ARYA COLLEGE OF ENGINEERING

CIVIL ENGINEERING DEPARTMENT

III Semester, B.Tech. (II Year), 2025-26

3CE3-04: ENGINEERING MECHANICS

GUESS PAPER

Chapter 1: Introduction to Mechanics

2-Mark Questions:

1. Define mechanics. Explain its scope.
2. What is the principle of transmissibility of forces?
3. State and explain the conditions of equilibrium.
4. What are the differences between conservative and non-conservative forces?

4-Mark Questions:

1. Explain the fundamental laws of mechanics with examples.
2. Derive the equation of equilibrium for a rigid body.
3. Discuss the concept of a free body diagram and its significance in solving problems.
4. State and explain Lami's Theorem with a simple application.
5. Two forces of 100 N And 150N are acting simultaneously at a point. What is the resultantof these two forces, if the angle between them is 45 degree?

10-Mark Questions:

1. Derive the conditions for equilibrium in both two-dimensional and three-dimensional systems of forces.
2. Explain the principle of transmissibility and its application to determine the resultant of multiple forces.
3. Four forces of magnitude P, 2P, 3/3p, and 4P are acting at a point O. The angles made by these forces with x - axis are 0°, 60°, 150°, and 300°, respectively. Find the magnitude and direction of the resultant force.

Chapter 2. Statics of Particles and Rigid Bodies

2-Mark Questions:

1. Define a couple and its significance in mechanics.

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GUESS PAPER

2. What is the moment of a force?
3. What are the equilibrium conditions for a rigid body?
4. What do you understand by the resolution of forces?

4-Mark Questions:

1. Discuss the equilibrium of a particle under concurrent forces.
2. Explain the method of resolving a force into a force and a couple.
3. State and explain the equilibrium conditions for a system of forces acting on a rigid body.
4. Explain the concept of the moment of a force about a point.

10-Mark Questions:

1. Derive the equation for the equilibrium of a rigid body under coplanar forces.

2. Explain the principles of force and couple, and solve a problem involving both.

Chapter 3: Plane Trusses

2-Mark Questions:

1. What is a truss and how is it classified?
2. Define zero-force members in a truss.
3. What are the different types of loads that act on trusses?
4. What is meant by the determinacy of a truss?
5. Define a perfect truss. Differentiate between perfect and imperfect trusses with suitable examples.

4-Mark Questions:

1. Explain the method of joints for solving a truss system.
2. Derive the condition for determinacy in a truss.
3. Explain the method of sections and solve a simple truss using this method.
4. Explain the method of sections and method of joints for plane truss.

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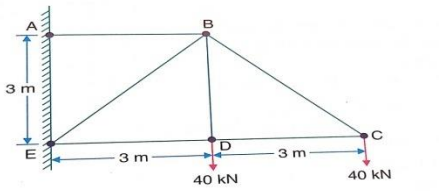
GUESS PAPER

10-Mark Questions:

1. Discuss the basic assumptions of truss analysis and solve a problem using the method of joints or method of sections.
2. Derive the necessary conditions for the stability and determinacy of plane trusses and solve a related problem.
3. Find the forces in all the members of the truss shown in fig.. Tabulate the results



Chapter 4: Centroid & Moment of Inertia (M.I.)

2-Mark Questions:

1. What is the centroid of a plane area?
2. State the perpendicular axis theorem.
3. What is the moment of inertia of a circle?
4. Define the polar moment of inertia

4-Mark Questions:

1. Derive the formula for the moment of inertia of a rectangle about its centroidal axis.
2. Explain the parallel axis theorem and provide an example.
3. What are the methods to calculate the moment of inertia for composite sections?

10-Mark Questions:

1. Derive the expression for the moment of inertia of a solid body (e.g., solid sphere or solid cylinder) and solve a problem using this formula.

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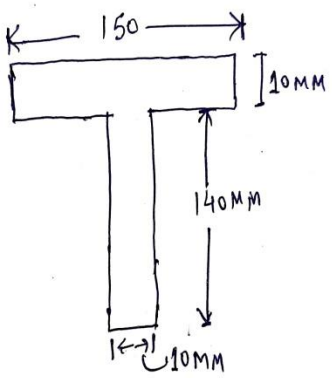
3CE3-04: ENGINEERING MECHANICS
GUESS PAPER

2. Calculate the centroid and moment of inertia for a composite area made of different geometric shapes.
3. Find the MOI for the given section.



4. Find MOI of I section.

Chapter 5: Virtual Work, Work, Energy, and Power

2-Mark Questions:

1. Define the principle of virtual work.
2. What is the difference between work and power?
3. Define kinetic energy of a rigid body.
4. What is the principle of conservation of energy?

4-Mark Questions:

1. Define the principle of virtual work.
2. What is the difference between work and power?
3. Define kinetic energy of a rigid body.
4. What is the principle of conservation of energy?

10-Mark Questions:

1. Discuss in detail the principle of virtual work and apply it to a problem in static equilibrium.

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CIVIL ENGINEERING DEPARTMENT
III Semester, B.Tech. (II Year), 2025-26
3CE3-04: ENGINEERING MECHANICS
GUESS PAPER

2. Derive the work-energy equation for a rigid body and solve a related numerical problem.

Chapter 6: Friction

2-Mark Questions:

1. Define the angle of friction.
2. What is the difference between static and kinetic friction?
3. What is meant by the angle of repose?
4. What is the law of friction?

4-Mark Questions:

1. Derive the equation for friction on an inclined plane.
2. Explain belt friction with an example.
3. Discuss the different types of friction and their applications.

10-Mark Questions:

1. Derive the equation for the frictional force acting on a body moving on a rough surface and solve a related numerical problem.

2. Discuss the concept of friction in mechanical systems, including applications like ladders and wedges.

Chapter 7: Springs
2-Mark Questions:

1. Define the stiffness of a spring.
2. What is the difference between springs in series and springs in parallel?
3. What are laminated plate springs?

4-Mark Questions:

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CIVIL ENGINEERING DEPARTMENT
III Semester, B.Tech. (II Year), 2025-26
3CE3-04: ENGINEERING MECHANICS
GUESS PAPER

1. Derive the formula for the stiffness of a spring in series and in parallel.
2. Explain the behavior of helical springs under axial loads.
3. Discuss the types of springs used in mechanical systems.
4. What is the difference between close coiled helical springs and open coiled helical springs.

10-Mark Questions:

1. Discuss in detail the various types of springs, including leaf springs, helical springs, and laminated springs, with their applications and behavior under loads.
2. Solve a problem related to the stiffness of springs in series and parallel, and calculate the equivalent spring constant.
3. 'A close coiled spring having radius " mm is manufactured from a wire having modulus of elasticity (E)=$2x10^5$ N/mm^2. If number of tums in the spring are 50 and diameter of wire is 10 mm, then find the stiffness of the spring. Also determine the load required to produce a deflection of 10 mm. Assume Poisson ratio as 0.3

Chapter 8: Simple Stresses and Strains

2-Mark Questions:

1. Define stress and strain.
2. What is Poisson's ratio?
3. Write the names of different types of friction..
4. What is Hooke's law for materials under stress?

4-Mark Questions:

1. Derive Hooke's law for uniaxial stress.
2. Explain the concept of complementary shear stresses.
3. Derive the relationship between elastic constants: Young's modulus, bulk modulus, and modulus of rigidity.

10-Mark Questions:

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1. Derive the expression for stress and strain in a thin-walled cylinder and solve a related problem.
2. Solve a numerical problem on stress and strain in a material under internal pressure using the concept of elastic constants.
3. A circular rod of diameter 16 mm and 500 mm long is subjected to a tensile force 40KN. The modulus of elasticity for steel is 200 KN/mm?.

Find.

i) Stresses.

ii) Strain.

iii) Elongation of the rod due to applied load.

4. Explain Stress - Strain Curve of mild steel in tension showing its all principal points.