2023
B.E. (Mechanical) First Semester
MEC-101: Statics

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt* <u>*five*</u> *questions in all, including Question No. I which is compulsory and selecting two questions from each Part.*

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1a)What is the significance of a dot product.
 b)What is polygon law of forces.
 c)What is the significance of point of contraflexture.
 d)Define radius of gyration
 e)What are conservative forces (10)

Part-A

2a)The following forces acts at a point: i)20N inclined at 30° towards North of East, ii) 25 N towards north, iii)30 N towards North West and 35 N inclined at 40° towards South of West. Find the magnitude and direction of resultant force. (5)
 b)Two forces P_1 and P_2 acting at a point have a resultant R.If P_2 is doubled,R is doubled.Again if the direction of P_2 is reversed then R is doubled,show that: $P_1 : P_2 : R = \sqrt{2}:\sqrt{3}:\sqrt{2}$ (5)

3a)A body of weight 20 N is suspended by two strings 5 m and 12 m long and other ends being fastened to the extremities of a rod of length 13 m. If the rod be so held that the body hangs immediately below the middle point, find the tension in the strings. (4)
 b)Three cylinders weighing 100 N each and of 80 mm diameter are placed in a channel of 180 mm width as shown in figure below .Determine the pressure exerted by:
 i)The cylinder A on B at the point of contact ii)The cylinder B on the base and iii) The cylinder B on the wall . (6)
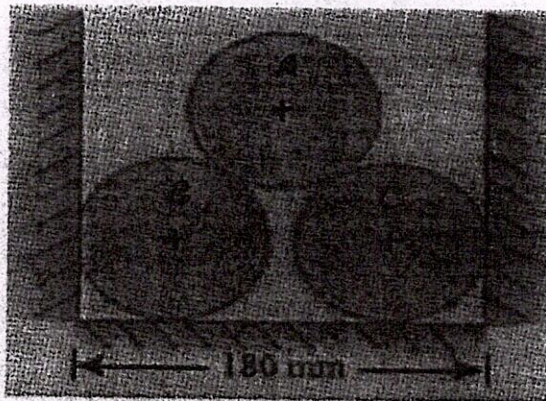

4a)A carriage wheel of weight W and a radius r is to be dragged over an obstacle of height h by a horizontal pull F applied at the centre of wheel. Show that F should be greater than $[W (2rh - h^2)^{1/2}] / (r - h)$. (5)
 b)State the assumptions made while making an analysis of framed structures. Also explain the procedure of method of joints to determine the stresses in the members of framed structure.(5)

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Part-B

5a) Draw the shear force and bending moment diagram for simply supported beam of length L subjected to the point load W acting at the centre of the beam. (4)

b) A suspension bridge having 30 m span and 1.25 m wide platform is subjected to an average load of 20kN/m^2. The bridge is supported by a pair of cables having central dip of 4m. If the maximum permissible stress in the cable material is not to exceed 1050 N/mm^2, make calculations for the necessary cross-section of the cable. (6)

6a) A block overlying a 10° wedge on a horizontal floor and leaning against a vertical wall and weighing 1500 N is to be raised by applying a horizontal force to the wedge. Assuming the coefficient of friction between all the surfaces in contact to be 0.3, determine the minimum horizontal force to be applied to raise the block. (5)

b) A toy is made of cone base 6 cm and height 8 cm with hemisphere on the base of the cone. Considering the material of both parts same, find the centre of gravity of the toy. (5)

7a) Find the moment of inertia of a T- section with flange as 150 mm X 50 mm and web as 150 mm X 50 mm about X-X and Y-Y axes through the centre of gravity of the section. (4)
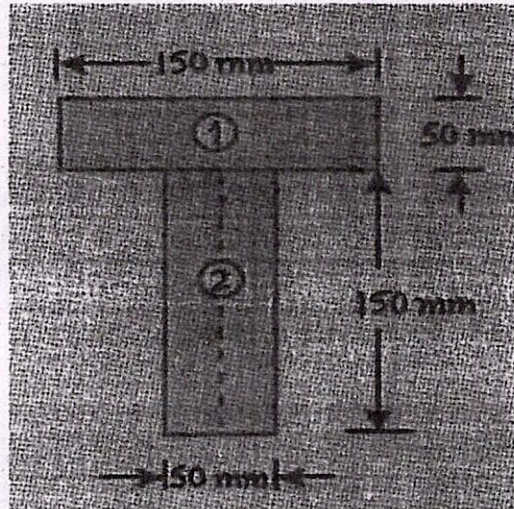
b) Derive the relation for product of inertia of right angled triangle of width b and height h. (4)

c) Explain the principle of virtual work. (2)

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