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**INSTITUTE OF TECHNOLOGY AND MANAGEMENT**

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

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II B.Tech I Sem Supply End Examination, October 2021

**MECHANICS OF SOLIDS**

(MECH)

**Time: 3 Hours.**

**Max. Marks: 70**

Note: 1. Answer any FIVE questions.

2. Each question carries 14 marks and may have a, b as sub questions.

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|---|----|---|----|-----|-----|
| 1 | a) | Derive an expression for strain energy stored in a body when the load is applied with an impact   | 7M | C01 | BL6 |
|   | b) | A straight bar 550mm long is 28 mm diameter for 320 mm length and 18 mm diameter for the remaining length. If the bar is subjected to an axial pull of 25 kN, find the extension of the bar. Take $E = 200$ Gpa   | 7M | C01 | BL3 |
| 2 | a) | Define the principle of superposition, saint venant's principle and factor of safety and what is its utility.   | 7M | C01 | BL1 |
|   | b) | Draw the shear force and bending moment diagram for a simply supported beam of length 9 m and carrying a uniformly distributed load of 10KN/m for a distance of 6 m from the left end. Also, calculate the maximum bending moment on the section.   | 7M | C01 | BL3 |
| 3 | a) | What are the types of beams? Explain in detail with neat sketch   | 7M | C02 | BL4 |
|   | b) | A beam of length 12 m has overhanging of 3 m on left and right leaving the span between the supports of 6 m. It carries UDL of 8 kN/m over the entire length and a concentrated load of 10 kN at the right extreme end. Draw SF and BM diagrams and find the point of contra flexure point. | 7M | C02 | BL3 |
| 4 | a) | What do you mean by simple bending? What are the assumptions made in the theory of simple bending?  | 7M | C03 | BL1 |
|   | b) | Show from first principles that if a beam of rectangular section is subjected to a transverse shearing force, the maximum shear stress at a cross-section is 1.5 times the mean shear stress  | 7M | C03 | BL3 |
| 5 | a) | A cantilever beam of 2 m long is loaded with a uniformly distributed load of 3 kN/m run over a length of 1 m from the free end. It also carries a point load of 5 kN at a distance of 1.5 m from the free end. Draw the S.F and B.M   | 7M | C02 | BL3 |
|   | b) | Establish the relation to find the shear stress across sections of<br>1) Circular section 2) I section.<br>What is the maximum value in each case.  | 7M | C03 | BL4 |

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|---|----|---|----|-----|-----|
| 6 | a) | Define and explain the following theories of failure. i) Maximum principal stress theory ii) Maximum Principal strain theory  | 7M | CO4 | BL4 |
|   | b) | A point in a strained material is subjected to mutually perpendicular stresses of 40 N/mm <sup>2</sup> (tensile) and 20 N/mm <sup>2</sup> (compressive). It is also subjected to a shear stress of 20 N/mm <sup>2</sup> . Draw Mohr's circle and find the principal stresses and maximum shear stress | 7M | CO4 | BL3 |
| 7 | a) | Explain with reasons which theory of failure is best suited for i) Ductile materials and ii) Brittle materials.   | 7M | CO4 | BL4 |
|   | b) | A cylindrical shell is subjected to internal fluid pressure. Find an expression for change in diameter and change in length of the cylinder?  | 7M | CO5 | BL3 |
| 8 | a) | A solid circular shaft of diameter 100mm has the angle of twist in a length of 2.5m, when the shaft is subjected to a torque of 12 kN-m. Find the maximum shear stress and angle of twist. Take $G = 85 \text{ GPa}$  | 7M | CO5 | BL3 |
|   | b) | A spherical shell of 1.5 m diameter is subjected to an internal pressure of 1.45 N/mm <sup>2</sup> . Taking the maximum allowable stress as 110 N/mm <sup>2</sup> , find the necessary thickness of plate. Take the joint efficiency at 71%.  | 7M | CO5 | BL3 |

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