

Total No. of Printed Pages:2

S.E. (Mining) (Sem-III) (Revised Course 2016-2017)
EXAMINATION Nov/Dec 2019
Mechanics of Solids

[Duration : Three Hours]

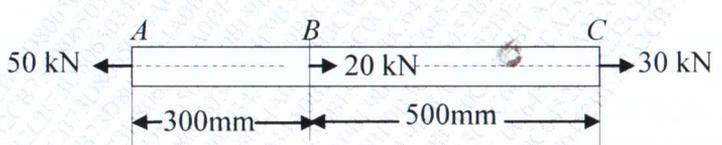
[Total Marks : 100]

Instructions:

1. Answer **FIVE** questions. At least **TWO** from **PART – A**, **TWO** from **PART – B** and **ONE** from **PART – C**.
2. **MISSING** data, if any may be suitably **ASSUMED**.
3. Illustrate your **answers** with **figures** wherever required.
4. Figures to **right** indicate **full marks**.

PART – A

Answer **ANY TWO** questions.

- | Question No. | | Marks |
|--------------|---|-------|
| Q 1 | (A) A Steel rod 2 m long and 30mm × 30mm in cross-section is subjected to a tensile force of 50 kN. Determine the elongation of the rod, if modulus of elasticity for the rod material is 100 GPa. | (10) |
| | (B) A steel bar of cross-sectional area 300mm ² is loaded as shown in Figure 1. Find the change in length of the bar. Take E as 200 GPa. | (10) |
| |  | |
| | Figure 1. | |
| Q 2 | The stresses at a point of a machine component are 150 MPa and 50 MPa both tensile. Using Mohr's circle find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55° with the axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component. Solve and also co-relate your answers with purely analytical method of analysis. | (20) |
| Q 3 | (A) A rectangular beam 80mm wide and 200mm deep is simply supported over a span of 9m. The beam is subjected to a uniformly distributed load of 5kN/m. Draw the shear force and bending moment diagram for the beam. Also determine the maximum bending stress induced in the beam. | (10) |
| Q 3 | (B) A leaf spring 1 m is made up of plates each 50mm wide and 10mm thick. If the bending stress in the plates is limited to 100 MPa, how many plates are required to enable the spring to carry a central point load of 2 kN? If the modulus of elasticity for the spring | (10) |

material is 200GPa, what is the deflection under this load?

PART – B

Answer **ANY TWO** questions of the following.

- Q 4 (A) State the assumptions for Shear stress in circular shaft subjected to Torsion. (10)
Calculate the maximum torque that a shaft of 125 mm diameter can transmit, if the maximum angle of twist is 1° in a length of 1.5 m. Take $C=70$ GPa.
- Q 4 (B) A closely coiled helical spring of round steel wire 5 mm in diameter having 12 complete coils of 50 mm mean diameter is subjected to an axial load of 100 N. Find the deflection of the spring and the maximum shearing stress in the material. Take Modulus of Rigidity (C) for the material = 80 GPa. (10)
- Q 5 What is the need for studying various theories of failure? Name the various theories of failure and explain any one in detail. (20)
- Q 6 (A) Find the maximum torque that can be safely applied to a shaft of 80 mm diameter. The permissible angle of twist is 1.5° in length of 5 m and Shear stress not to exceed 42 MPa. Take $C=84$ GPa. (10)
- Q 6 (B) State the assumptions made in the Euler's Column Theory. (10)
A Steel rod 6 m long and of 50mm diameter is used as a column, with one end fixed and the other end free. Determine the crippling load by Euler's formula. Take E as 200GPa.

PART – C

Answer **ANY ONE** question of the following.

- Q 7 (A) For a given stress, compare the moments of resistance of a beam of a square section, when placed (10)
i) With its two sides horizontal and
ii) With its diagonal horizontal
- Q 7 (B) A cylindrical shell, of a Boiler, 1.3m diameter is made up of 18mm thick plates. Find the circumferential and longitudinal stress in the plates, if the Boiler is subjected to an internal pressure of 2.4 MPa. Take efficiency of the joints as 70%. (10)
- Q 8 (A) Derive an expression for distribution of shearing stress over a depth of rectangular cross section of a beam. (10)
A Wooden beam of, 150mm wide, 250mm deep and 4m long, is carrying a uniformly distributed load of 40 KN/m. Determine the maximum shear stress and sketch the variation of shear stress along the depth of the beam.
- (B) Compare the ratio of the strength of a solid steel column to that of a hollow column of the same cross sectional area. The internal diameter of the hollow column is $\frac{3}{4}$ of the external diameter. Both the columns have the same length and are pinned at both ends. (10)