31031- Engineering Mechanics

UNIT 1

PART – A (2 MARK)

1. Define Hardness.
2. Define force.
3. Define poission's ratio.
4. Define Stress.
5. Define Hooke's law.
6. Define Composite material.
7. Define tenacity and durability.
8. Define strain.
9. Define factor of safety.

PART – B (3 MARK)

10. Derive the elongation of bar due to self weight
11. Write the relationship between three elastic constant.
12. Explain the types of three elastic constant.
13. What are the advantages of composite material?
14. Youngs modulus for a material $2x10^5$ N/mm^2 and modulus of rigidity is 0.8N/mm^2. Find the bulk modulus.
15. Explain the mechanical properties.
16. Write the significance of percentage elongation and reduction area.

PART – C (10 MARK)

1. A steel flat 150mm wide, 20mm thick and 600mm long carries a pull of 300kN. Find the extension in length and the contraction in width thickness under the pull. Take Poisson's ratio as 0.3 and E=2x105 N/mm2. Calculate also the change in volume.
2. A cylindrical bar of 150mm diameter and 300mm long is increased by 0.12mm in length under an axial compression of 250kN. Compute the values of Young's modulus, poission's ratio and volumetric change.
3. A prismatic metal bar of rectangular section 14mmx8mm gets elongated to 1.2mm from its original length of 490mm while applying a tensile load of 30kN. Find the stress , strain and young's modulus of the bar.
4. Draw the stress – strain curve for ductile material and explain it
5. A steel bar of 500mm long. The two end portions are 32mm and 28mm in diameter and each end portion is 125mm long. The middle portion is 250mm long and 25mmx25mm square section. Calculate the maximum and minimum stresses induced and total elongation, if it carries an axial pull of 60kN. Assume E=200kN/mm^2.

6. A ceiling fan weighing 200N is hung at one end of a steel pipe of 20mm internal and 25mm external diameter and 2.5m length. If the specific weight of steel is 75000N/m^3. Calculate the total elongation of pipe.
7. A load of 3kN has to be lifted by a steel wire. To certain the strength of steel wire a 8mm steel bar of same materials was tested in tension. Testing machine and yield load was found be 12.375 kN. If the factor of safety is 1.65, find the diameter of the wire to be used to lift the load of 3kN.
8. The extension of a 20mm diameter metal bar on the application of an axial pull of 40kN is 0.2mm. If the observe axial strain is 1.273×10^{-3}. Calculate the initial length of the metal bar and also the modulus of elasticity of the metal.

UNIT 2

PART – A (2 MARKS)

1. What are the types of loads?
2. What are the types of Reaction?
3. What are the types of support?
4. What are the types of Reaction?
5. What are the types of beams?
6. Define point of contra flexure.
7. Define static equilibrium equation.

PART – B (3 MARKS)

8. Explain shear force and bending moment.
9. Explain the types of loads.
10. Explain the types of Reaction.
11. Explain the types of support.
12. Explain the types of Reaction.
13. Explain the types of beams.
14. Explain indeterminate and determinate Structure.

PART – C (10 MARK)

1. A SSB of 6m Span it has a self weight 4kN/m and point load of 20kN at a distance 2m from left and right side support. Draw a SFD & BMD and find the Maximum Bending Moment.
2. A Beam of length 8m is simply supported at 6m apart with 2m overhang on the right end. It carries an udl of 30kN/m over a length of 3m from the left support and a point load of 15kN at the right extreme end. Draw SFD and BMD.
3. A Cantilever beam of 6m span it carries a two point load of 10KN each at 2m and 4m from fixed end. And also Carries udl of 2kN/m over a length of 2m from free end. Draw the SFD and BMD
4. A SSB of 8m Span it has a point load of 20kN at a distance 2m from left and right side support and udl of 5kN/m placed in between the point loads. Draw a SFD & BMD and find the Maximum Bending Moment.
5. A Cantilever beam of 8m span it carries a three point load of 10KN each at 2m, 4m and 6m from the free end. Draw the SFD and BMD
6. A beam ABC of span 6m. A and B are simple support and point C over hang 2m from the right support. It carries a point load of 10kN at extreme end and udl of15kN/m of a span of AB. Draw SFD & BMD.
7. A Cantilever beam of 6m span it carries a two point load of 10KN each at 2m and 4m from free end. And also Carries udl of 2kN/m over a length of 2m from free end. Draw the SFD and BMD
8. A SSB of 8m Span it has a self weight 5kN/m and two point load of 20kN each at a distance 2m from left and right side support. Draw a SFD & BMD and find the Maximum Bending Moment.

9. A simply supported beam of 6m length is subjected to a udl of 20kN/m on the left half of the span in addition to a point load of 40kN at 2m from the right support. Draw SFD and BMD
10. Construct SF and BM diagrams for the cantilever of span 4m loaded with uniformly distributed load of 5kN/m throughout the span. Calculate the shear force and bending moment at every 1m.
11. A cantilever beam of span 'L' carries a udl of 'w'kN/m. Find the SFD and BMD.
12. A Simply supported beam span L acting a point load 'W' at the centre .Draw the SFD and BMD.

UNIT 3

PART – A (2 MARKS)

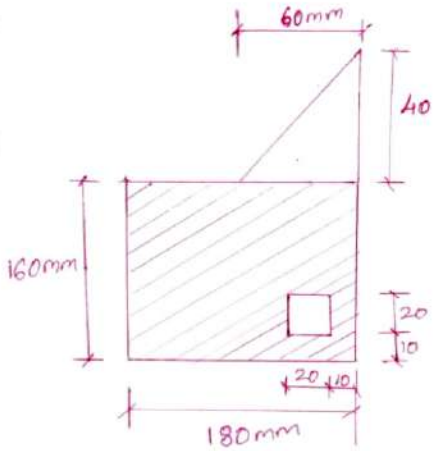
1. Define Center of gravity.
2. Define centroid.
3. Define moment of inertia.
4. Define Radius of curvature.
5. State the position of Centroid of rectangular Section.
6. State the position of Centroid of Z-Section.
7. Write the types of section

PART – B (3 MARKS)

8. State the parallel axis theorem.
9. State the perpendicular axis theorem.
10. State the position of symmetrical Section.
11. State the position of anti symmetrical Section.
12. State the position of Asymmetrical Section.
13. Explain the i) Section modulus ii) Polar moment of inertia

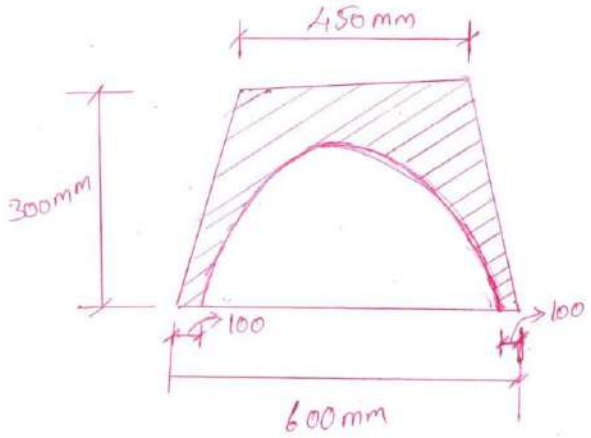
PART – C (10 MARKS)

1. Find the centroid Z section of flange size is 100mmx 20mm and web is 160mmx20mm.
2. Find the centroid of given figure.

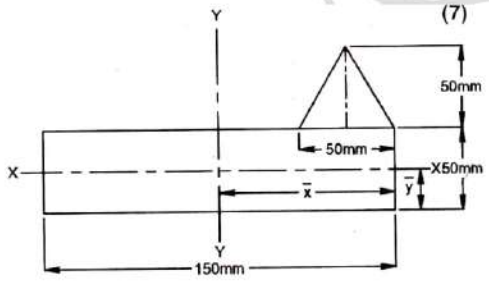


3. Find the Centroid of I- section of top flange size is 100mmx 20mm and web is 60mmx20mm and bottom flange is 200mmx20mm.

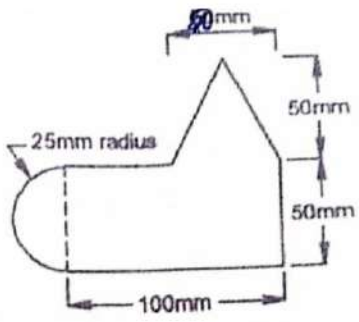
4. Find the Centroid of given section.



5. Find the section modulus and radius of gyration of Z section of flange size is 100mmx 20mm and web is 160mmx20mm.
6. Find the centroid of given figure



7. Find the moment of inertia of given inverted T section flang of 180mmx10mm has a web of 150mmx18mm so that over all depth is 160mm.
8. Locate the centroid of the lamina shown in fig.



9. A channel section is 150mm x 75mm overall (150mm vertical). The thickness of flanges and web are 9mm and 6mm respectively. Find the moment of inertia of channel section.

UNIT 4

PART – A (2 MARKS)

1. Write the strength and stiffness equation of shaft.
2. Write the strength and stiffness equation of bending equation.
3. What is neutral axis?
4. What is flexural Rigidity?
5. Draw the bending stress distribution diagram.
6. What is meant by torque?
7. What is couple?
8. Write the types of shaft.

PART – B (3 MARKS)

9. Derive the theory of simple bending equation
10. State the assumption made in theory of simple bending.
11. State the assumption made in theory of pure torsion.
12. Explain the bending equation.
13. Explain the torsion equation.
14. Some problems based o bending and torsion equation.

PART – C (10 MARKS)

1. Find the safe concentrated load can be applied at the free end of a cantilever of length 2.5m. the section of the cantilever is hollow square of external side 60mmx60mm and internal side 50mmx50mm. The safe bearing stress for the beam material is 75N/mm2.
2. A hollow shaft of 20mm outside diameter and 16mm inside diameter is subjected to a torque of 40Nm. Find the shear stress induced at the outside and inside shaft.
3. A simply supported rectangular beam is subjected to a maximum bending moment of 2.4kNm. The permissible bending stress in the beam is 16N/mm2. If the breadth of the beam is restricted to 60mm, find the depth of the beam required.
4. A hollow shaft of 120mm outer diameter and 80mm inner diameter runs at 60rpm. The maximum torque exceeds the mean by 25% and the Maximum shear stress is 80N/mm2.Find the maximum torque and power transmitted
5. A simply supported beam of 6m span carries a point load of 40kN at is center. Its cross section is a rectangle of breadth 300mm and depth 400mm. Determine the maximum bending stress and stress at a fiber 40mm above the neutral axis.
6. A solid circular shaft transmits100KW at 160 rpm. The maximum shear stress is 60N/mm2 and G=8x104N/mm2. Determine the Torque, Diameter of the shaft and length of the shaft

UNIT 5
PART – A (2 MARKS)

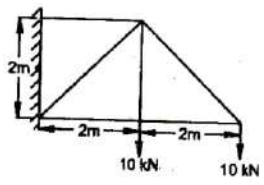
1. What is meant by frame?
2. What is meant by tie?
3. Define strut.
4. Draw two types of common trusses.
5. What is space diagram?
6. What is bow's notation?
7. Define resultant force.
8. What is resolution of force?

PART – B (3 MARKS)

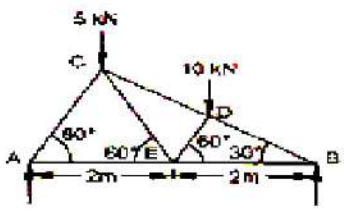
9. Explain deficient frame.
10. Explain determinate and indeterminate beam.
11. Explain prefect and imperfect frame.
12. List the methods for analysis of frames.
13. How will you identify the nil force members in frame?

PART – C (10 MARKS)

1. Determine the magnitude and nature of force in the members of truss shown in figure by method of joints and graphical method.



2. Determine the magnitude and nature of force in the members of truss shown in figure by graphical method and method joints.



3. Determine the magnitude and nature of forces in the members of truss shown in fig. by method of joints and graphical method.