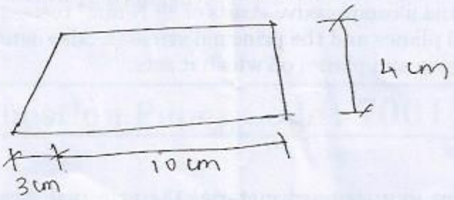


Fig.Q.12(b)

13. (a) A cast iron flat 300 mm long and 30 mm (thickness) × 60 mm (width) uniform cross section, is acted upon by the following forces : 30 kN tensile in the direction of the length 360 kN compression in the direction of the width 240 kN tensile in the direction of the thickness. Calculate the direct strain, net strain in each direction and change in volume of the flat. Assume the modulus of elasticity and Poisson's ratio for cast iron as 140 kN/mm² and 0.25 respectively. (13)

Or

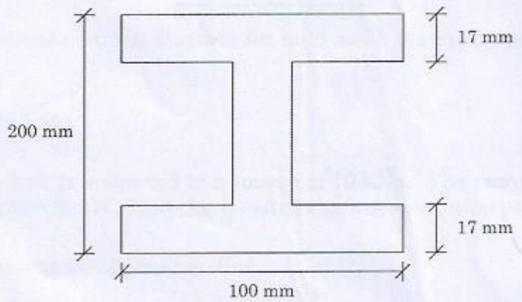
(b) (i) Derive the relationship between Young's Modulus and Rigidity Modulus. (6)

(ii) A bar of 40mm diameter is subjected to a tensile load of 400kN. An extension 0.23mm is observed in gauge length of 150mm and the change in diameter is 0.02mm. Calculate the Young's modulus and rigidity modulus of the material. (7)

14. (a) A solid circular shaft transmits 75kW power @ 200 rpm. Calculate the shaft diameter if the twist in the shaft is not to exceed 1° in 2m length of the shaft and shear stress is limited to 50MN/m² and C as 100GN/m². (13)

Or

(b) Find the maximum. shear stress for the I section shown in Figure Q 14(b) such that SF = 50kN.



(13)

Fig.Q.14(b)

15. (a) Two planes AB and AC which are right angles carry shear stress of intensity 17.5 N/mm^2 while these planes also carry a tensile stress of 70 N/mm^2 and a compressive stress of 35 N/mm^2 respectively. Determine the principal planes and the principal stresses. Also determine the maximum shear stress and planes on which it acts. (13)

Or

(b) At a point in a strained material the principal stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Determine the normal stress, shear stress and resultant stress on a plane inclined at 50° to the axis of major principal stress. Also determine the maximum shear stress at the point. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A concrete column of cross sectional area 400mm × 400mm is reinforced by four longitudinal 50mm dia round steel bar placed at each corner, if the column carries a compressive load of 300kN determine (i) Load carried (ii) The compressive stress produced in the concrete and the steel bar. Young's modulus of elasticity of steel is 15 times that of concrete. (15)

Or

(b) A helical spring, in which the mean diameter of the coils is 12 times the wire diameter, is to be designed to absorb 300 J energy with an extension of 150 mm. The maximum shear stress is not to exceed 140 N/mm^2 Determine the mean diameter of the spring, diameter of the wire which forms the spring and the number of turns. Assume the modulus of rigidity of the material of the spring as 80 kN/mm^2. (15)