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**Paper Id:** | 4 | 0 | 4 | 1 | **Roll No:**

B TECH
(SEM I) THEORY EXAMINATION 2017-18
ENGINEERING MECHANICS

Time: 3 Hours   *Total Marks: 100*

Notes: 1. *Attempt all Sections. Assume any missing data.*

Q. No. 1- Attempt any four parts.   **[4x5 =20]**

    a) State and prove Varignon's theorem.

    b) If the force F shown in figure is resolved into components parallel to the bars AB and BC, the magnitude of the component parallel to bar BC is 4 kN. What are the magnitudes of F and its component parallel to AB?
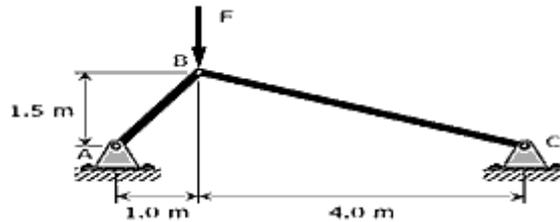

    c) The 2225-N block shown in figure is in contact with 45° incline. The coefficient of static friction is 0.25. Compute the value of the horizontal force P necessary to just prevent motion down the incline.


    d) A 1000 N cylinder supported by a horizontal rod AB and a smooth uniform rod CD which weighs 500 N as shown in figure. Assuming A B C and D to be pin jointed and weight of AB is negligible, Find reactions at C and D.
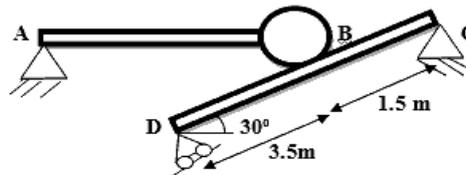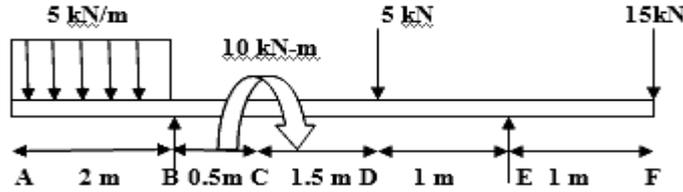

    e) Find the least value of P required to cause the system of blocks shown in given figure to have impending motion to the left. The coefficient of friction under each block is 0.20.
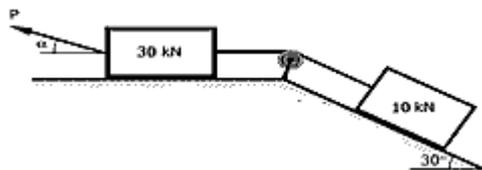
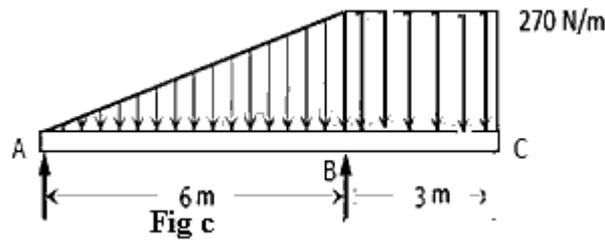**Q. No. 2- Attempt any two parts.**   **[10x2=20]**

    a) Find the force in each member of the truss in shown in figure.
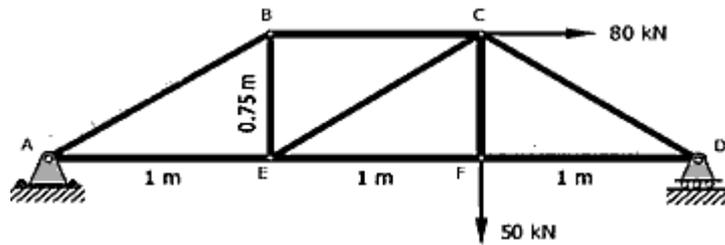
b) Draw SFD and BMD for the overhanging beam shown in figure.
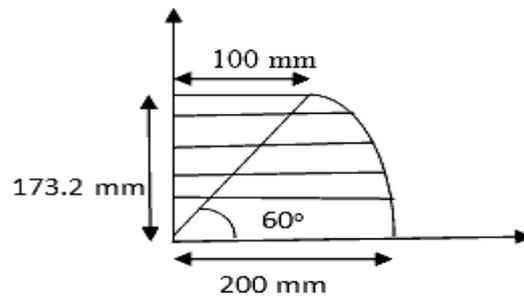

c) Find the expression for Shear Force and Bending Moment, hence draw the SFD and BMD for the beam shown in figure.
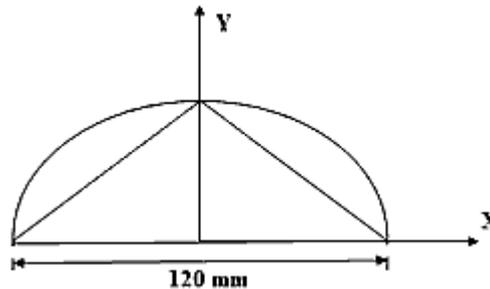

Fig c

Q. No. 3- Attempt any two parts.   [10x2=20]

a) Find the centroid for a triangle and sector of a circle as shown in figure.

b) Find the polar moment of inertia of a semicircle about its center from which a triangle base 120mm and height 60 mm is removed as shown in the figure.
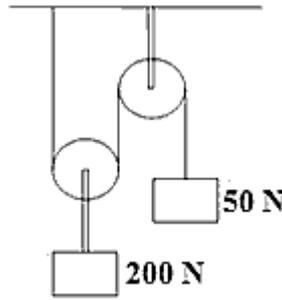

c) Find the mass moment of inertia of a sphere about its centroidal axis.

Q. No. 4- Attempt any two parts.   [10x2=20]

a) Find the tension in the string and acceleration of blocks A and B weighing 200 N and 50 N respectively, connected by a string and frictionless and weightless pulley as shown in figure.

b) Two equal weight of 3000 N are lying on two inclined planes connected by a string passing over a frictionless pulley as shown. Using D'Alembarts principle, find the acceleration of the weights and tension in the string. μ= 0.2 for wedge.


30°   60°
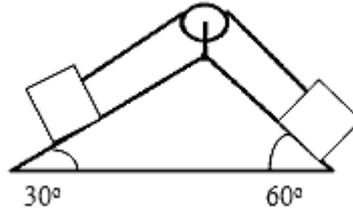
c) **(i)** A fly wheel makes 100 rev from a velocity 120 rpm to 160 rpm. Find the acceleration and time taken. Also find the total number of revolution if the fly wheel started from rest.
(ii) Acceleration of a particle is given by a=10-x. Particle starts from rest at x=0 v=0. Find the position when velocity is zero and the velocity when acceleration is zero.

Q. No. 5- Attempt any four parts.   **[4x5 =20]**

a) State assumptions for Bending. Derive an expression for bending Equation.
b) A simply supported beam, 2 m wide by 4 m high and 12 m long is subjected to a concentrated load of 2000 N at a point 3 m from one of the supports. Determine the maximum fiber stress.
c) A steel propeller shaft transmitting 450 KW at 300 rpm without exceeding a shearing stress of 40 N/mm^2 or twisting through more than 1°per meter. Compute the proper diameter if G = 80 kN/mm^2.
d) Find the elongation for the tapered circular bar with given dimension in figure. Also find the total strain energy.

50 mm

50 cm

20 mm

200 kN
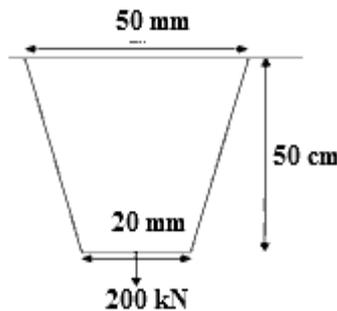
e) A member ABCD of uniform diameter 200mm is loaded as shown in figure, find the net change in length if E=200GN/m^2.

100 kN   60 kN   40 kN   80 kN

A   200 mm   B   300 mm   C   500 mm   D