C

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION

Mechanical Engineering

(Machine Design)

04ME 6505 Advanced Mechanics of Solids

Max. Marks: 60 Duration: 3 Hours

Part A *(8x3=24 marks)*

1. Define stress at a point
2. Explain the concept of Principle Stress and Principle strain
3. Write Short note on Saint Venants Principle
4. What are the assumptions of Contact stresses
5. Differentiate between symmetrical bending and unsymmetrical bending
6. Explain the concept membrane Analogy
7. Explain the difference between strain hardening and work hardening
8. Explain Creep

Part B *(6x6=36marks)*

9. Define Hydrostatic state of stress

Or

10. Explain the concept of stress Invariants

11. The state of stress at a point wrt x, y and z – axis are given as σ_x = 4 kN/m^2; σ_y = 0 kN/m^2; σ_z = 5 kN/m^2; τ_{xy} = 3 kN/m^2; τ_{yz} = -2 kN/m^2; τ_{zx} = -3 kN/m^2. If a new set of axis x', y', z' is formed by rotating x,y,z through 60^0 about the z axis, find the new stress tensor.

Or

12.(a) Explain 3D Mohr's Circle.(3marks)
(b) What is Strain Energy.(3marks)

Or

13. Investigate whether the following polynomial is permissible as an Airy's stress function ϕ = A(xy^2-3/4xyh^3).If permissible, derive the expressions for stress components.

Or

14.Explain the use of polynomials in the solutions to problems in Elasticity.

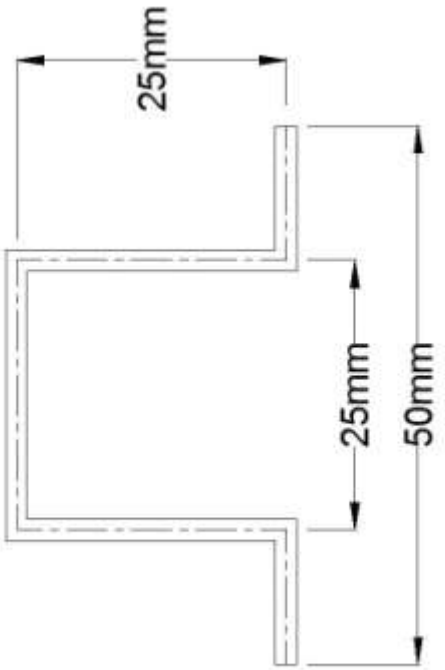
15. Two semi-circular disks are made of steel (E_1= E_2=200GPa & ν_1= ν_2=0.29).The radii of curvature of the two surfaces at the point of contact are R_1=60mm & R'_1=130mm, R_2=80mm

& R'_2=200mm.The angle α between the planes of minimum curvature is π/3 rad. If the load P=4.5kN, determine the maximum principal stress, maximum shear stress & maximum octahedral shear stress in the disks & state the location of the point where each of these stresses occur.

Or

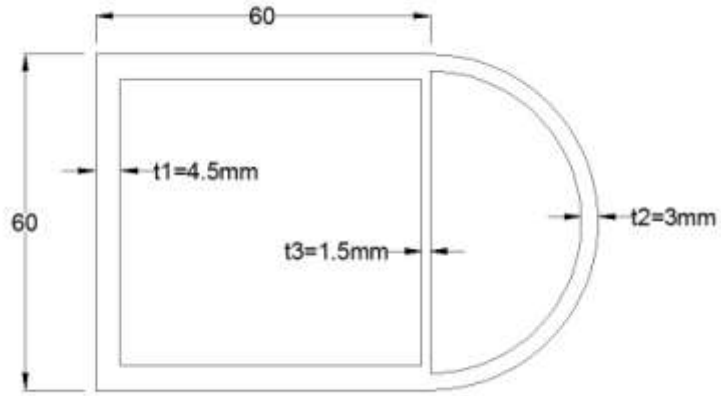
16.A steel railway car wheel may be considered as a cylinder with a radius of 440mm. The wheel rolls on a steel rail whose top surface may be considered another cylinder with a radius of 330mm. For the steel wheel & steel rail, E=200GPa, ν=0.29 & Y=880MPa. If the wheel load is 110kN, determine σ_{max}, τ_{max}, $\tau_{oct(max)}$,$2\tau_0$ & the factor of safety against initiation of yielding based on maximum shear stress criterion.

17. Locate the shear centre for the beam cross-section shown in figure. The walls of the cross-section have constant thickness t=2mm.



Or

18. A hollow thin wall torsion member has two compartments with cross-sectional dimensions as shown in figure. The material is an aluminium alloy for which G=26GPa. Determine the torque and unit angle of twist if the maximum shear stress at locations away from stress concentrations is 4oMPa.



19. What are the different yield criteria.

Or

20. Explain the different types of rheological models.