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MAR-21-210004

B. Tech. EXAMINATION, March 2021

Semester I & II (CBCS)

ENGINEERING MECHANICS

ME-101

Time : 2 Hours *Maximum Marks : 60*

The candidates shall limit their answers precisely within 20 pages only (A4 size sheets/assignment sheets), no extra sheet allowed. The candidates should write only on one side of the page and the back side of the page should remain blank. Only blue ball pen is admissible.

Note : Attempt *Four* questions in all, selecting *one* question from each Sections A, B, C and D. All questions carry equal marks. Assume missing data suitably, if any.

Section A

1. (a) A body of 70 kN weight is suspended by two strings whose lengths are 6 cm and 8 cm from points in the same horizontal level. The horizontal distance between the two points is 10 cm. Determine the tensions in the strings. **7.5**

(b) Two forces P_1 and P_2 acting at a point have a resultant R. If P_2 be doubled, R is doubled. Again, if the direction of P_2 is reversed, then R is doubled, show that :

$P_1 : P_2 : R = \sqrt{2} : \sqrt{3} : \sqrt{2}$. **7.5**

2. (a) Three cylinders weighing 400 N each and 16 cm in diameter are placed in a channel of 36 cm width as shown in Figure 1. Determine the following : **7.5**

(i) The pressure exerted by the top cylinder P on cylinder Q.

(ii) The pressure exerted by the cylinder Q on the horizontal floor.

(iii) The pressure exerted by the cylinder Q on the vertical wall.

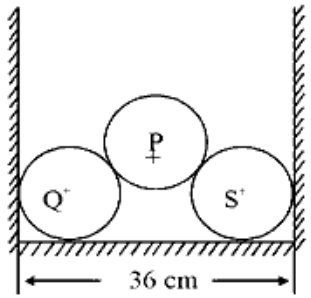

Fig.1

(b) State and prove Varignon's theorem. **7.5**

Section B

3. (a) Determine the minimum angle θ at which a uniform ladder can be placed against a wall without slipping under its own weight. The coefficient of friction for all surfaces is 0.2. **7.5**

   (b) What is the purpose of wedge ? Explain wedge friction with the help of free body diagrams. **7.5**

4. (a) A body consists of a solid hemisphere of radius 4 cm and right circular solid cone of height 12 cm. The hemisphere and cone has a common base and are made of same material. Locate the position of centre of gravity of the composite body. **7.5**

   (b) Derive the relation for moment of inertia of triangular lamina about its centroidal axis. **7.5**

Section C

5. What are the assumptions made while analyzing framed structure ? Explain step by step procedure of method of joints to analyze framed structures. **15**

6. A beam AB 10 meters long has supports at its ends A and B. It carries a point load of 5 kN at 3 meters from A and a point load of 5 kN at 7 meters from A and a uniformly distributed load of 1 kN per meter between the point loads. Draw the shear force and bending moment diagrams for the beam. **15**

Section D

7. (a) An automobile enters a curved road at 30 km/hr and then leaves at 48 km/hr. The curved road is in a quarter of a circle and has a length of 400 m. If the car travels at constant acceleration along the curve, calculate the resultant acceleration at both ends of the curve. **7.5**

   (b) A wheel rotating at 60 rpm is uniformly accelerated for 60 seconds during which it makes 60 revolutions. Find : **7.5**

   (i) Angular velocity at the end of 60 seconds

   (ii) Time required for speed to reach 150 rpm.

8. (a) A stone 10 kg mass falls through a height of 10 m and penetrates into a wet ground. The resistance to penetration is 5000 N and it is constant. Find the distance of penetration in the ground by the stone. **7.5**

(b) A body of 10 kg mass moving towards right with a speed of 8 m/s strikes with another body of 20 kg mass moving towards left with 25 m/s. Determine :

(i) Final velocities of two bodies

(ii) Loss in kinetic energy due to impact

(iii) Impulse acting on either body during impact.

Take coefficient of restitution between the bodies as 0.65. **7.5**

9. (a) What is principle of transmissibility of force ?

(b) What is a couple ?

(c) Define angle of repose.

(d) Sketch differential screw jack.

(e) Differentiate between centroid and centre of gravity.

(f) What is a redundant frame ?

(g) Define point of contraflexture.

(h) What are different types of beams ?

(i) What is general plane motion ?

(j) State D' Alembert's principle. **1.5×10=15**