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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.



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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.





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- 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.
- 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.
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OR

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



b) Determine the coordinate of centroid of the shaded area as shown in 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.
- 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.
- 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.



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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.



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.





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.





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

Fig. 4 b



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.





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



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





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

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