

Paper ID [ME202]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem.- 4th)

STRENGTH OF MATERIALS - II (ME-202/204)

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

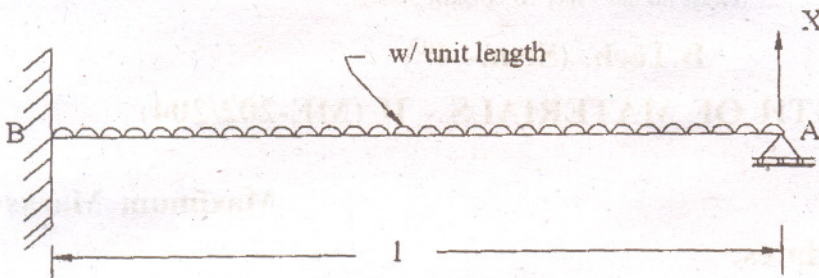
(10 × 2 = 20)

- a) Discuss what is 'Fictitious Load Method'.
- b) Sketch the diagram showing the distribution of normal stress in the curved beam. (Draw only diagram).
- c) Define strain energy.
- d) Name the theories of failures that can be used for brittle fracture.
- e) Explain Maxwell-Betti's Theorem.
- f) Write the expression for strain energy in flat spiral spring.
- g) What is the nature of stress at the inside of a crane hook.
- h) Write Lamé's equation.
- i) What are the basic differences between the closed and open helical spring.
- j) Where is the maximum radial stress in a solid rotating circular disc?

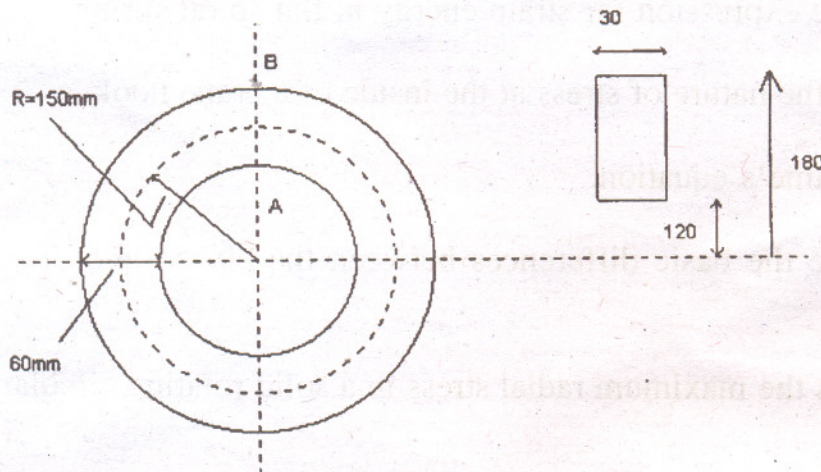
Section - B

(4 × 5 = 20)

- Q2)** Using the Castigliano's theorem, determine the reaction X at the end, A of the cantilever shown in Fig below.



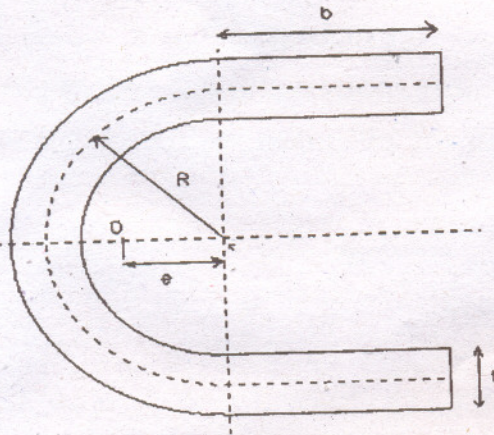
- Q3)** Consider a bolt of radius r which is subjected to a bending moment 100Nmm and torque of 200Nmm . Calculate the value of radius using minimum of three theories of failures.
- Q4)** An axial load of 20N is supported on an open helical spring of 10 no. of turns with mean 200mm made from 10mm rod. Calculate axial deflection, axial twist and twist about horizontal axis.
- Q5)** A flat steel turbine disk of 50 mm outside diameter and 10 mm inside diameter rotates at 2000 rpm . At this speed the blades and shrouding causes a tensile rim loading of 50 N/mm^2 . The maximum stress at this speed is 200 N/mm^2 . Let $E = 200 \times 10^5\text{ N/mm}^2$. Calculate the maximum shrinkage allowance on the diameter when the disk and the shift are rotating.
- Q6)** A steel ring of 300 mm mean diameter has a rectangular cross-section with 60mm in radial direction & 30mm perpendicular to the radial direction (shown in figure below). If the maximum tensile stress is limited to 120 N/mm^2 , find the tensile load that can be applied on the ring.



Section - C

(2 × 10 = 20)

- Q7) A cylinder of 12mm internal diameter & 20mm external diameter is strengthened by shrinking other cylinder on it. The inside diameter of this cylinder which is shrunk is originally 19.25 mm. Compute the value of external diameter of outer cylinder so as the contact pressure between the two cylinders after shrinkage is 300 N/mm^2 . Take $E = 2.2 \times 10^6 \text{ N/mm}^2$
- Q8) For the section shown below, find the position of shear center from the center of radius, shown in the figure given below.



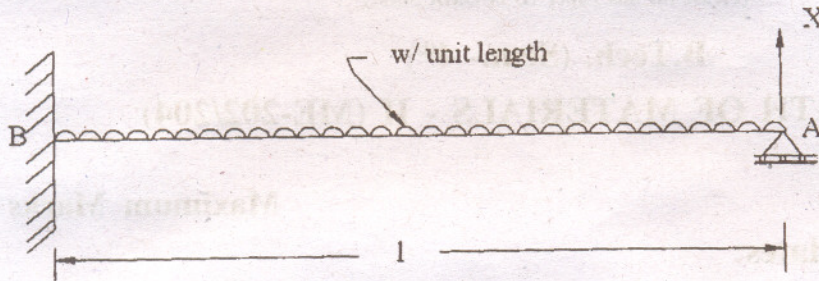
- Q9) Derive the Winkler-Bach formula to calculate the stress in a curved beam subjected to bending.



Section - B

(4 × 5 = 20)

Q2) Using the Castigliano's theorem, determine the reaction X at the end, A of the cantilever shown in Fig below.



Q3) Consider a bolt of radius r which is subjected to a bending moment 100Nmm and torque of 200Nmm . Calculate the value of radius using minimum of three theories of failures.

Q4) An axial load of 20N is supported on an open helical spring of 10 no. of turns with mean 200mm made from 10mm rod.

Calculate axial deflection, axial twist and twist about horizontal axis.

Q5) A flat steel turbine disk of 50 mm outside diameter and 10 mm inside diameter rotates at 2000 rpm . At this speed the blades and shrouding causes a tensile rim loading of 50 N/mm^2 . The maximum stress at this speed is 200 N/mm^2 . Let $E = 200 \times 10^5\text{ N/mm}^2$. Calculate the maximum shrinkage allowance on the diameter when the disk and the shift are rotating.

Q6) A steel ring of 300 mm mean diameter has a rectangular cross-section with 60mm in radial direction & 30mm perpendicular to the radial direction (shown in figure below). If the maximum tensile stress is limited to 120 N/mm^2 , find the tensile load that can be applied on the ring.

