Total No. of Questions : 6]

SEAT No. :

P987

[Total No. of Pages : 4

[4456]-111
F.E. (Common) (Semester - I & II)
ENGINEERING MECHANICS
(2012 Course)

Time :2 Hours] *[Max. Marks :50*

Instructions to the candidates :

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 diagram 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.*

Q1) a) The resultant of two forces P and Q is 1200 N horizontally leftward. Determine the force Q and the corresponding angle θ for the system of force s as shown in **Fig. 1 a**. **[4]**

b) The tanker is pulled with constant acceleration of 0.001 m/s^2 using cable that makes an angle of 10^o with the horizontal as shown in **Fig. 1 b**. If the force in the cable is 45.694 kN, determine the mass of tanker using Newton's 2nd law of motion. **[4]**

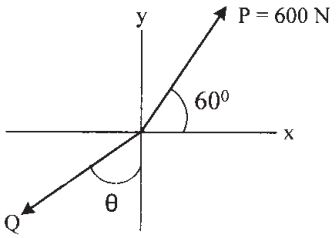

Fig. 1 a

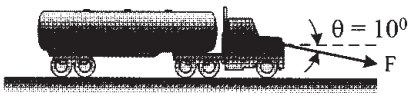

Fig. 1 b

c) An outdoor track is 126 m in diameter. A runner increases her speed at a constant rate from 4.2 to 7.2 m/s over a distance of 28.5 m. Determine the total acceleration of the runner 2 s after she begins to increases her speed. **[4]**

d) A 2 kg stone is dropped from a height h and strike the ground with a velocity of 24 m/s. find the kinetic energy of the stone as it strikes the ground and the height h from which it was dropped using work energy method. **[4]**

P.T.O.

OR

Q2) a) Determine the y coordinate of centroid of the shaded area as shown in **Fig. 2 a**. **[4]**

b) A sphere is fired into a medium with a initial speed of 27 m/s. If it experience a deceleration a = (-6t) m/s^2, where t is in seconds, determine the distance traveled before it stop. **[4]**

c) The small 0.6 kg block slides on a smooth circular path of radius 3 m in the vertical plane. If the speed of the block is 5 m/s as it passes point A and 4 m/s as it passes point B, determine the normal force exerted on the block by the surface at each of these location. Refer **Fig. 2 c**. **[4]**

d) A railroad car having a mass of 15 Mg is coasting at 1.5 m/s on a horizontal track. At the same time another car having a mass of 12 Mg is coasting at 0.75 m/s in the opposite direction. If the car meet and couple together, determine the speed of both cars just after the coupling. **[4]**

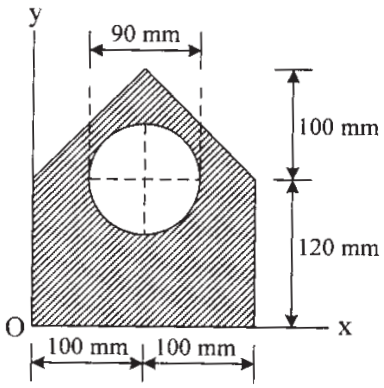

Fig. 2 a

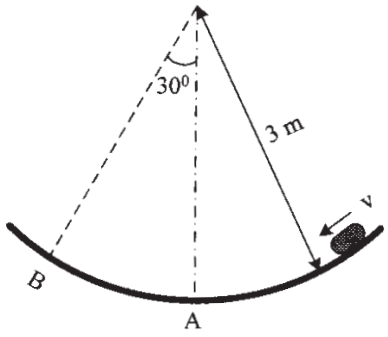

Fig. 2 c

Q3) a) Determine the magnitude of F_1 and F_2 so that the particle is in equilibrium. Refer **Fig. 3 a**. **[6]**

b) Determine the reactions at support for the beam loaded and supported as shown in **Fig. 3 b**. **[5]**

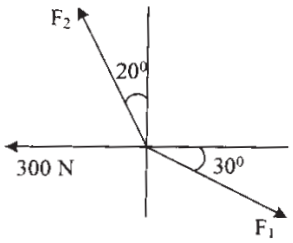

Fig. 3 a

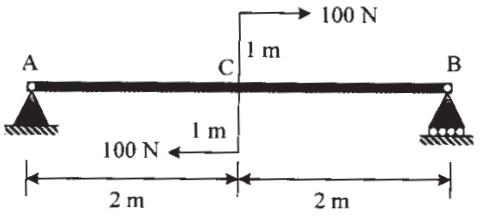

Fig. 3 b

c) A concrete foundation mat of 5 m radius supports four equally spaced columns, each of which is located 4 m from the centre of the mat. Determine the magnitude and point of application of the resultant of the four loads as shown in **Fig. 3 c**. **[6]**

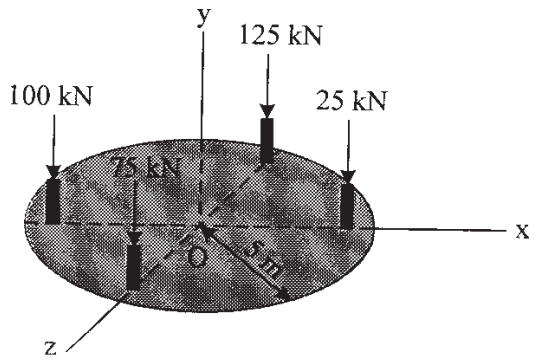

Fig. 3 c

OR

Q4) a) A 300 mm wooden beam weighing 540N is supported by a pin and bracket at A and by cable BC. Find the reaction at A and tension in cable BC. Refer **Fig. 4 a**. **[6]**

b) A rectangular plate is supported by three cables at A as shown in **Fig. 4 b**. Knowing that the tension in cable AD is 120 N, determine the weight of the plate. **[6]**

c) State and explain Two Force and Three Force Principle for equilibrium with sketches. **[5]**

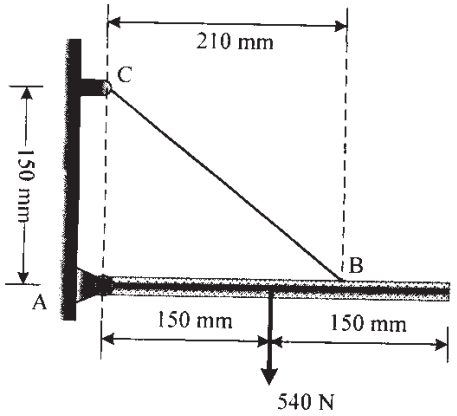

Fig. 4 a

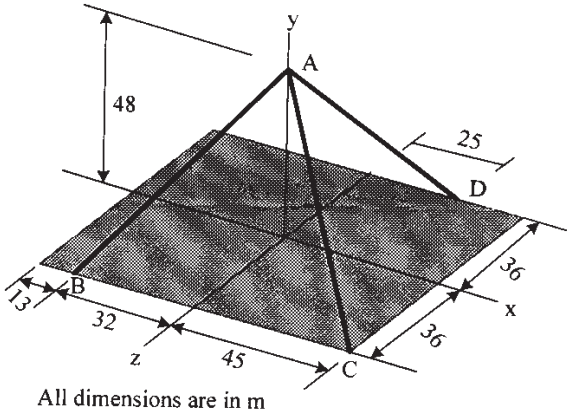

Fig. 4 b

Q5) a) Determine the magnitude and nature of forces in the members AB, AH and GC of the truss loaded and supported as shown in **Fig. 5 a**. **[6]**

b) The 15 m ladder has a uniform weight of 80 N and rest against the smooth wall at B as shown in **Fig. 5 b**. If the coefficient of static friction between ladder and floor is $\mu_s = 0.4$, determine the smallest angle θ at which the ladder will not slip. **[6]**

c) Define angle of repose, angle of friction, coefficient of friction and cone of friction with sketches. **[5]**

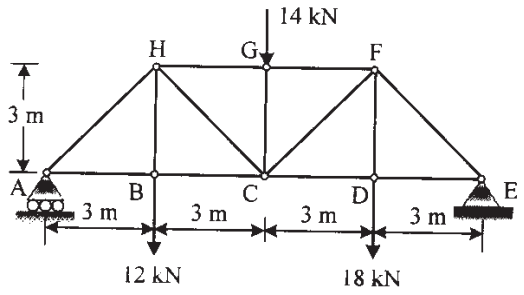

Fig. 5 a

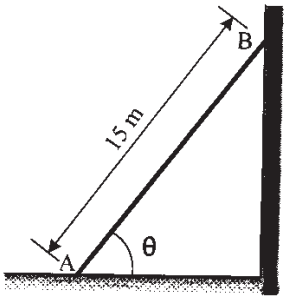

Fig. 5 b

OR

Q6) a) Determine the forces in member of HG, HC and BC in the truss as shown in **Fig. 5 a**. Use method of section. **[6]**

b) Determine the horizontal force P needed to just moving the 300 N block up the plane. Take $\mu_s = 0.3$ and refer **Fig. 6 b**. **[5]**

c) Two loads are suspended as shown in **Fig. 6 c** from cable ABCD. Knowing that $d_c = 0.75$ m and $d_b = 1.125$ m, determine the component of reaction at A and maximum tension in the cable. **[6]**

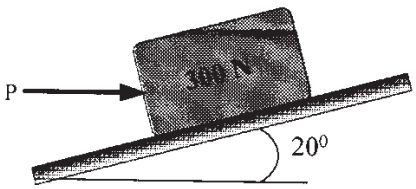

Fig. 6 b

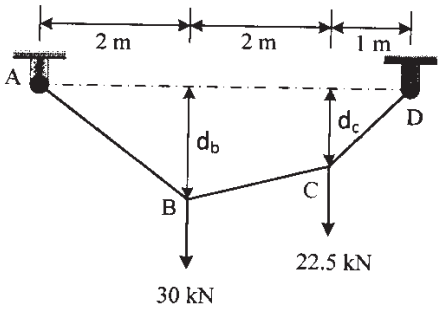

Fig. 6 c