May - June - 2012

[4161] – 110

Seat No.	

F.E. (Semester – II) Examination, 2012
ENGINEERING MECHANICS
(2008 Pattern)

Time : 2 Hours | Max. Marks : 50

Instructions : *1) Attempt Q. **1** or Q. **2**, Q. **3** or Q. **4** and Q. **5** or Q. **6**.*
*2) Answer should be written in **one** answer book.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) Figures to the **right** indicate **full** marks.*
*5) Assume suitable data, **if necessary** and **clearly** state.*
*6) Use of cell phone is **prohibited** in the examination hall.*
*7) Use of electronic pocket calculator is **allowed**.*

1. a) Resolve the 60 N force in to components acting along the u and v axes and determine the magnitudes of the components. Refer Fig. 1 a. **6**

   b) If block A of the pulley system is moving downward with a speed 1 m/s while block C is moving up at 0.5 m/s, determine the speed of block B. Also determine the relative velocity of A with respect to C. Refer Fig. 1 b. **6**

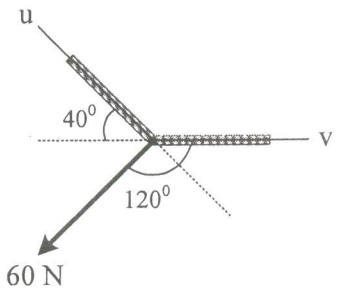

Fig. 1 a

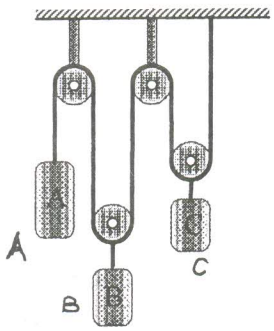

Fig. 1 b

OR

2. a) Determine the distance y to the centroid of the trapezoidal area in terms of the dimensions shown in Fig. 2 a. 6

b) The 400 Kg mine car is hoisted up the incline using the cable and motor M. For a short time, the force in the cable is $F = (3200\ t^2)$ N, where t is in seconds. If the car has an initial velocity $v_0 = 2$ m/s when $t = 0$, determine the distance it moves up the plane when $t = 2$ s. Ref. Fig. 2 b. 6

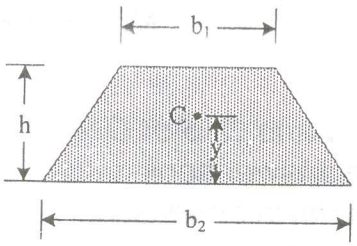

Fig. 2 a

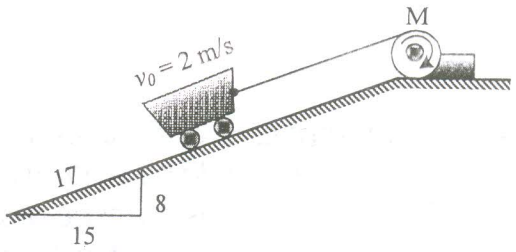

Fig. 2 b

3. a) The 500 N crate is hoisted using the ropes AB and AC. Each rope can withstand a maximum tension of 2500 N before it breaks. If AB always remains horizontal, determine the smallest angle θ to which the crate can be hoisted. Refer Fig. 3 a. 6

b) Three parallel bolting forces act on the rim of the circular cover plate of radius $r = 0.8$ m as shown in Fig. 3 b. Determine the magnitude and direction of a resultant force equivalent to the given force system and locate its point of application on the cover plate. 7

c) A rocket follows a path such that its acceleration is defined by $\mathbf{a} = (4\mathbf{i} + t\mathbf{j})$ m/s^2. If it starts from rest at $\mathbf{r} = \mathbf{0}$, determine the speed of the rocket and the radius of curvature of its path when $t = 10$ s. 6

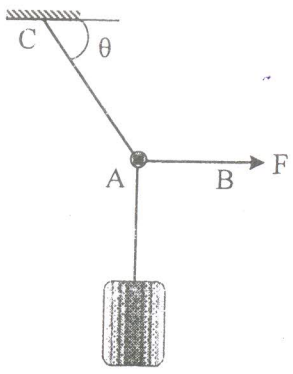

Fig. 3 a

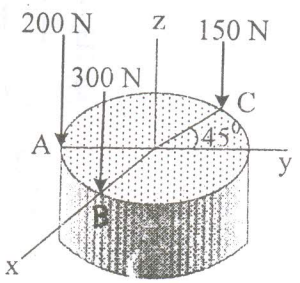

Fig. 3 b

OR

4. a) Determine the reaction at A and B for the member ACB loaded and supported as shown in Fig. 4 a when $\alpha = 30°$. 6

   b) Determine the force developed in cable AB, AC and AD used to support the 40 N crate as shown in Fig. 4 b. 7

   c) The bottle rests at a distance of 0.9 m from the centre of the circular horizontal platform. If the coefficient of static friction between the bottle and the platform is $\mu_s = 0.3$, determine the maximum speed that the bottle can attain before slipping. 6

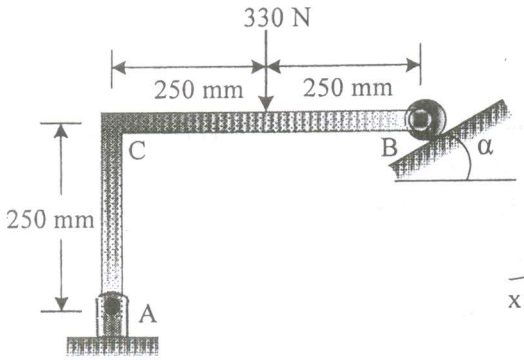

Fig. 4 a

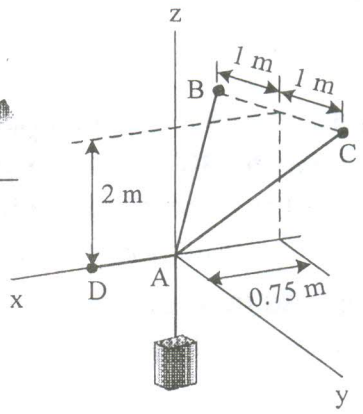

Fig. 4 b

5. a) Determine the force in each member of the truss and state if the members are in tension or compresion. Refer Fig. 5 a. Assume L = 2 m and P = 10 kN. 7

   b) Determine whether the 10 kg block shown in Fig. 5 b is in equilibrium, and find the magnitude and direction of the friction force when P = 40 N and $\theta = 20°$. 6

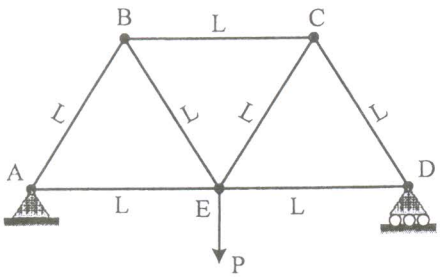

Fig. 5 a

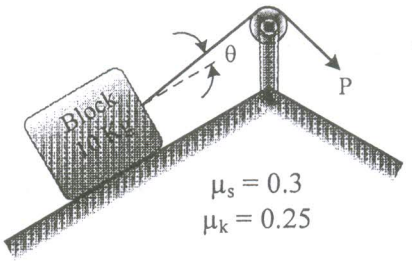

Fig. 5 b

c) A 2 kg stone is dropped from a height h and strikes the ground with a velocity of 24 m/s. Using work energy principle find the kinetic energy of the stone as it strikes the ground and the height h from which it was dropped. **6**

OR

6. a) Determine the horizontal and vertical components of reaction at pin B and C for the frame shown in Fig. 6 a. **7**

b) Determine the maximum tension in the rope at points A and B that is necessary to maintain equilibrium. Take $\mu_s = 0.3$ between the rope and the fixed post D. Refer Fig. 6 b. **6**

c) A truck is traveling on a level road at a speed of 90 km/h when its brakes are applied to slow it down to 30 km/h. An antiskid breaking system limit the breaking force to a value at which the wheels of the truck are just about to slide. The coefficient of kinetic friction between the road and the wheels is $\mu_k = 0.65$, Using impulse momentum principle determine the shortest time needed for the truck to slow down. **6**

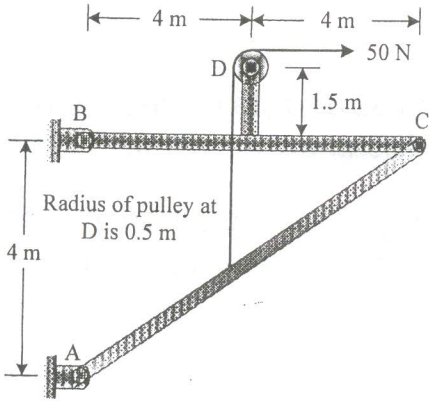

Fig. 6 a

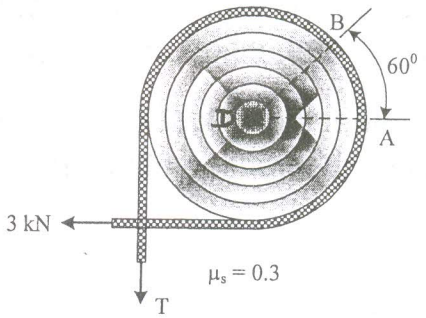

Fig. 6 b