AN ROINN OIDEACHAIS M.50

LEAVING CERTIFICATE EXAMINATION, 1970

APPLIED MATHEMATICS - PASS

TUESDAY, 23rd JUNE - Afternoon, 2 to 4.30

Not more than six questions may be answered.
All questions are of equal value.
Mathematical Tables may be obtained from the Superintendent.

1. A man can swim with a speed of 2 meters per second in still water, and wishes to cross a straight river of width 50 meters which flows with constant speed 1·6 m/sec. parallel to the banks. Find the time taken to swim straight across the river.

2. A train travels 48 meters, 32 meters, 16 meters in each of 3 consecutive seconds, along a straight railway track. Show that this is consistent with motion under constant deceleration. Find how much farther the train will travel before coming to rest.

3. A particle of mass 9 lbs. slides from rest down the line of greatest slope on a smooth plane inclined at 30° to the horizontal. If the particle travels 9 feet, find the time taken and the speed of the particle then.
Show that the sum of the kinetic energy and potential energy is the same at the start as it is at the end. Find the average rate of working of the force of gravity during the motion.
(Take g to be 32 ft./sec.^{2})

4. A string 2 feet long can just sustain a force of 40 lbs. wt. without breaking. A particle of mass 4 lbs. is attached to one end of the string and revolves uniformly on a smooth horizontal table, the other end being fixed to a point on the table.
Draw a diagram showing the forces acting on the particle during the motion and find the greatest number of complete revolutions it can make in a minute without breaking the string.
(Take g to be 32 ft./sec.^{2})

5. Two uniform rods AB and BC of equal lengths l and of equal weights are rigidly connected at B. If the rod BC is horizontal when the rods are suspended from A, prove that $\cos ABC = \frac{1}{3}$.
Find the distance of the centre of gravity of system from A.

6. A uniform sphere of weight W and radius a is suspended by a string of length $2a$ which has one end attached to a point on the surface of the sphere. The other end is attached to a point on a smooth vertical wall against which the sphere rests in equilibrium. Show that the angle which the string makes with the wall is α, where $\sin\alpha = \frac{1}{3}$, and find the tension in the string and the reaction of the wall.

7. A uniform heavy rod AB is 4 feet long and is 60 lbs. wt. It is free to turn in a vertical plane about a hinge at A. A load of 90 lbs. wt. is attached at B and the system is supported, with AB inclined at 45° to the upward drawn vertical at A, by means of a horizontal string attached to a point of the rod 1½ ft. from A. Find the tension in the string and the magnitude of the reaction at the hinge.

8. Forces of magnitude 1, 2, 3, 4 lbs. wt. act along the sides AB, BC, CD, DA, respectively, of a square ABCD of side ½ foot, where the order of the letters indicates the direction of the force and where the corners of the square are lettered in rotation. Find the magnitude and direction of the resultant of this system of forces, and find where its line of action cuts the side AB.

9. A right cylinder of height 50 cm. and radius 20 cm. is immersed in a liquid with its axis vertical and its uppermost face 2 metres below the surface of the liquid. If the pressure on the bottom face of the cylinder is 250,000 dynes per square cm., compute:

(i) the specific gravity of the liquid, to two places of decimals,

(ii) the force on the top face of the cylinder.