

Answer Key Ph.D. Entrance Test [Mechanical Engg MRSPTU]

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|-------|-------|
| 1. B | 31. A |
| 2. C | 32. D |
| 3. C | 33. A |
| 4. D | 34. C |
| 5. B | 35. A |
| 6. A | 36. D |
| 7. D | 37. A |
| 8. C | 38. C |
| 9. A | 39. B |
| 10. C | 40. C |
| 11. B | |
| 12. C | |
| 13. B | |
| 14. A | |
| 15. D | |
| 16. B | |
| 17. A | |
| 18. A | |
| 19. A | |
| 20. D | |
| 21. C | |
| 22. B | |
| 23. D | |
| 24. C | |
| 25. C | |
| 26. C | |
| 27. D | |
| 28. C | |
| 29. A | |
| 30. D | |

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Ph.D. Entrance Examination of MECHANICAL ENGG.

- Which of the following statements about eigenvalues and eigenvectors is correct?
 - An eigenvector is always orthogonal to its eigenvalue.
 - Eigenvectors of a symmetric matrix corresponding to distinct eigenvalues are orthogonal.
 - Every square matrix has real eigenvalues.
 - Eigenvalues are always positive.
- If $f(x)=x^3-3x+1$, and $f(x)$ satisfies the conditions of the Mean Value Theorem on the interval $[0,2]$, what is the value of 'c' where the theorem holds?
 - $c = 0.5$
 - $c = 1.5$
 - $c = 1$
 - $c = 2$
- The one-dimensional heat equation $\partial u/\partial t = k\partial^2 u/\partial x^2$ describes:
 - Conservation of mass.
 - Conservation of momentum.
 - Heat conduction in a rod.
 - Wave propagation in a string.
- The roots of the characteristic equation for the Cauchy-Euler equation $x^2[d^2y/dx^2] + 5x[dy/dx] + 6y=0$ are real and distinct. The general solution is:
 - $y=C_1x^m+C_2x^{m+1}$
 - $y=C_1x^2+C_2x^3$
 - $y=C_1x^{-2}+C_2x^{-3}$
 - $y=C_1x^{-1}+C_2x^{-2}$
- For a complex function $f(z)=u(x,y)+i\{v(x,y)\}$, where $z=x+iy$, the function is analytic if:
 - The Laplacian of u and v vanishes.
 - The partial derivatives of u and v satisfy the Cauchy-Riemann equations.
 - The gradient of u and v are orthogonal.
 - $f'(z)$ is non-zero everywhere in its domain.
- The Laurent series of a function $f(z)$ converges in which region?
 - Inside the annular region between two singularities.
 - The entire complex plane.
 - Only on the boundary of the annular region.
 - In a small region around a pole.
- In a Binomial distribution, the sum of probabilities of all possible outcomes is:
 - n
 - p
 - 0.5
 - 1
- The expectation (mean) of a random variable X is given by:
 - $\int Xdx$
 - $\sum P(X)$
 - $\sum XP(X)$ for discrete X .
 - $\sum X^2P(X)$
- Which of the following is an explicit single-step method for solving ordinary differential equations?
 - Euler's method
 - Backward Euler method
 - Trapezoidal rule
 - Gauss-Seidel method

10. Which of the following is true regarding riveting?
- Riveting is used for high-strength joints in thin materials
 - Riveting involves fusing the base materials with a filler metal
 - Riveting creates permanent joints that cannot be undone
 - Rivets are typically used for high-temperature joints
11. In the analysis of planar rigid body motion, the instantaneous center of rotation:
- Lies at the geometric center of the rigid body
 - Is a point on the body that has zero velocity at an instant of time
 - Is always at the fixed pivot of the body
 - Does not exist for pure translation
12. For a particle of mass m , moving with velocity v , under the action of a constant force F , the impulse-momentum relationship is given by:
- $mv^2 = 2F \cdot s$
 - $F = d(mv)/dt$
 - $F \cdot t = m(v_2 - v_1)$
 - $\Delta KE = F \cdot s$
13. In a rigid body planar collision, the coefficient of restitution 'e':
- Is the ratio of initial velocities along the line of impact
 - Is the ratio of final relative velocity to the initial relative velocity along the line of impact
 - Is always equal to one for perfectly inelastic collisions
 - Is determined only by the angle of impact
14. In a plane truss, a zero-force member is identified when:
- Two non-collinear members meet at a joint with no external load or support
 - Two collinear members meet at a joint with no external load or support
 - A joint is under equilibrium with multiple external forces
 - The truss is symmetric with respect to an axis
15. Poisson's ratio is defined as:
- The ratio of longitudinal strain to lateral strain
 - The ratio of shear stress to shear strain
 - The ratio of stress to strain in the lateral direction
 - The ratio of lateral strain to longitudinal strain
16. For a thin-walled cylindrical pressure vessel under internal pressure p , the hoop stress is given by:
- $pr/2t$
 - pr/t
 - $2pr/t$
 - pt/r
17. Bending stress in a beam is maximum:
- At the outermost fibers
 - At the neutral axis
 - At the centroid of the cross-section
 - Throughout the cross-section
18. The critical load for a column using Euler's formula is proportional to:
- $1/L^2$
 - L^2
 - L
 - \sqrt{L}
19. Which of the following is a typical advantage of abrasive jet machining over traditional machining processes?
- Ability to machine hard and brittle materials
 - High cutting efficiency
 - Better surface finish
 - Reduced tool wear

20. In a slider-crank mechanism, the crank rotates at a constant angular velocity. The maximum velocity of the slider occurs when:
- The crank is at the dead center
 - The crank makes an angle of 45° with the line of stroke
 - The crank and connecting rod are collinear
 - The crank and connecting rod are perpendicular
21. A slider-crank mechanism operates at a constant crank angular velocity of ω . If the crank length is r and the connecting rod length is l , the maximum acceleration of the slider occurs when the crank angle is:
- 0°
 - 90°
 - 180°
 - 270°
22. The comparators are used in metrology primarily for:
- Magnifying the measurements
 - Detecting small variations in dimension
 - Measuring large components
 - Aligning the machine tools
23. In vibration isolation, the transmissibility ratio is less than 1 when:
- $\omega/\omega_n < \sqrt{2}$
 - $\omega/\omega_n = 0$
 - $\omega/\omega_n = 1$
 - $\omega/\omega_n > \sqrt{2}$
24. Materials Requirement Planning (MRP) primarily aims to:
- Minimize inventory
 - Improve machine maintenance
 - Optimize the production schedule and inventory
 - Reduce labour costs
25. The S-N curve (Wohler curve) is used to represent:
- The relationship between stress and strain
 - The modulus of elasticity
 - The fatigue strength of materials
 - The material toughness
26. When designing a shaft, the primary concern under dynamic loading is:
- Torsional stress
 - Bending stress
 - Combined bending and torsion
 - Shear stress due to axial loading
27. In network flow models, a bipartite graph is commonly used to represent:
- Inventory levels in supply chain models
 - Nodes and edges in a transportation problem
 - Sources and sinks in a network
 - Tasks and workers in an assignment problem
28. The primary function of a flywheel in a mechanical system is to:
- Maintain a constant angular velocity
 - Absorb shock loads and dampen vibrations
 - Store rotational energy and smooth power transmission
 - Increase the speed of the engine

29. Which of the following is true about the CPM network?
- The total project duration is determined by the longest path through the network
 - Slack time is not considered in CPM
 - All activities have the same duration in the CPM network
 - The critical path can be changed during the project execution phase
30. In the case of viscous flow through pipes, the head loss due to friction is primarily influenced by:
- The density of the fluid
 - The temperature of the fluid
 - The velocity of the fluid and the pipe diameter
 - The viscosity of the fluid and the roughness of the pipe surface
31. In PERT, the variance of an activity is calculated using the formula:
- Variance = $\{(P-O)/6\}^2$
 - Variance = $\{(P-O)/4\}^2$
 - Variance = $\{(P-O)/2\}^2$
 - Variance = $\{(P-O)/3\}^2$
- where O is the optimistic time, and P is the pessimistic time.
32. The Thermal boundary layer is primarily dependent on which factor in fluid flow?
- Viscosity of the fluid
 - Surface roughness of the boundary
 - Thickness of the fluid layer
 - Temperature difference between the solid surface and the fluid
33. For radiative heat transfer, black bodies are characterized by:
- High emissivity and perfect absorption
 - High reflectivity and low emissivity
 - Low emissivity and perfect absorption
 - High emissivity and low absorption
34. In the Carnot cycle, which of the following statements is true?
- The Carnot cycle does not involve any heat exchange with the surroundings.
 - The Carnot cycle is irreversible and cannot be used for real engines.
 - The Carnot cycle operates between two temperatures, and it is always reversible.
 - The Carnot cycle is a thermodynamic process where work is not done.
35. The work done in a reversible isothermal expansion of an ideal gas is given by:
- $W = nRT \ln(V_2/V_1)$
 - $W = P(V_2 - V_1)$
 - $W = nRT (V_2 - V_1)$
 - $W = 0$
36. The riser in metal casting is designed to:
- Increase the cooling rate
 - Speed up the cooling process of the metal
 - Provide a path for the molten metal to enter the mold
 - Prevent defects due to shrinkage during solidification
37. In the extrusion process, the material:
- Is pulled through a die to form a continuous profile
 - Is hammered into the desired shape
 - Is compressed between two rolls
 - Is pressed through a mold by applying a force perpendicular to the material's surface

38. What is the primary purpose of quenching in heat treatment?
- a) To improve corrosion resistance
 - b) To reduce internal stresses
 - c) To increase the hardness of the material
 - d) To remove impurities from the metal
39. The Yield point in the stress-strain diagram refers to:
- a) The point at which the material fractures
 - b) The point at which plastic deformation begins
 - c) The point at which the material reaches its maximum strength
 - d) The point where the material is completely elastic
40. Which of the following forming processes is used for making small and intricate parts from sheet metal?
- a) Rolling
 - b) Extrusion
 - c) Deep drawing
 - d) Punching