



Code No. : 6007

**FACULTY OF ENGINEERING AND INFORMATICS**  
**B.E. I Year (Common to all Branches) (Supplementary)**  
**Examination, Dec. 2009/Jan. 2010**  
**ENGINEERING MECHANICS**

Time: 3 Hours]

[Max. Marks: 75

*Note : Answer all questions of Part A.*  
*Answer five questions from Part B.*

**PART – A**

**25**

1. The resultant of two forces 'P' and 'Q' is R. If Q is doubled, the new resultant is perpendicular to P then. 2
  - a)  $P = Q$
  - b)  $Q = R$
  - c)  $Q = 2R$
  - d) None of the above
  
2. Two forces act at angle of  $120^\circ$ . The bigger force is 40 kg and the resultant is perpendicular to smaller one. The smaller force is 2
  - a) 20 kg
  - b) 40 kg
  - c) 80 kg
  - d) None of the above
  
3. The ratio of moment of inertia of a circular plate to that of a square plate for equal depth is 2
  - a) less than one
  - b) equal to one
  - c) greater than one
  - d) none of the above

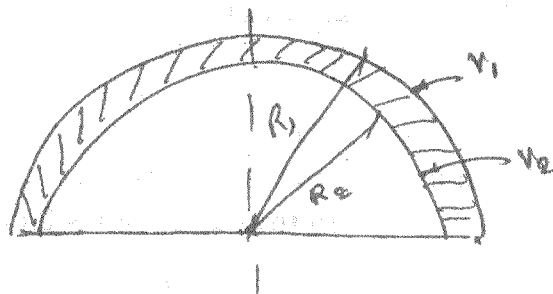


4. The force of 6 kg is just sufficient to move a body and the angle of friction of the body with the surface is  $45^\circ$ , then the weight of body will be 2
- a)  $6\sqrt{2}$  kg  
b)  $8\sqrt{2}$  kg  
c) 6 kg  
d) 4.5 kg
5. The M.I. of a sphere of radius R and mass M about an axis tangential to it is 2
- a)  $\frac{2}{3}MR^2$   
b)  $\frac{2}{5}MR^2$   
c)  $\frac{7}{5}MR^2$   
d)  $\frac{7}{3}MR^2$
6. A motor cycle runs at 15 km/hr for 2 hours, 20 km/hr for 3 hours and then finally 30 km/hr for 5 hours. How fast must the motor cycle has to move in the last 5 hrs to attain an average speed of 30 km/hr ? 3
7. A body vibrates in SHM with a period of oscillation 6 seconds and an amplitude of 2 cm. Find the velocity and acceleration of the body at the mean position. 3
8. A particle moves path of 40 m radius so that its arc distance from a fixed point on the path is given by  $S = 4t^3 - 10t$  where S is in mts and t is in seconds. Compute the total acceleration at the end of 2 sec. 3
9. State laws of friction. 3



10. Determine the CG of a hollow hemi sphere of 4 cm external diameter and 3 cm internal diameter.

3



PART - B

50

11. The forces  $\vec{F}_1 = -100\mathbf{k}$ ,  $\vec{F}_2 = 200\mathbf{k}$  and  $F_3 = 50\mathbf{k}$  in Newtons act at the points  $(10, 2, 0)$ ,  $(12, 6, 0)$  and  $(8, 8, 0)$  respectively on a plate in X - Y plane. Find the position of  $\vec{F}_4 = 100\mathbf{k}$  on the plate so that the resultant of all four forces should act at a point  $(5, 5, 0)$ .

10

12. a) Determine the push necessary to move a body up a plane inclined at  $20^\circ$  to the horizontal if the weight of the body is 200 N and inclination of the push is  $10^\circ$  to the horizontal plane. Take  $\mu = 0.2$ .

5

- b) Determine the C-G of a hemispherical solid of radius 'R'.

5

13. a) Determine M-I of solid sphere of radius R.

6

- b) Define parallel axis theorem and perpendicular axis theorem.

4

14. a) Define law of conservation of energy.

3

- b) A stone is thrown vertically upward with a velocity of 19.6 m/sec from the top of the tower 24.5 m high. Calculate the following.

7

- 1) The time required for the stone to reach the ground.

- 2) Velocity of the stone, in its downward travel at the point in the same level as the point of projection.

- 3) The maximum height which the stone will rise in its flight. Take  $g = 9.8 \text{ m/sec}^2$ .



15. a) State D'Alemberts principle. 3
- b) A ball is thrown so that it first clears a 7.5 mts wall 30 mt away. If it left the hand 1.5 m above the ground and at an angle of  $60^\circ$  to the horizontal, what is the initial velocity of the ball ? 7
16. a) A car weighing 18 kN rounds a curve of 60 m radius banked at an angle of  $30^\circ$ . Find the friction force acting on the tires when the car is travelling at 96.54 kmph. The co-efficient of friction between tires and road is 0.60. 5
- b) The bullet weighing 0.3 N and moving at 660 m/s penetrates the 45 N body emerges with a velocity 180 m/s as shown in Fig. How far and how long does the body move ? 5
- $\mu = 0.4$



17. a) Derive work-energy equation for translation. 5
- b) Explain terms free vibration, forced vibration and damped vibration. 5