B.Tech 1st Semester MID Term Examination - 2018

Engineering Mechanics

Paper Code: UME11B05

Time: 2 hours

Full Marks: 50

The figures in the right margin indicates full marks for each questions.

(Answer Any five Questions)

1. (a) Define rigid body and explain the term concentrated force. [1.5+1.5]
(b)Three smooth right circular cylinders, each of radius r and weight P, are arranged on smooth inclined surfaces as shown in figure: A . Determine the least value of angle α that will present the arrangement from slipping. [7]

2. (a) Write the two equations of equilibrium for a system of co-planer concurrent forces in terms of moments. [4]
(b) Find the tension S induced in the string CDE attached at the points C and E of the right angle bar ABC of weight P supported as shown in figure: B. Assume a perfectly flexible string, frictionless pulley and an ideal hinge at A. [6]

3. (a) Why coefficient of kinetic friction is less than that of static friction?-Explain briefly. [3]
(b) A block of weight Q rests on an inclined plane and has attached to it a string that overruns a pulley and carries a weight P and its other end as shown in figure: C. If the coefficient of friction between the block Q and the inclined plane is μ, find the limiting values of the ratio P/Q consistent with equilibrium. Neglect friction in the pulley, and assume that the angle of inclination α of the plane is greater than the angle of friction $\phi = \tan^{-1}\mu$. [7]

4. (a) State pappus theorem I and II [1.5+1.5]
(b) For the figure: D . Prove that if the equation of the curve OB referred to the coordinate axes x any y taken along two adjacent sides of a rectangle $OEBD$ is $y = kx^n$ then the coordinates x_c and y_c of the centroid C of the area of the shaded spandrel OBD are given by the formulas: [7]
$x_c = (n + 1)a/(n + 2)$, $y_c = (n + 1)b/(4n+2)$.

5. With reference to the coordinate axes x and y, locate the centroid of the shaded area of the plane figure shown in figure: E . [10]

6. Using the method of joints calculate the axial force in each of the bars 1,2,3 and 4 of the plane truss as shown in fig. F. [10]

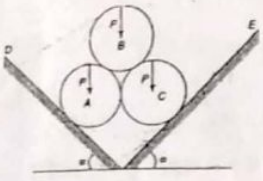

Figure : A

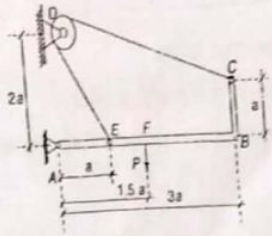

Figure : B

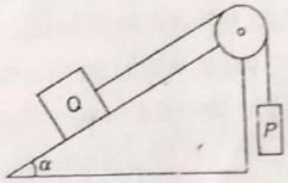

Figure : C

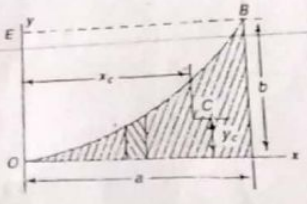

Figure : D

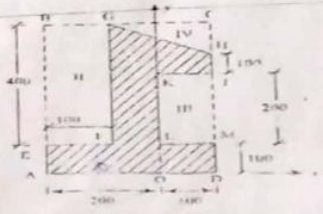

Figure : E

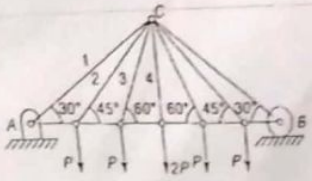

Figure : F

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B.Tech1stSemester Mid-Term Examination - 2016
Engineering Mechanics
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Full Marks: 50 **Time: 2 hours**

Answer any FIVE questions.

1 Three smooth spheres of weight P,P,Q are placed in a smooth trench as shown in Fig. 1. Find the pressure exerted on the walls and the floor at the point of contact A,B,C and D. The following numerical data are given as P=0.3KN, Q= 0.6KN, r_1=0.4m, r_2=0.6m, r_3=0.4m, α= 30. [10]

2a) A prismatic bar AB of weight Q and length 'l' is hinged at A and supported at B by elastic spring that passes over a pulley. The spring is fixed at the other end D as shown in the Fig. 2. The distance between the hinged A and the pulley C is equal to the length of the bar AB. The stiffness of the spring is K and the spring is unstretched when the bar AB is horizontal. Find the configuration of the equilibrium of the system as defined by the α which the bar makes with the horizontal as shown in the figure in terms of Q,K and l. [8]

) State Varignon's Theorem. [2]

3 Determine the axial forces in the bar 1,2,3,4 and 5 of the plane truss supported and loaded as shown in the Fig.3. [10]

4 A pulley A is supported by two bars AB & AC, which are hinged at point B & C to a vertical mast EF. Over the pulley hangs a flexible cable DG which is fastened to the mast at D and carries at the other end G a load Q = 20 KN. Neglecting friction in the pulley, determine the forces produced in the bars AB & AC. The angles between the various members are shown in the Fig.4. [10]

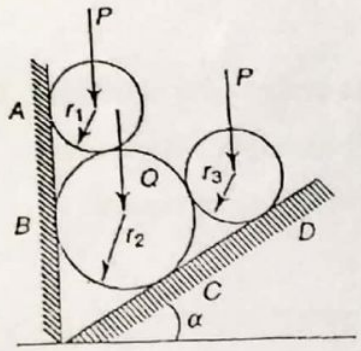


Fig.1

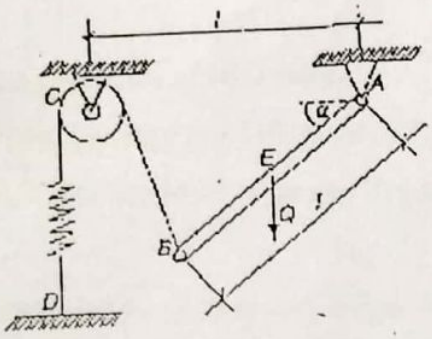


Fig.2

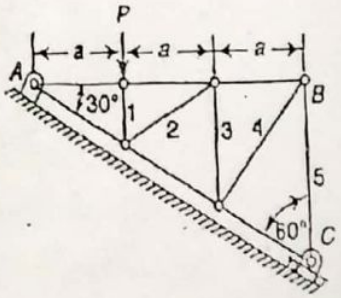
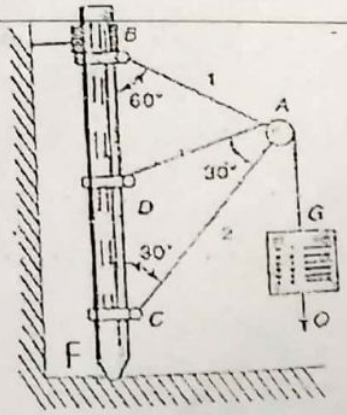


Fig.3



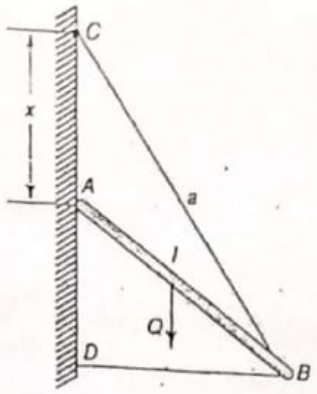


Fig.5

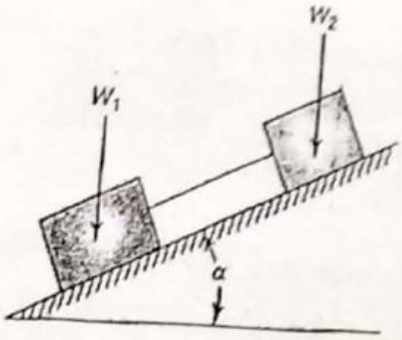


Fig.6

Q 5 A prismatic bar AB of weight Q and length'l' is supported at other end B by a string CB of length 'a' and rests at A vertically below C against a perfectly smooth vertical wall. Find the position of the bar as defined by the length X for which equilibrium is possible shown in the fig. 5. [10]

Q.6a) Two blocks of weights W_1 and W_2 rest on a rough inclined plane and are connected by a short piece of string as shown in the Fig.6. If the coefficient of frictions are $\mu_1=0.2$ and $\mu_2=0.3$, respectively,find the angle of inclination of the plane for which sliding will impend. Assume $W_1=W_2=22.25$ N. [7]

b) State Laws of friction. [3]