Code No: 121AC **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, June - 2022
ENGINEERING MECHANICS
(Common to CE, ME, AE, PTM)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) Determine the resultant of the given forces acting as shown in figure 1, and find the angle which the resultant makes with the positive ***x*** – axis.

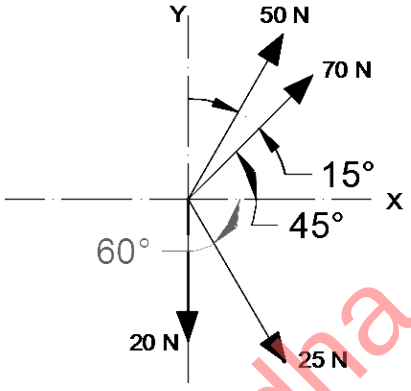

Figure: 1

b) Explain the steps to be followed while drawing free body diagrams. [8+7]

2.a) If three concurrent forces are acting on a body which is in equilibrium, then prove that the resultant of the two forces should be equal and opposite to the third force.

b) Determine the maximum safe vertical load W that can be supported by the tripod shown in figure 2 without exceeding a compressive load of 10 kN in any member. (All the dimensions shown in m). [7+8]

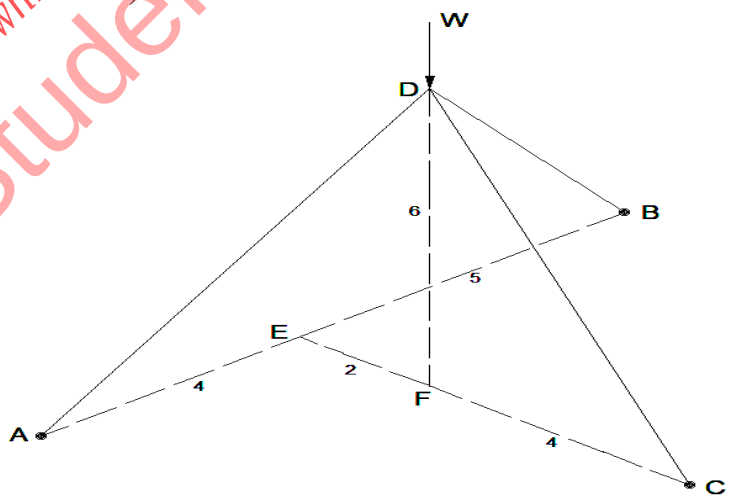

Figure: 2

3.a) A wedge is used to split logs. If φ is the angle of friction between the wedge and the log, determine the maximum angle α of the wedge so that it will remain embedded in the log.

b) Determine the limiting ratio of the tensions and express the difference of tensions as a function of the maximum tension for the case of a flat belt in contact with a flat pulley rim. Angle of lap = 175^0 and Coefficient of friction = 0.3. [7+8]

4.a) Explain the effect of centrifugal tension on power transmission in belt drives.

b) A square threaded screw jack has a pitch of 1 cm and a mean diameter of 7.5 cm. The mean diameter of the bearing surface between the cap and the screw is 9 cm. The coefficient of friction between all surfaces is 0.10. What force is required at the end of a lever 90 cm long to raise a load of 40 kN? [7+8]

5.a) Explain, how to choose the axes of reference, while determining the coordinates of the centroid.

b) A semicircle of radius *r* is cut off from a circle of radius R. The base of the semicircle coincides with a diameter of the circle, and its center is located at the center of the circle. Calculate the polar moment of inertia of the remaining figure about the center of the circle. [7+8]

6.a) State the kinetic equation of motion in a (i) centroidal rotation, (ii) non-centroidal rotation, and (iii) general plane motion.

b) A uniform bar, 3 m long and weighing 2.4 kg/m, is rotating in a horizontal plane about a vertical axis at one end. If the angular velocity is constant at 4 rad/s, compute the axial force on a transverse section at its midpoint. [7+8]

7.a) Explain about the fixed axis rotation of a rigid body.

b) A circular disc of radius *r*, suspended from a fixed plane by a slender rod, performs torsional oscillations about its equilibrium position. Find the maximum tangential and normal components of acceleration of a point on the periphery of the disc, if it oscillates with an amplitude of 1 radian. [7+8]

8.a) State and prove Work – Energy principle.

b) By using the work-energy equation, calculate the velocity and acceleration of the block A shown in figure 3 after it has moved 6 m from rest. The coefficient of kinetic friction is 0.3, and the pulleys are considered to be frictionless and weightless. Also calculate the tension in the string attached to A. The weights A and B are equal to 400 N and 800 N respectively, and the pulleys C and D are of 20 cm and 30 cm diameter respectively. [7+8]

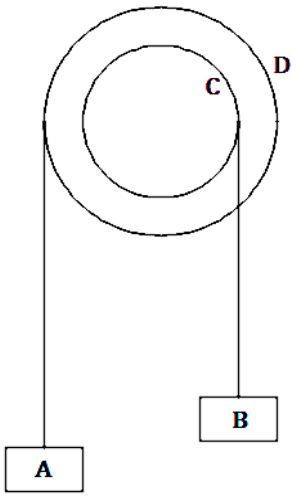

Figure: 3

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