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)**

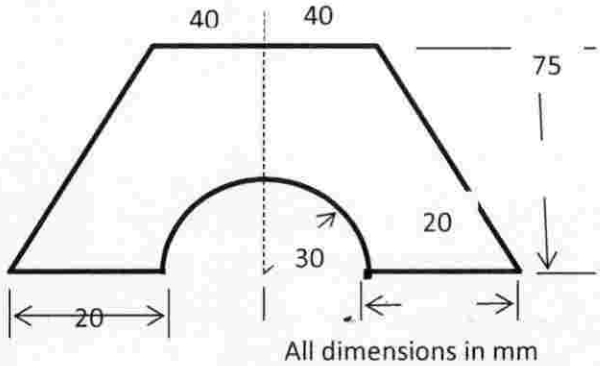
1 SI unit of moment is _____
2 _____is the maximum value of the static friction to which it can rise and balance the externally applied force.
3 _____theorem states that the amount of a force about any axis is equal to the sum of moments of its components about that axis.
4 The ratio of shear stress 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



All dimensions in mm

P.T.O

2 A rectangular lamina kept vertically, with a width of 200 mm and height of 300 mm, is having a central hole of diameter 150mm at a distance of 100 mm from the top. Find the moment of inertia about an axis passing through the centre of gravity and parallel to the shorter side.

3 A uniform ladder 6 m long, weighing 300 N, is placed against a smooth wall with its lower end 2 m from the wall. The coefficient of friction between the ladder and floor is 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 20 mm and length 1 m, if the longitudinal strain in the bar during a tensile stress is four times the lateral strain. Take $E = 1 \times 10^5$ N/mm^2.

5 The tensile stress at a point across two mutually perpendicular planesare150 N/mm^2 and 75 N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined at 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 180 mm radius. Show that the reaction between the cup of one sphere is double than that 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.

****