B.E.(with Credits)-Regular-Semester 2012 - Mining Engineering Sem IV

MN405 - Strength of Material

P. Pages : 3 **GUG/W/16/3932**

Time : Three Hours * 4 0 4 7 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Answer all questions.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Non programmable calculator is allowed.

1. a) Derive the expression for girth stress in thin walled pressure vessels. **6**

b) A cylindrical steel pressure vessel 400 mm in diameter with a wall thickness of 20 mm, is subjected to an internal pressure of $4.5\,MN/m^2$ i) Calculate the tangential and longitudinal stresses in the steel, ii) To what value may the internal pressure be increased if the stress in the steel is limited to $120\,MN/m^2$. **10**

OR

2. a) Draw the comparative stress Strain behaviour for concrete, Aluminium, cast iron, and High carbon steel. How do you determined yield strength by offset method? **8**

b) A uniform bar of length L, cross sectional are A, and unit mass e, is suspended vertically from one end. Show that it's total elongation is $\delta = eg\,L^2/2E$. If the total mass of the bar is M, show also that $\delta = Mg\,L/2\,AE$. **8**

3. a) Derive the expression for principal stresses when the element is subjected to biaxial stresses along with Tangential stresses on oblique plane with angle θ. **6**

b) A state of stress is specified in fig. 3 b. Determine the normal and sharing stresses on i) The principal planes (ii) The planes of maximum in-plane shearing stress and (iii) The planes whose normals are at + 36.8º and +126.8º with x-axis show the results on complete sketch **10**

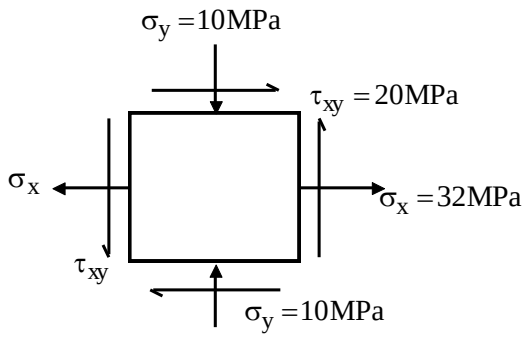


Fig. 3 (b)

OR

4. a) Derive the formula of Torsion with all suitable assumptions. **6**

b) A 5m steel shaft rotating at 2Hz has 70kw applied at a gear that is 2m from the left end where 20 kw are removed. At the right end, 30 kw are removed and another 20kw leaves the shaft at 1.5m from the right end i) Find the uniform shaft diameter so that the shearing stress will not exceed 60 MPa. Use G = 83 GPa. **10**

5. Cantilever beam acted upon by a uniformly distributed load and a couple as shown in figure 5. Draw shear force and bending moment diagrams. Locate point of contra flexure if any and write the maximum value of B.X. **16**

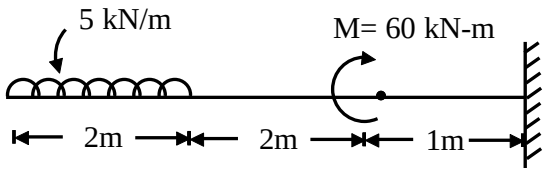


Fig. 5

OR

6. Prepare the load diagram and then draw Bending moment diagrams from the following shear force diagram (fig. 6) **16**

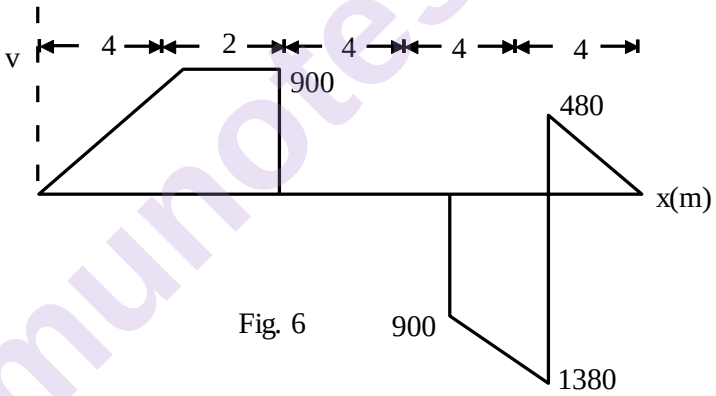


Fig. 6

7. a) Derive the formula of flexural stress with suitable assumptions. **4**

b) A cantilever beam, 50 mm wide by 150 mm high and 6 m long, carries a load that varies uniformly from zero at the free end to 1000 N/m at the wall. Compute (i) The magnitude and location of the maximum flexural stress, (ii) Determine the type and magnitude of the stress in a fiber 20mm from the top of the beam at a section 2 m from the free end. **12**

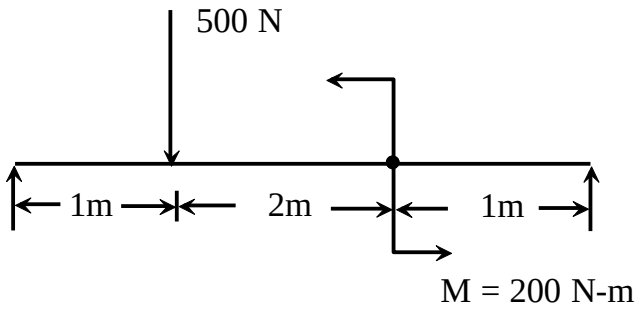
OR

8. a) Derive the formula for horizontal shear in beam. **4**

b) Write short notes on : **6**
i) Grouting
ii) Shotcreting.

c) A Timber beam 80mm wide by 160mm high is subjected to a vertical shear V = 40 kN. Determine the shearing stress developed at layers 20 mm apart from top to bottom of the section. **6**

9. Find the value of $EI\delta$ at the point of application of the 200 N-m. couple as shown in fig. where will be the maximum deflection of the beam. **16**



OR

10. a) Derive the equation of the critical load for long columns using Euler's formula. What are its limitations. **6**

b) A 50mm by 100mm timber is used as a column with fixed ends. Determine the minimum length at which Euler's formula can be used if E = 10 GPa and the proportional limit is 30 MPa. What central load can be carried with a factor of safety of 2 if the length is 2.5m? **10**

****