Cien.2204      **Mechanics and Strength of Materials (2+1)**

**Marks: 50**

**Time:2 hours**

**1**    **Fill up the blanks**      (10x1=10)

1   The magnitude of the force of friction between two bodies, one lying above the other depends upon the...................body(ies)

2   In an overhang-simply supported beam with a downward load at the overhanging. If one of the support reactions is upward then the direction of the other support reaction is ...................

3   Shear force at the supports of a simply supported beam is..................., when a concentrated load P is acting at the mid span of the beam.

4   A cantilever beam is one that is.....................at one end and is free at the other.

5   Torque applied to shaft produces ............... stresses on the faces perpendicular to the axis.

6   Bending moment of a simply supported beam is maximum at a point where shear force...............

7   In a couple, the lines of action of the forces are.....................

8   The lami's theorem is applicable only for .....................forces.

9   The center of gravity of hemisphere lies at a distance of....................from its base measured along the vertical radius.

10   The moment of inertia of a triangular section of base (b) and height (h) about an axis passing through its vertex and parallel to the base is ............... as that passing through its CG and parallel to the base.

**II**    **Write short notes/answers etc on ANY FIVE**      (5x2=10)

1   What are the assumptions for pure bending?

2   What are the types of friction? Explain briefly.

3   What is the importance of Moment of Inertia of a section?

4   Write the relationship between Modulus of Elasticity and Bulk modulus of a material.

5   Explain the Lami's theorem with diagram.

6   Show the difference between a simply supported beam and a cantilever beam under same loading.

7   What do you mean by Euler's column? What are the support conditions?

**III**    **Answer any FIVE of the following.**      (5x4=20)

1   A solid circular shaft of 100 mm diameter is transmitting 120 kW at 150 rpm. Find the intensity of shear stress in the shaft.

2 Derive the equations for maximum slope and deflection of a simply supported beam subjected to uniformly distributed load of w kN/m.

3 A steel rod 5 m long and of 40 mm diameter is used as a column, with one end fixed and the other free. Determine the crippling load by Euler's formula. Take EI = 200 GPa

4 A trapezoidal masonry dam 1m wide at top, 3m wide at its bottom is 4m high. It is retaining water having level with the top of the wall on its vertical face. Find the maximum and minimum intensities of stress at the base of the wall, if weight of masonry and water is 24 kN/m$^3$ and 10 kN/m$^3$.

5 A right circular cylinder of 12 cm diameter is joined with a hemisphere of the same diameter face to face. Find the greatest height of the cylinder, so that center of gravity of the composite section coincides with the plane of joining the two sections. The density of the material of hemisphere is twice that the material of cylinder.

6 Find the moment of inertia of a T-section having flange and web both 150 mm x 50 mm about X-X and Y-Y axis passing through the center of gravity of the section.

7 A man walking over a dome of 10 m radius. How far can he descend from the top of the dome without slipping? Take coefficient of friction between the surface of the dome and shoes of the man as 0.6.

IV **Write an essay on any ONE of the following** (1x10=10)

1 A simply supported beam ABCD as shown in the Fig.1 below. The support A is hinged and the support B is on a roller support inclined at 45° with the vertical. Determine the horizontal and vertical components of reaction at support A. Show clearly the direction as well as the magnitude of the resultant. Draw the Shear force and bending moment diagrams.
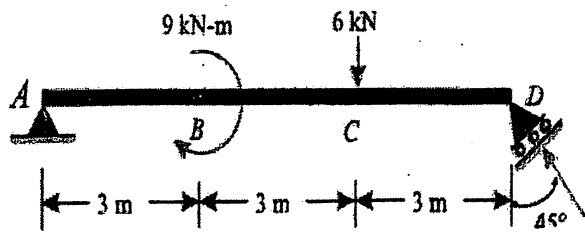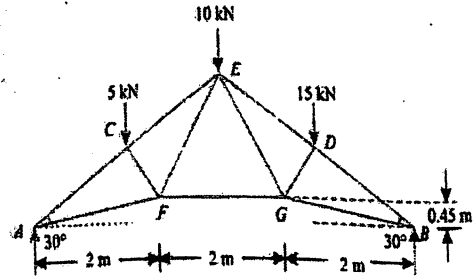


Fig.1



Fig.2

2 The roof truss as shown in Fig.2 above is supported at A and B and carries vertical loads at each of the upper chord points. Determine the forces in the members CE and FG of truss, stating whether they are in tension or compression.

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