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Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 33503 Roll No.

B. Tech. Examination 2022-23

(Even Semester)

ENGINEERING MECHANICS

Time : Three Hours] *[Maximum Marks : 60*

Note :– Attempt all questions.

SECTION–A

1. Attempt all parts of the following : 8×1=8

   (a) What do you mean by resolution of a force?

   (b) Define limiting friction.

   (c) Define shear force and bending moment.

   (d) What relationship exists between the number of joints J and number of member M in a simple truss.

   (e) Define centroid of an area.

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(f) Define force, momentum and impulse.

(g) Write the relation between modulus of elasticity and modulus of rigidity.

(h) Define Poisson's ratio.

SECTION – B

2. Attempt any two parts of the following : 2×6=12

(a) Two smooth spheres each of weight W and each of radius 'r' are in equilibrium in a horizontal channel of width 'b' ($b < 4r$) amd vertical sides as shown in figure (i). Find the three reactions from the sides of channel which are all smooth. Also find the force exerted by each sphere on the other.

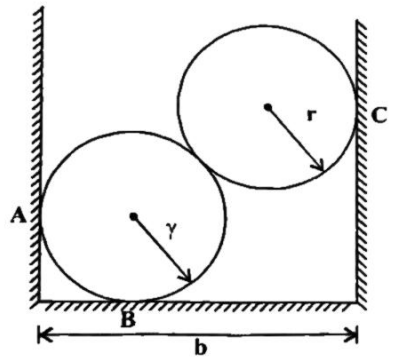

Figure (i)

(b) Draw the shear force and bending moment diagram for the beam loaded as shown in figure (ii) :

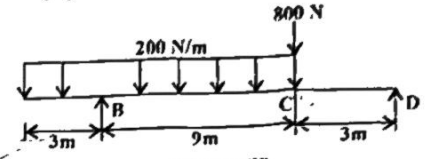

Figure (ii)

(c) Show that the moment of inertia of a triangular section about its base is equal to $bh^3/12$, where b and h are base and height of the triangular section respectively.

(d) A steelbar subjected to loads as shown in figure (iii). Determine the change in length of the bar ABCD of 10 cm diameter.

$E = 180\ kN/mm^2$.

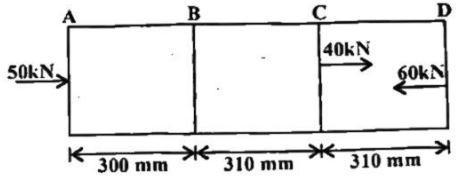

Figure (iii)

SECTION – C

Note :– Attempt all questions. Attempt any two parts from each question. 5×8=40

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3. (a) A uniform ladder has a mass of 200 N and a length of 3m. Determine the maximum distance d it can be placed from the smooth wall and not slip. The coefficient of friction between the floor and the ladder is 0.3

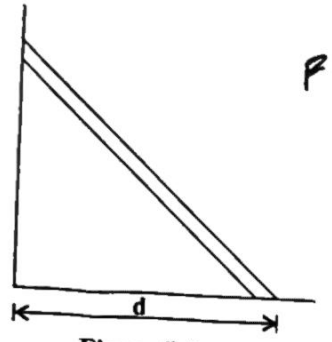


Figure (iv)

(b) Drive the relation $T_2/T_1 = e^{\mu\beta}$ for the tension on the tight and slack sides of the belt passing over a pulley with friction.

(c) What is principle of transmissibility of a force? Also state the Varignon's theorem of moments.

4. (a) A plane truss is shown in figure (v). Two 5 kN loads are shown acting on joints C and E. Determine the force transmitted by each member of the truss.

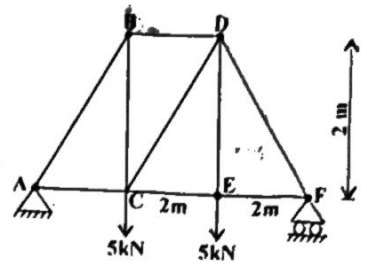
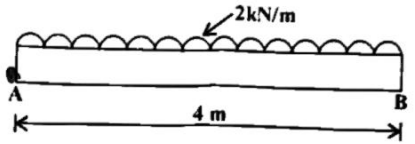


Figure (v)

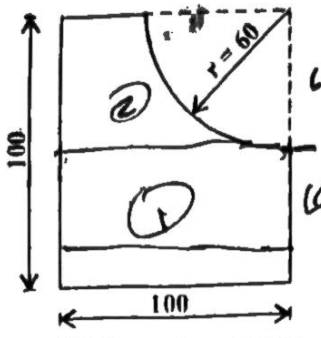
(b) Draw the shear force and bending moment diagram for a cantilever of span 4m carrying a uniformly distributed load of 2 kN/m over the entire span.



(c) Define truss and also write the assumptions in truss.

5. (a) Write the D'Alembert's principle with proper explanation.

(b) The cross section of a machine part is shown in figure (vi). Determine its moment of inertia and radius of gyration about the horizontal centroidal axis.



All dimensions in mm
Figure (vi)

(c) Define moment of inertia and also prove parallel axis theorem.

6. (a) Draw the stress-strain diagram of ductile material with proper explanation.

(b) Calculate the strain energy stored in a 3-m long bar of 50 mm side square cross-section, if it is subjected to a loadof 50 kN. Take E = 200 GPa.

(c) An alluminium rod of length 1200 mm and cross-section area 400 mm^2 is is found to elongate by 1.5 mm when subjected to an axial pull of 35 kN. Determine the modulus of elasticity for aluminium.

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