20.1.09

Ex/BESUS/AM-101A/09

B.Arch. Part-I 1st Semester Examination, 2009

Engineering Mechanics

(AM-101A)

Time : 3 hours **Full Marks : 70**

Use separate answerscript for each half.
Answer SIX questions, taking THREE from each half.
Two marks are reserved for neatness in each half.

FIRST HALF

1. a) Referring to Fig. Q1a, find the value of the angle φ defining the position of the point B where the particle will jump clear of the cylindrical surface after the string OA has been cut. Neglect friction.

b) A ball of weight W is supported in a vertical plane as shown in Fig. Q1b . Find the compressive force in the bar BC: (a) just before the string AB is cut and (b) just after the string AB is cut. **[7+4]**

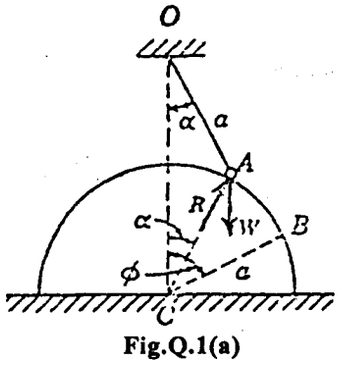

Fig.Q.1(a)

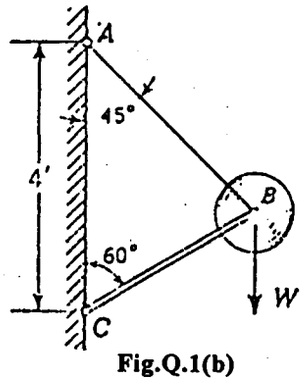

Fig.Q.1(b)

2. a) Prove that the equation of the path of the projectile is parabola.

b) An airplane is moving with a horizontal velocity v at a height h above a level. If a projectile is fired from a gun at the instant when the plane is vertically above the gun, what must be the angle of elevation α and that is the minimum initial velocity v_0 of the projectile in order to hit the airplane ? **[4+7]**

3. In Fig. Q3, a small car of weight W starts from rest at A and rolls without friction along an inclined plane to B where it strikes a block also of weight W and initially at rest. Assuming a plastic impact at B, the car and block will move from B to C as one particle. If the coefficient of friction between the block and plane is 0.5, calculate the distance x to the point C where the bodies come to rest. **[11]**

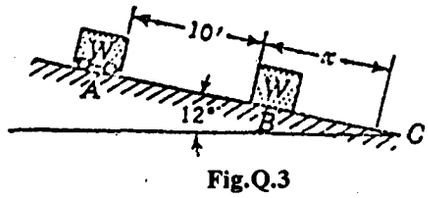

Fig.Q.3

4. A particle of mass m moves rectilinearly under the action of a force $X = F(t)$ as represented by the force-time diagram *OCB* in the Fig. Q4. If the curve is a parabola, find the displacement at time t_1. [11]

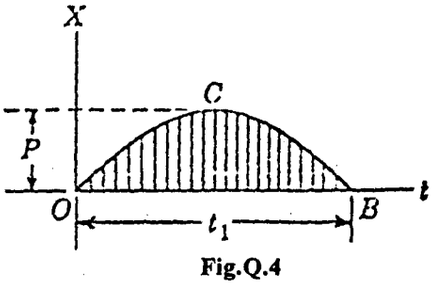

Fig.Q.4

SECOND HALF

5. a) Explain the term 'equilibrium'.

b) Two smooth circular cylinders, each of weight W = 100 N and radius r = 6 cm, are connected at their centres by a string AB of length l = 16 cm and rest upon a horizontal plane, supporting above them a third cylinder of weight Q = 200 N and radius r = 6 cm (Fig. Q.5). Find the force S in the string AB and the pressures induced on the floors at the points of contact D and E. Draw the vector diagram of the three ball system isolated from the floor as a whole. [11]

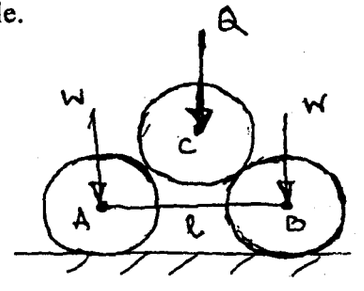

Fig.Q.5

6. a) State theorem of Varignon and explain its applicability.

b) A beam AB, hinged at A and supported at B by a vertical bar BC, is subjected to the action of a force P as shown in Fig.Q.6. Assuming ideal hinges at A, B and C; find the force S in bar BC neglecting the weight of beam. [11]

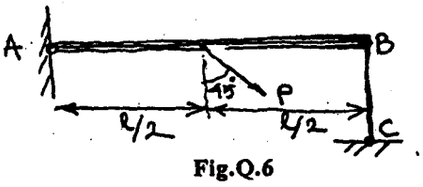

Fig.Q.6

7. 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 Fig.Q.7. If the co-efficients of friction 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 $W_1 = W_2 = 5$N. [11]

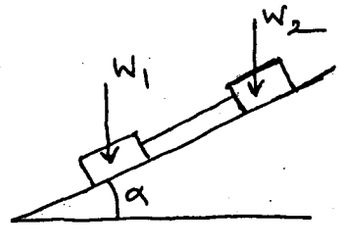

Fig.Q.7

8. Determine the axial force in each bar of the plane truss supported and loaded as shown in Fig.Q.8. ABCD is square and AC is horizontal. [11]

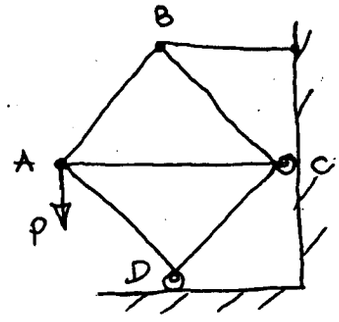

Fig.Q.8

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