G 1034 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2016

Sixth Semester

Branch : Mechanical Engineering

MECHANICS OF MATERIALS (M)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. What is Saint Venant's principle ?
2. Briefly explain the significance of boundary conditions.
3. Differentiate between "stress invariant" and "strain invariant".
4. How will you determine principal strain ?
5. State the application of determining strain components in polar co-ordinates.
6. Sketch and briefly explain any *two* cases of symmetrical stress distribution.
7. Write a note on long cylinders.
8. How will you determine stress distribution in a spherical shell ?
9. Sketch and explain the various loads, stresses and reactions in a c-clamp.
10. Derive an expression for strain energy for a curve beam.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each question carries 12 *marks.*

11. What is a "stress function" ? Discuss its importance. Derive the compatibility equations for stresses and strains.

Or

12. A bar of length 25 cm. has varying cross-section. It carries a load of 14 kN. Find the extension if the cross-section is given by $(6 + x^2/100)$ cm.^{2}, where x is the distance from one end in cm. Take E = 200 GPa (neglect weight of bar).

Turn over

13. The principal stresses at a point in a material are 40 MN/m^2 tensile and 60 MN/m^2 compressive. Calculate the normal, shear and resultant stresses on a plane at 30° with the plane of the given tensile normal stress.

Or

14. Derive the relations between (i) Volumetric strain and principal strains ; (ii) Volumetric strain and principal stresses ; and (iii) Elastic constants (E, G, K and μ).

15. Derive the expressions for all the strain components in polar co-ordinates. Discuss their effect on an isotropic material.

Or

16. Determine the stress at inner radius due to centrifugal force in a rotor having an outer radius of 66 cm. with a radius of 10 cm. for the inner hole. The rotor is cut by slots 26 cm. deep at its periphery for winding which has the same mass as the mass of the material removed. The rotor revolves at 1800 r.p.m. Take $\mu = 0.3$ and $\rho = 7500$ kg./$m.^3$

17. A compound cylinder is made of two tubes shrunk on each other, with outer diameter as 20 cm., inner diameter as 10 cm., and common diameter as 15 cm. Find the pressure at the common surface due to shrinkage if the hoop stress at the inside of the outer tube is to be equal to the hoop stress at the inside of the inner tube under an internal pressure of 1000 bar. What is the maximum hoop stress ?

Or

18. A steel hub with external radius 12.5 cm. and internal radius of 7.5 cm. is shrunk on a steel shaft with internal radius 7.505 cm. Find the maximum hoop stress in the hub, contact pressure and the final radius of the surface in contact. Take E = 200 GN/m^2 and $\mu = 0.25$.

19. From fundamentals, derive an expression for bending stress for curved beams of large curvature.

Or

20. A beam of square section is subjected to uniform bending moment 660 N-m. If the cross-section of the beam is 4 cm. × 4 cm., find for each of the following cases, the maximum tensile and compressive stresses in the section :

    (i) The beam is straight.

    (ii) The beam is curved to a radius of 20 cm. along the centroidal axis and bending moment increases the curvature.

(5 × 12 = 60 marks)