[4656] – 202

Seat No.	

F.E. (Semester – II) Examination, 2014
ENGINEERING MECHANICS
(2012 Course)

Time : 2 Hours Max. Marks : 50

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

1. a) Determine the magnitude of force P so that the resultant of the force system as shown in Fig. 1a is vertical and hence find magnitude of resultant force. **4**

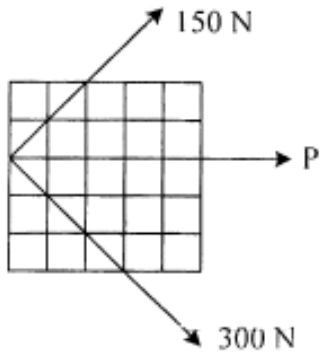

Fig. 1a

b) The small collar of mass 0.5 kg is released from rest at A and strikes the base B with velocity 4.7 m/s as shown in Fig. 1 b, determine the work done by frictional force using work energy principle. **4**

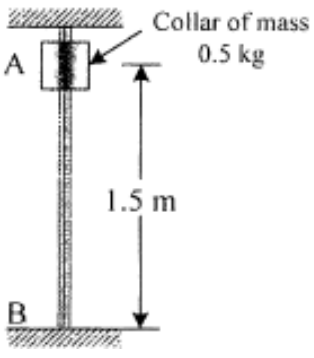

Fig. 1b

P.T.O.

c) During a break test, the car of mass 1500 kg is stop from an initial speed of 100 kmph in a distance of 50 m. Determine the breaking force assuming uniform deceleration. **4**

d) A particle moves in a circular path of radius 0.4 m. Calculate magnitude of acceleration a of the particle if its speed is 0.6 m/s but it increasing at the rate of 1.2 m/s each second. **4**

OR

2. a) The pendulum bob has a mass m and is released from rest when $\theta = 0°$. Determine the tension in the cord as a function of the angle of decent θ. Neglect the size of bob. **4**

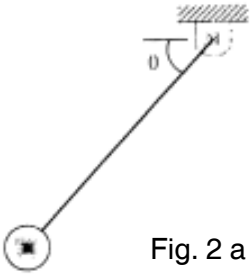

Fig. 2 a

b) Determine the coordinate of centroid of the shaded area as shown in Fig. 2 b. **4**

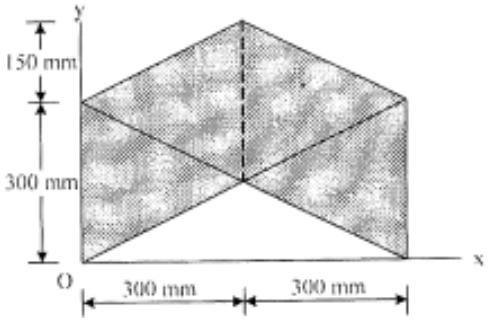

Fig. 2 b

c) A ball is projected vertically upward with a velocity of 9.81 m/s. Determine the maximum height travel by the ball, the velocity at which it strikes the ground and total time of journey. **4**

d) 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. **4**

3. a) A cylinder of weight 1000 N is rest on the stair as shown in Fig. 3 a. Determine the minimum magnitude of force P to raise the cylinder over the step. **6**

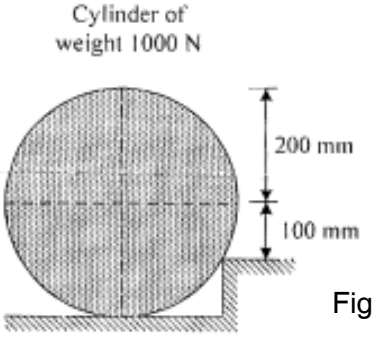

Fig. 3 a

b) The ball is suspended from the horizontal ring using three spring each having a stiffness of k = 50 N/m and an unstretched length of 1.5 m. If h = 2 m, determine the weight of ball. Refer Fig. 3 b. **6**

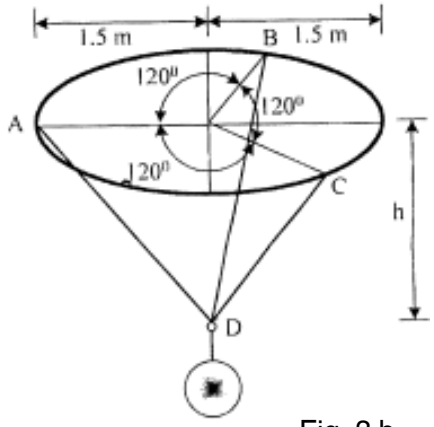

Fig. 3 b

c) Determine the length a of overhang so that the reaction at B is twice of the reaction at A for the beam loaded and supported as shown in Fig. 3 c. **5**

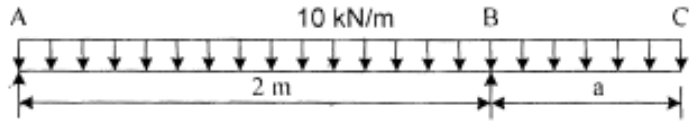

Fig. 3 c

OR

4. a) Three parallel bolting forces act on the rim of the circular cover plate as shown in Fig. 4 a. Determine the magnitude, direction and locate point of application of the resultant force on the cover plate. **6**

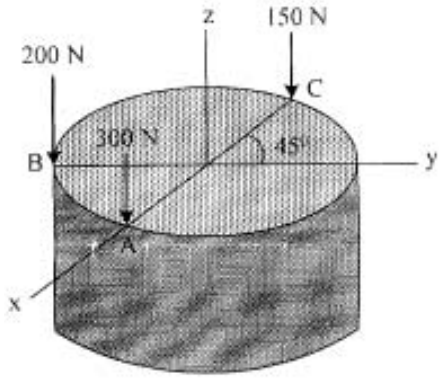

Fig. 4 a

b) Determine the magnitude and direction θ of force F so that the particle is in equilibrium. Refer Fig. 4 b. **5**

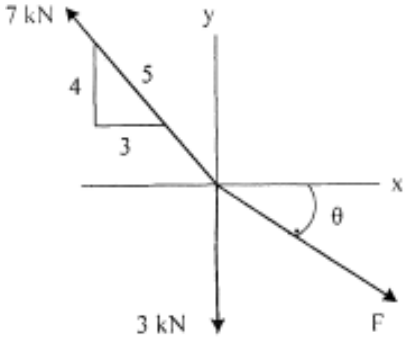

Fig. 4 b

c) A force of 150 N acts on the end of beam ABD as shown in Fig. 4 c. Determine the magnitude of tension in cable BC to maintain equilibrium. **6**

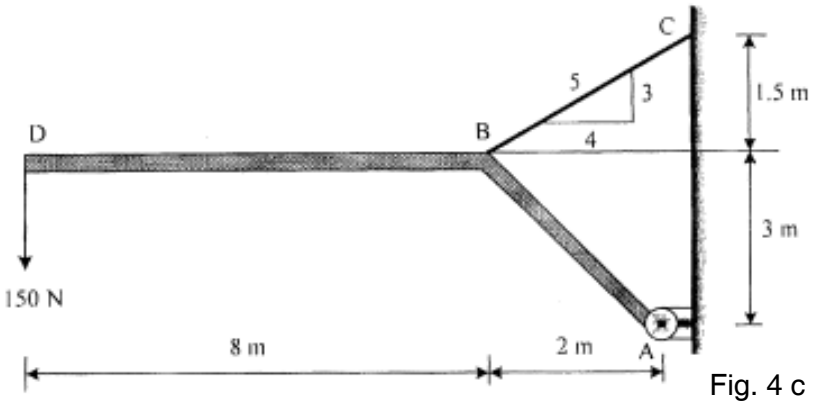

Fig. 4 c

5. a) A block of mass m rest on a frictional plane which makes an angle α with the horizontal as shown in Fig. 5 a. If the coefficient of friction between the block and the frictional plane is 0.2, determine the angle α for limiting condition. **5**

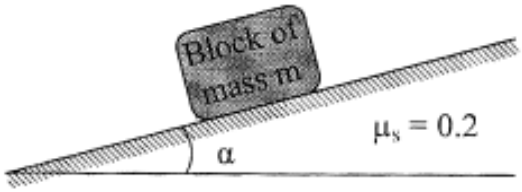

Fig. 5 a

b) Determine the forces in each member of the plane truss as shown in Fig. 5 b in terms of the external loading and state if the members are in tension or compression. Use $\theta = 30°$, L = 2 m and P = 100 N. **6**

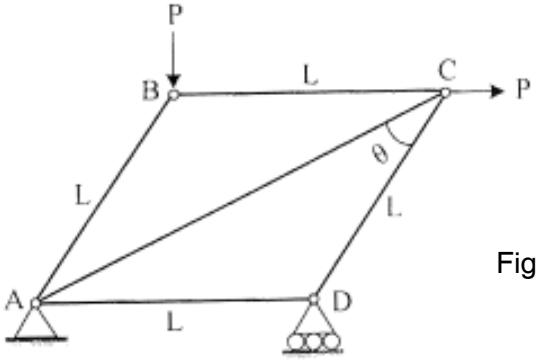

Fig. 5 b

c) Determine the range of P for the equilibrium of block of weight W as shown in Fig. 5 c. The coefficient of friction between rope and pulley is 0.2. **6**

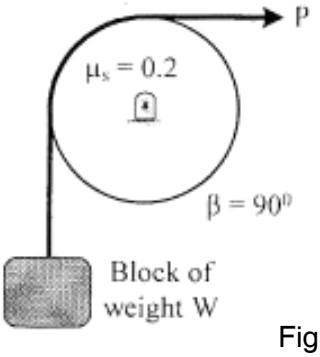

Fig. 5 c

OR

6. a) Determine the components of reaction at C for the frame loaded and supported as shown in Fig. 6 a. **6**

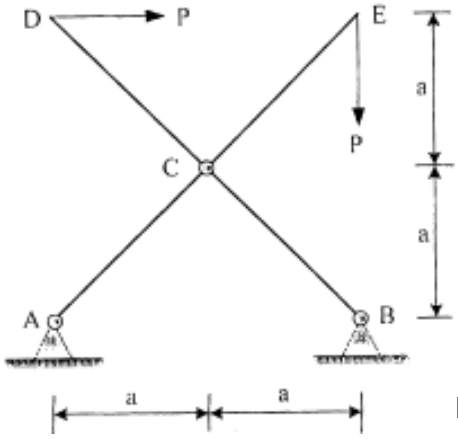

Fig. 6 a

b) Determine the range of P for the limiting equilibrium of block B of mass 150 kg rest on an inclined plane as shown in Fig. 6 b. **6**

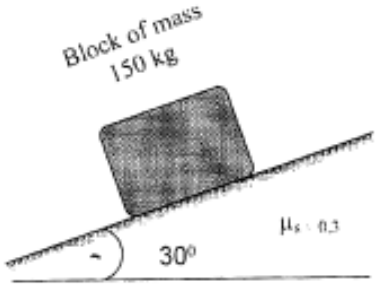

Fig. 6 b

c) State the assumption for the analysis of cable and laws of static friction. **5**

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