F 3067 (Pages : 2) Reg. No..............................

Name..................................

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering/Production Engineering

PE 010 503
ME 010 503 } ADVANCED MECHANICS OF MATERIALS (ME, PE)

(Regular—New Scheme)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. Distinguish between Stress vector and Stress tensor.
2. Give an example for plane strain problems.
3. What are thick cylinders ? Write one of their applications.
4. What do you mean by "strain energy due to torsion" ?
5. State the importance of shear flow in beams.

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. What are stress invariants and strain invariants ? Explain.
7. State and explain Saint Venant's principle.
8. Which are the parameters used to identify the effects of stress concentration ? Explain.
9. Derive reciprocal relations. State Maxwell reciprocal theorem. Discuss its limitations.
10. How will you find torsion effect in a solid bar of non-circular cross-section ? Give a standard methodology.

(5 × 5 = 25 marks)

Part C

Each question carries 12 *marks.*

11. Derive and explain all the constitutive equations. Explain the generalized Hooke's law. Discuss how these relations can be used to deduce expressions for plane stress conditions.

Or

12. Derive all the relations between elastic constants in solid mechanics. How are they useful in simplifying problems in elasticity ?

Turn over

13. Define Airy's stress function. Discuss how this function can be applied using polynomial method for finding solutions to 2-D plane strain problems.

Or

14. A horizontal cantilever 2 m. long is loaded at the free end by a vertical load of 2 kN. The cross-section of the cantilever is of angle section 15 cm. × 10 cm. × 1.2 cm. and is arranged in such a way that shorter leg is horizontal. If the load passes through shear centre of the angle, determine the maximum tensile and compressive stresses in the section.

15. Derive expressions for stresses and strains in rotating discs. State and discuss all the assumptions made.

Or

16. Explain :

    (i) Unsymmetrical bending. (6 marks)

    (ii) Curved beams with circular cross-section. (6 marks)

17. With necessary assumptions, derive the expressions for evaluation of stresses using (i) Castigliano's first theorem and (ii) Castigliano's second theorem. Give any *three* practical applications.

Or

18. A flat ribbon spring steel 3.2 mm. wide and 0.5 mm. thick is wound round a cylinder 50 mm. dia. Find the maximum stress and energy stored in ribbon per metre length of ribbon. Take E = 220 GPa.

19. With neat sketches and assumption, derive the torsional formula for any two thin walled open sections.

Or

20. Explain :

    (i) Prandtle's method. (6 marks)

    (ii) Torsion for circular bars. (6 marks)

[5 × 12 = 60 marks]