

Total No. of Printed Pages:2

S.E.(Mining) (Semester- III) (Revised Course 2007-08)
EXAMINATION MAY/JUNE 2019
Mechanics of Solids

[Duration : 3 Hours]

[Total Marks : 100]

Please check whether you have got the right question paper.

Instruction :

1. Answer ANY FIVE questions at least ONE from EACH MODULE.
2. MISSING data, if any may be suitable ASSUMED
3. Illustrate your answers with figures wherever required
4. Figures to RIGHT indicate FULL marks.

MODULE-I

- Q.1 A) A 550mm long round bar of copper has a diameter of 30mm over a length of 200mm, diameter of 20mm over a length of 200mm and diameter of 10mm over its remaining length. Determine the stresses in each section and total elongation of the rod when it is subjected to a pull of 30KN. 10
 Take $E=100\text{KN/mm}^2$
- B) A circular bar rigidly fixed at its both ends uniformly tapers from 90mm from one end to 60 mm at the other end. If its temperature is raised through 26K what will be the maximum stress developed in the bar. Take E as 200 GPa and α as $12 \times 10^{-6}/K$ for the same bar material. 10
- Q.2 An element in a strained body is subjected to a tensile stress of 100MPa and a shear stress of 30 MPa tending to rotate the element in the anticlockwise direction. Using Mohr's circle find : 20
- i) The magnitude normal and shear stress on a section inclined at an angle of 30° with the tensile stress.
 - ii) The maximum shear stress on the element.
- Solve and also co-relate your answers with purely analytical method of analysis.

MODULE-II

- Q.3 A timber beam of rectangular section supports load of 20 KN uniformly distributed over a span of 3.6m. If the depth of the beam section is twice the width and maximum stress is not to exceed 7 MPa find the dimensions of the beam section. Also draw the shear force and bending moment diagram for the beam. 20
- Q.4 A) Derive an expression for distribution of shearing stress over a depth of triangular cross section of a beam 10
 A beam of triangular cross section having base width of 90mm and height 110mm is subjected to a shear force of 20 KN. Find the value of maximum shear stress and sketch the shear stress distribution along the depth of beam.

- B) A leaf spring is to be made of six steel plates 60mm wide and 7mm thick. Calculate the length of the spring so that it may carry a central load of 2000N, the stress being limited to 150N/mm^2 . Calculate also the deflection at the centre of the spring. Take $E = 2.1 \times 10^5 \text{N/mm}^2$ 10

MODULE-III

- Q.5 State the assumptions made for shear stress in circular shaft subjected to Torsion. 20
A solid circular shaft of 100mm diameter is required to transmit 150 KW at 100 r.p.m if the angle of twists not to exceed 2° , find the length of the shaft Take modulus of rigidity for the shaft material as 90GPa.
- Q.6 A) Show that for a column of length l , fixed at both ends and subjected to an axial compressive load P , the critical load is given by the relation 10
$$P = 4\pi^2 EI/l^2$$
- B) A close coiled helical spring is to have a stiffness of 4N/mm of compression under a maximum load of 140N and a maximum shearing stress of 130N/mm^2 . The solid length of the spring when the coils are touching is to be 60 mm. Find the diameter of the wire, the mean diameter of the coils and the number of coils required. 10

MODULE-IV

- Q.7 A) The stress induced in a member under suddenly applied load is twice that of gradual loading. Justify 10
- B) Use Castigliano's theorem to determine the deflection at the midpoint of simply supported beam of length l with point load W at mid span. 10
- Q.8 A) Discuss over the importance of theories of failure. Which theories of failure are best suited for brittle materials and why? 10
- B) A cylindrical shell made of mild steel plate and 2m in diameter is to be subjected to an internal pressure of 2MN/m^2 . If the material yields at 200MN/m^2 calculate the thickness of the plate on the basis of the following three theories assuming a factor of safety 3 in each case 10
- Maximum principal stress theory
 - Maximum shear stress theory and
 - Maximum shear strain theory.