Seat No. | | | | | | |

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BBI1304

Strength of Materials
(New) (1020)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and solve **any two** out of a, b & c.
5. Use of non-programmable calculator is allowed.
6. Assume suitable data if necessary.
7. Attempt complete questions at one place only.

UNIT - I

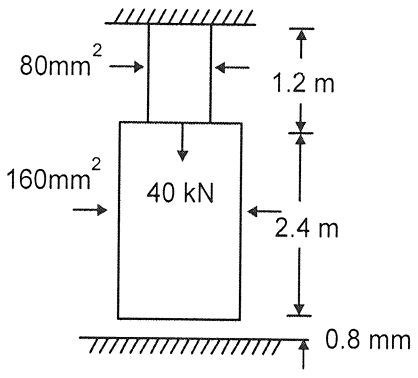
1. a) i) Define Poisson's ratio. **2**

ii) A thin tyre of steel is mounted on to a rigid wheel of 1.2 m diameter. Determine the internal diameter of the tyre if the hoop stress is limited to 120 MPa. Also determine the least temperature to which the tyre should be heated so that it can be slipped on the wheel Take

$E_s = 210$ GPa and $\alpha s = 11 \times 10^{-6} / ^\circ C$. **8**

b) i) Define factor of safety. **2**

ii) A suspended bar system consists of two cross sections as shown in fig. Initially its lower end is 0.8 mm above the ground surface. Determine the reaction at the lower support & the stresses in each section when a load of 40 kN is applied Take E = 205 GPa. **8**



c) Determine the elongation of a conical bar under the action of its own weight if the length of the bar is 'ℓ' the diameter of the bar is 'd' and weight per unit volume of the material is 'ρ'. 10

UNIT - II

2. a) i) Explain maximum shear strain energy theory. 2

ii) An elemental cube is subjected to tensile stresses of $30\,N/mm^2$ & $10\,N/mm^2$ acting on two mutually perpendicular planes & shear stress of $10\,N/mm^2$ on these planes. Determine the magnitude and direction of principle stresses & also the greatest shear stress using Mohr's circle method. 8

b) A list operated by three ropes each having 28 wires of 1.4 mm diameter. The cage weight 1.2 kN & the weight of the rope is 4.2 N/m length. Determine the maximum load carried by lift if each wire is 36 m long & the list operates.

i) Without any drop of load.

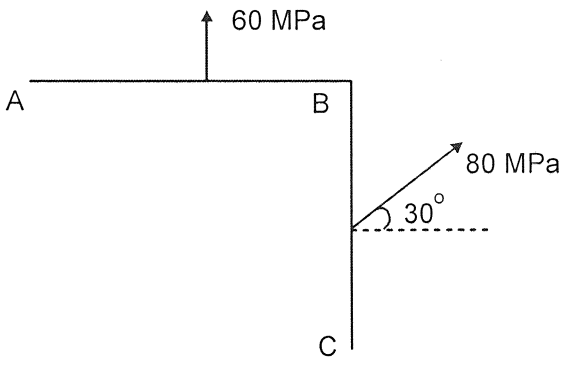
ii) With a drop of 96 mm of the load during operational Erope = 72 GPa Allowable stress = 115 MPa. 10

c) The resultant stress on a plane at a point in a material under stress is 80 MPa inclined at 30° to the normal to the plane as shown. The normal component of stress on another plane at right angle to the first plane is 60 MPa. Determine

i) Resultant stress on second plane.

ii) The principle stresses and their planes.

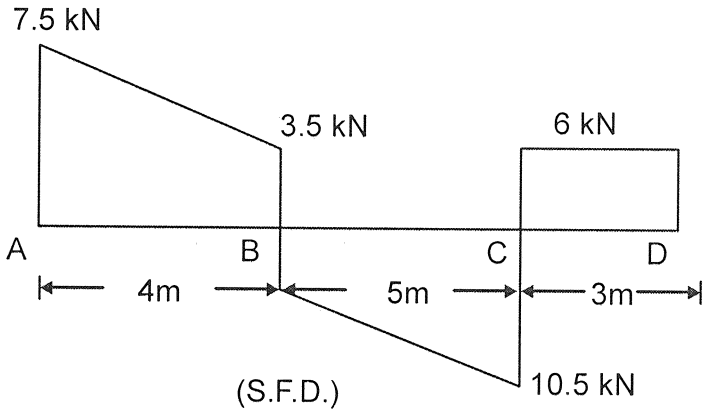
iii) The maximum shear stresses and their planes. 10



UNIT - III

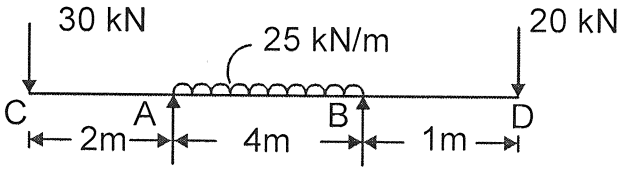
3. a) i) Define point of contraflexure. 2

ii) Draw load diagram & B. M. D. from the S.F.D. as shown in fig. 8



b) Derive the equation for slope and deflections for simply supported beam with uniformely distributed load over entire span. 10

c) Draw SFD and BMD for the loading as shown below. 10



UNIT - IV

4. a) A masonary chimney that is 20 m high tapers from 2.4 m external diameter at the base to 1.6 m diameter at top. The weight of the chimney is 1200 kN. Determine the uniform horizontal wind pressure so that no tension occurs at the base. 10

b) A cast-iron bracket of I - section has its top flange 200 mm x 40 mm, bottom flange as 120 mm x 40 mm and web as 300 mm x 40 mm. The over all depth is 380 mm. The bracket is subjected to bending. If the maximum tensile stress in the top flange is not to exceed 15 MPa, determine the bending moment that the section can take. If the beam is subjected to shear force of 150 kN. Sketch the stress distribution over the depth of the section. 10

c) i) Explain middle third rule for circular sections. 2

ii) A short column of rectangular section 160 mm x 120 mm carries a load of 200 kN. The load point is at a point 40 mm from longer side and 70 mm from shorter side. Determine the maximum tensile & compressive stresses in the section. 8

UNIT - V

5. a) Derive the relation for circular shaft when subjected to torsion. 10

$$\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{L}$$

b) A closed cylindrical vessels mode up of steel plates 4mm thick with plane ends, carries fluid pressure $3N/mm^2$. The diameter of the cylinder is 25 cm and length is 75 cm. Calculate longitudinal & hoop stresses in the cylinder wall and determine the change in diameter, length and volume of cylinder.

Take $E = 2.1 \times 10^5 N/mm^2$, and $\mu = 0.286$. 10

c) i) Define Polar modulus for solid & hollow shaft. 2

ii) The outer and inner diameter of hollow shafts are 120mm & 60 mm respectively. The shaft transmits 800 kw at a speed of 400 rpm while an end thrust of 70 kN acts on the shaft. Determine the bending moment which can safely applied if the maximum permissible stress does not exceed 80 MPa. 8

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