Code No: R2021031 **R20** SET - 1

II B. Tech I Semester Regular Examinations, Feb/March - 2022
MECHANICS OF SOLIDS
(Com to ME, AME)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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1 a) A hollow circular mild steel column of external diameter 300 mm and internal diameter 250 mm carries an axial load of 1500 k N. Determine the compressive stress in the column. If the initial length of the column is 3.75 m, find the decrease in length of the column. Take E = 2 x 10^5 N/mm^2.

b) A steel bar is placed between two copper bars each having the same area and length as the steel bar at 15^0C.At this stage they are rigidly connected together at both the ends. When the temperature is raised to 315^0C, the length of the bars increases by 1.50 mm. Determine the original length and the final stresses in the bars. Take E_s = 2.1 x 10^5 N/mm^2; E_c= 1 x 10^5 N/mm^2.α_s=0.000012 per ^{o}C : α_c =0.0000175 per ^{0} C.

Or

2 a) The principal tensile stresses at a point across two perpendicular planes are 80 N/mm^2.Find the normal, and tangential stresses and the resultant stress and its obliquity on a plane at 20^0 with the major principal plane. Find also the intensity of stress which acting alone can produce the same maximum strain. Take Poisson's ratio =1/4.

b) A bar is 3 metres long and 60 mm diameter. It is subjected to a tensile load of 200 k N. Find the stress and the elongation when the load is applied gradually. What would be the maximum stress and the maximum elongation if the load had been suddenly applied? Take E = 2 x 10^5 N/mm^2.

3 a) Draw S.F. and B.M. diagrams for the simply supported beam shown in Fig.01.

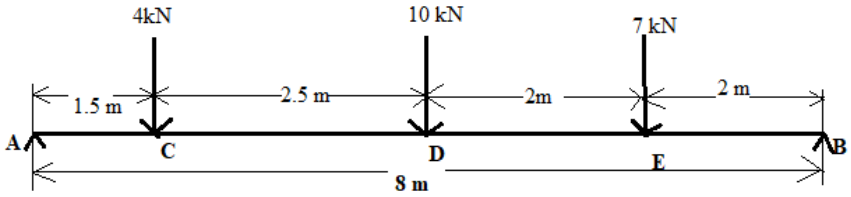

Fig.01

b) A horizontal beam is simply supported at the ends and carries a uniformly distributed load of 10 kN/m between the supports placed 10 m apart. Anticlockwise moments of 150 k Nm and 100 k Nm are applied to the left and right ends of the beam at the supports shown in Fig .02. Determine the position and magnitude of the maximum bending moments and draw S.F and B.M. diagrams. 7M

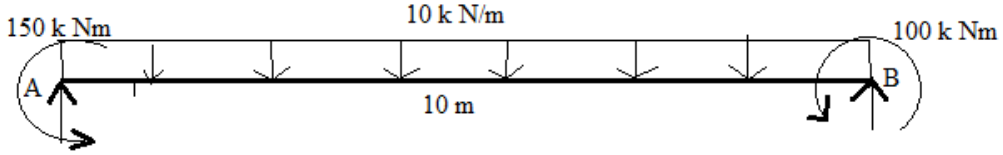

Fig.02

Or

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4 a) Abeam 6 meters long is simply supported at the ends and carries a uniformly distributed load of 30 k N per metre run for a distance of 4 metres from the left end. Find the maximum shear force and bending moment draw S.F and B.M. diagrams.

b) A simply supported beam carries inclined loads 100 N, 200 N and 300 N inclined at 30^0,45^0, and 60^0 to the vertical as shown in Fig.03.These loads act at 1 metre, 2 metre and 3 metres from the left support respectively. If the span is 4 metres, draw Shear force, Bending Moment and Thrust diagrams.

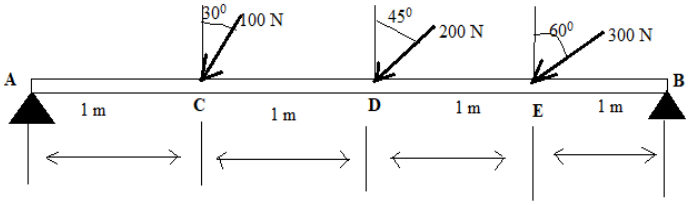

Fig.03

5 a) Derive the Expression for Bending Equation.

b) The cross-section of a short masonry pier is 0.60 m x 1.20 m.The force action across the section consists of a normal compressive load of 300 k N at n and a bending moment of 150 k Nm which cause tension above XX.For this load condition, find the maximum and minimum stresses across the section.

Or

6 a) Derive the Expression for Shear Stress Equation.

b) A cantilever of mild steel 60 mm wide and 20 mm deep is 1 meter long. If at the free end of the cantilever there is a clockwise couple of 80 Nm find the radius to which the cantilever will be bent. Find also the vertical displacement of the free end. Ignore the self-weight of the member. Take E = 2 x 10^5 N/mm^2.

7 a) Cantilever of length l carrying a concentrated load W at a distance ‘a ‘ from the fixed end. Derive the expression for deflection at free end.

b) Fig.04 shows a simply supported steel beam AB of span 6 m carrying a uniformly distributed load of 60 k N/m on the part CB. The beam is ISWB having I_{xx} = 9821.6 cm^4.Determine the slopes at A and B.

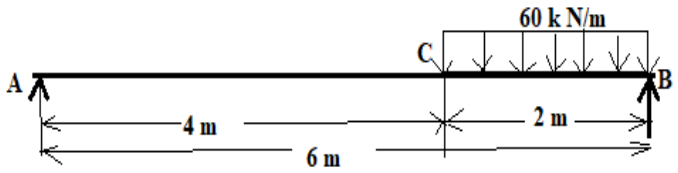

Fig.04

Or

8 a) A simply supported beam of span ‘l’ carries a triangular load whose intensity varies from zero at one end to ‘w’ at the other end. Find the deflection at the centre.

b) A simply supported beam of length l carries a uniformly distributed load of w per unit run over the whole span. Find the slope at each end and the deflection at the centre.

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9 a) A thin cylindrical tube with closed ends has an internal diameter of 50 mm and a wall thickness of 2.50 mm. The tube is axially loaded in tension with a load of 10 k N and is subjected to an axial torque of 500 Nm under an internal pressure of 6 N/mm^2.Determine the principal stresses on the outer surface of the tube and the maximum shear stress.

b) A seamless pipe 1 metre diameter contains a fluid under a pressure of 1.5 N/mm^2.If the permissible tensile stress be 100 N/mm^2, find the minimum thickness of the pipe.

Or

10 a) The internal and external radii of a thick cylinder are 200 mm and 300 mm respectively .The external pressure on the cylinder is 4 N/mm^2.Find the internal pressure that can be applied if the maximum hoop stress is limited to 15 N/mm^2.Sketch also the distribution of radial pressure and hoop stress across the wall section.

b) A pipe of 500 mm internal diameter and 100 mm thickness contains a fluid at a pressure of 6 N/mm^2.Find the maximum and minimum hoop stresses across the section. Also sketch the radial pressure distribution across this section.