| Reg. No. | | | | | | | | | | | | | | | | |
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| Question Paper Code | 14029 |
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**M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**

Third Semester

**Mechanical Engineering**

**24PCDEL308 – ADVANCED MECHANICS OF MATERIALS**

Regulations - 2024

Duration: 3 Hours Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 1. | The ratio of stress to strain within elastic limit is known as<br>a) Modulus of rigidity b) Bulk modulus c) Young's modulus d) Poisson's ratio | 1 | K1 | CO1 |
| 2. | In a plane stress condition, which of the following stresses is zero?<br>a) σx b) σy c) τxy d) σz | 1 | K2 | CO1 |
| 3. | The shear center of a section is the point through which:<br>a) Bending stress is zero b) Shear stress is maximum<br>c) Load passes without twisting the section d) Deflection is minimum | 1 | K1 | CO2 |
| 4. | For a rectangular section, the shear center lies<br>a) At the centroid b) Above the centroid<br>c) Below the centroid d) Outside the section | 1 | K2 | CO2 |
| 5. | In a curved beam, the neutral axis<br>a) Coincides with the centroidal axis b) Lies closer to the inner fiber<br>c) Lies closer to the outer fiber d) Always at mid-thickness | 1 | K1 | CO3 |
| 6. | The deflection of a flat rectangular plate under uniform load is maximum at<br>a) Corner b) Edge c) Center d) Any point | 1 | K1 | CO3 |
| 7. | The torsional constant (J) for a rectangular section depends primarily on<br>a) Length and width b) Area and perimeter<br>c) Shape and dimensions of cross-section d) Material only | 1 | K2 | CO4 |
| 8. | In a thin-walled hollow tube the shear stress is assumed to be<br>a) Uniform along the wall thickness b) Zero at the center<br>c) Maximum at the outer surface d) Varying linearly | 1 | K2 | CO4 |
| 9. | Contact stress in line contact applications is generally calculated using:<br>a) Lame's equation b) Hertz's theory c) Hooke's law d) Rankine's theory | 1 | K1 | CO5 |
| 10. | In a rotating disc, tangential stress is also called<br>a) Hoop stress b) Shear stress c) Axial stress d) Bending stress | 1 | K1 | CO5 |

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 11. | What are boundary conditions in elasticity problems? | 2 | K1 | CO1 |
| 12. | Write the generalized Hooke's law for a linearly elastic isotropic material. | 2 | K1 | CO1 |
| 13. | Define shear center and state its importance. | 2 | K2 | CO2 |
| 14. | Distinguish between shear stress and shear flow. | 2 | K2 | CO2 |
| 15. | What are the boundary conditions commonly used for flat rectangular plates? | 2 | K1 | CO3 |
| 16. | What are the assumptions made in the analysis of curved beams? | 2 | K1 | CO3 |
| 17. | Define torsional rigidity. | 2 | K2 | CO4 |
| 18. | What is Prandtl's stress function? | 2 | K1 | CO4 |

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|---|---|---|---|---|---|
| 19. | State the assumptions made in the analysis of a rotating disc. | *2* | *K2* | *CO5* |
| 20. | What is Hertzian contact stress? | *2* | *K1* | *CO5* |
| 21. | Differentiate between solid disc and ring disc under rotation. | *2* | *K2* | *CO3* |
| 22. | Define tangential stress in rotating discs. | *2* | *K2* | *CO4* |

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

| | | | | | |
|---|---|---|---|---|---|
| 23. | a) | Derive the stress-strain relations and the generalized Hooke's law for a 3D Isotropic elastic body. | *11* | *K3* | *CO1* |
| | | **OR** | | | |
| | b) | Explain St.Venant's principle and discuss its engineering significance with suitable examples. | *11* | *K3* | *CO1* |
| 24. | a) | Derive the expression for location of shear center for a channel section. | *11* | *K3* | *CO2* |
| | | OR | | | |
| | b) | Determine the position of the shear centre for the channel section of 120mm x 120mm and 10mm thickness. | *11* | *K3* | *CO2* |
| 25. | a) | Determine the stresses in a crane hook with given dimensions and load at the tip. | *11* | *K3* | *CO3* |
| | | OR | | | |
| | b) | Explain the behavior of a closed ring subjected to (i) a concentrated load and (ii) a uniformly distributed load. | *11* | *K3* | *CO3* |
| 26. | a) | Derive the expression for bending stress in a curved beam and explain the location of the neutral axis. | *11* | *K3* | *CO4* |
| | | **OR** | | | |
| | b) | Determine the maximum shear stress and angle of twist for a rectangular bar under torque. | *11* | *K3* | *CO4* |
| 27. | a) | Derive the expressions for radial and tangential stresses in a rotating ring of uniform and varying thickness. Also, determine the allowable speed for the rotating disc. | *11* | *K3* | *CO5* |
| | | **OR** | | | |
| | b) | A hollow rotating disc (ring) is subjected to a specified angular velocity. Find the radial stress distribution. | *11* | *K3* | *CO5* |
| 28. | a) | At a point in a body, the stresses are: $\sigma x$ = 80 MPa, $\sigma y$ = 40 MPa, $\tau xy$ = 30 MPa. Determine: (a) The principal stresses and (b) The maximum shear stress. | *11* | *K3* | *CO1* |
| | | **OR** | | | |
| | b) | Derive the Relation Between the Elastic Constants: E, G, K, and $\nu$. | *11* | *K3* | *CO1* |