F.E. (Common)
ENGINEERING MECHANICS
(2008 Pattern) (Semester - II)

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) *Answers should be written in one answer books.*
3) *Figures to the right indicate full marks.*
4) *Neat diagrams should be drawn wherever necessary.*
5) *If necessary, assume suitable data.*
6) *Use of nonprogrammable electronic pocket calculator is allowed.*
7) *Use of Cell phone is prohibited in examination hall.*

Q1) a) Determine the magnitude and direction of the resultant force for the concurrent force system as shown in Fig. 1 a. **[6]**
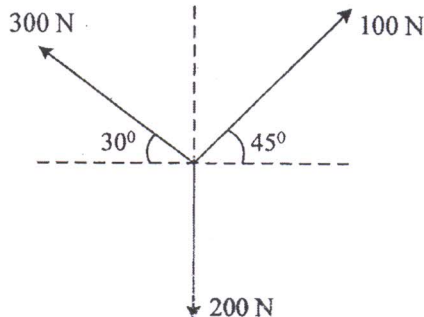

Fig. 1 a

b) A truck travels 164 m in 8 s while being decelerated at a constant rate of 0.5 m/s². Determine initial velocity final velocity and the distance travelled in first 0.6 s. **[6]**

OR

Q2) a) A wire is bend into a shape ABCDE as shown in Fig. 2 a. Determine the position of centroid with respect to point C. **[6]**

b) Determine the acceleration of 5 kg cylinder A moving downward as shown in Fig. 2 b. The block B has mass of 10kg. The coefficient of kinetic friction between block and surface is 0.1. Neglect the mass of rope and pulleys. **[6]**
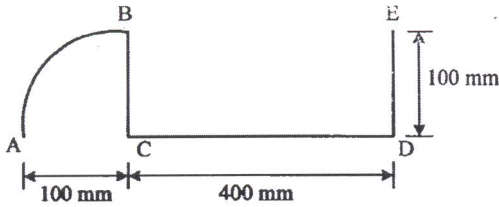
Fig. 2 a

Block B of mass 10 kg
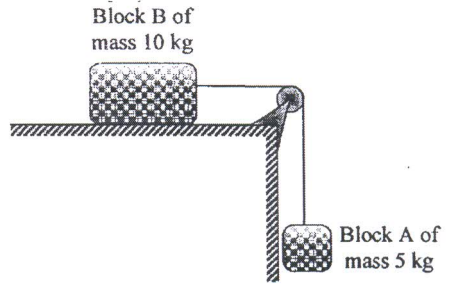
Block A of mass 5 kg

Fig. 2 b

Q3) a) The square steel plate has a mass of 1800 kg with mass centre at its center G as shown in Fig. 3 a. Calculate the tension in each of the three cables with which the plate is lifted. **[6]**

b) The 20 kg homogeneous smooth sphere rests on the two inclines as shown in Fig. 3 b. Determine the contact reactions at A and B. **[7]**

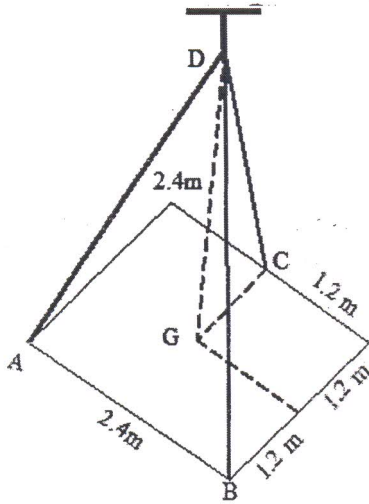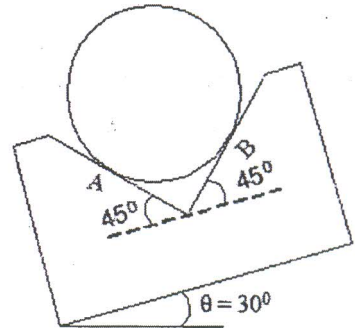Fig. 3 a

Fig. 3 b

c) Calculate the minimum possible magnitude u of the muzzle velocity which a projectile must have when fired from point A to reach a target B on the same horizontal plane 12 km away. Refer Fig. 3 c. **[6]**
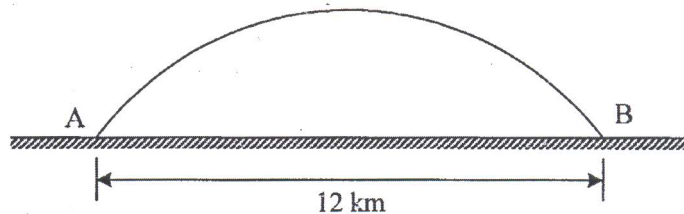

Fig. 3 c

OR

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Q4) a) Determine the support reactions for the beam loaded and supported as shown in Fig. 4 a. **[6]**

Fig. 4 a
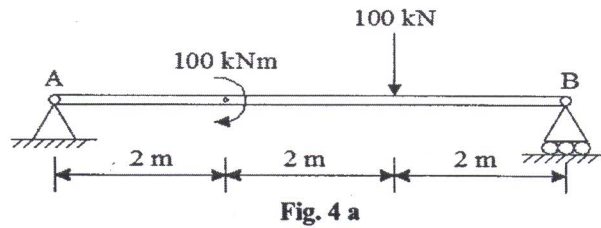
b) Determine the magnitude and point of application of resultant of the system of parallel forces which act on the plate as shown in Fig. 4 b. **[7]**

Fig. 4 b
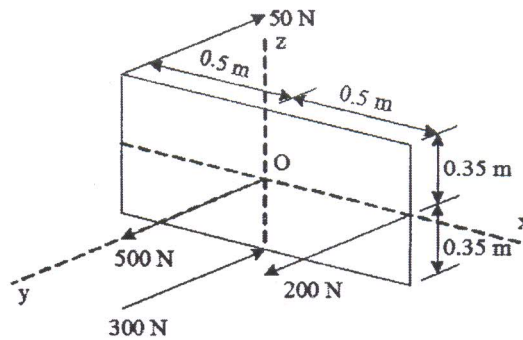
c) The pendulum bob has a mass m kg and is released from rest from the position as shown in Fig. 4 c. If the tension in the cord is 2.5 times the weight of the bob, determine the velocity and acceleration of the bob in position shown. **[6]**

Fig. 4 c
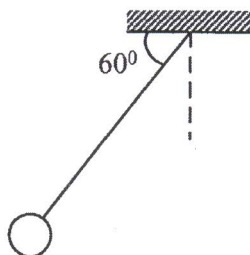
Q5) a) Determine the forces in all the members of the truss supported and loaded as shown in Fig.5 a. **[6]**

b) Determine the forces in all the segments of the cable supported and loaded as shown in Fig. 5 b. **[7]**

c) One of the requirement for tennis balls to be used in official competition is that, when dropped onto a rigid surface from a height of 2540 mm, the height of the first bounce of the ball must be in the range of 1346 mm $\leq h \leq$ 1473 mm. Determine the range of the coefficient of restitution of the tennis balls satisfying this requirement. **[6]**

Fig. 5 a

Fig 5 b

OR

Q6) a) Define with sketches angle of friction, angle of repose, cone of friction and coefficient of friction. **[6]**

b) Determine the forces in the members DE, DC and BC for the truss loaded as shown in Fig. 5 a. Use method of section. **[7]**

c) Two spheres A and B of radius 25 mm are travelling along the same straight path in the opposite direction. Sphere A has mass of 1.2 kg moving with velocity 5m/s towards right while sphere B of mass 2.4 kg is moving with 2.5m/s towards left. If coefficient of restitution is 0.8, determine their velocities after collision. **[6]**

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