KERALA AGRICULTURAL UNIVERSITY
B.Tech. (Ag. Engg.) 2018 Admission
I Semester Final Examination-January 2019

Iden.1101

Engineering Mechanics (2+1)

Marks: 50

Time: 2 hours

I   **Fill in the Blanks**

     (10x1=10)

1. SI unit of moment is _____

2. _____is the maximum value of the static friction to which it can rise and balance the externally applied force.

3. _____theorem states that the amount of a force about any axis is equal to the sum of moments of its components about that axis.

4. The ratio of shear stress to the corresponding shear strain within elastic limit is known as_____

5. Maximum shear stress by Mohr's circle is equal to _____

6. Moment of inertia of a circular section with diameter D is _____

7. _____ is the point where the bending moment is zero after changing its sign from positive to negative or vice versa.

8. The ratio of the moment of inertia of a section about the neutral axis to the distance of the outer most layer from the neutral axis is known as _____

9. The maximum shear stress in a circular section of a beam is _____ times the average shear stress.

10. The relation between number of joints (j) and the number of members (n) in a perfect frame is given by _____

**II**   **Write Short notes on any FIVE of the following**

     (5x2=10)

1. Define the term "Moment of Inertia" and explain the method of determination of the moment of inertia using Routh's rule.

2. Perpendicular axis theorem and parallel axis theorem

3. Explain the relationship between bending moment, moment of inertia, bending stress, neutral axis, Young's modulus and radius of curvature

4. Distinguish between sliding friction and rolling friction

5. Distinguish between direct stress and bending stress

6. Principal Plane and Principal Stress

7. Torsional rigidity and polar moment of inertia.

III   **Answer any FIVE of the following.**

     (5x4=20)

1. Locate the centre of gravity of the area show
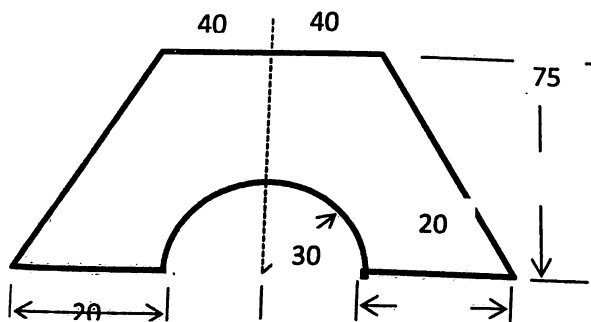
having a central hole of diameter 150mm at a distance of 100 mm from the top. Find tl moment of inertia about an axis passing through the centre of gravity and parallel to tl shorter side.

3 A uniform ladder 6 m long, weighing 300 N, is placed against a smooth wall with i lower end 2 m from the wall. The coefficient of friction between the ladder and floor 0.30. Show that the ladder will remain in equilibrium in this position.

4 Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 2 mm and length 1 m, if the longitudinal strain in the bar during a tensile stress is fou times the lateral strain. Take $E = 1 \times 10^5 \text{ N/mm}^2$.

5 The tensile stress at a point across two mutually perpendicular planes are 150 N/mm^2 an 75 N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined a 40° to the axis of the minor axis.

6 Two equal heavy spheres of 60 mm radius are in equilibrium with a smooth cup of 18(mm radius. Show that the reaction between the cup of one sphere is double than tha between the two spheres.

7 Prove that the torque transmitted by a solid shaft when subjected to a torsion is given by $T = (\pi/16) \tau D^3$, where D is the diameter.

IV **Answer any ONE of the following**   (1x10=10)

1 a Define shear force and bending moment. Explain the relationship between load, shear force and bending moment.

   b A simply supported beam of length 10 m carries a uniformly distributed load of 10 kN/m for the first half portion and a concentrated load of 40 kN at the middle of the second half. Find the reactions at the ends and draw the Shear Force Diagram and Bending Moment Diagrams.

2 a Derive the relationship for shear stress at any point in the cross section of a beam (area A), which is subjected to a shear force of F.

   b A rectangular beam 150 mm wide and 300 mm deep is subjected to a maximum shear force of 100 kN. Determine
      i) average shear stress,
      ii) maximum shear stress and
      iii) shear stress at a distance of 30 mm above the neutral axis.

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