

Code: AE2T3, ME2T4

I B.Tech-II Semester-Regular Examinations - July 2013**ENGINEERING MECHANICS - II**
(For Mechanical & Aeronautical Engineering)

Duration: 3 hours

Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

- 1 a) A point moving with uniform acceleration describes distances 's₁' and 's₂' in successive intervals of 't₁' and 't₂' seconds respectively. Show that the acceleration is

$$\frac{2(s_2 t_1 - s_1 t_2)}{t_1 t_2 (t_1 + t_2)} \quad 7 \text{ M}$$

- b) An automobile starting from rest increases its speed from '0' to 'v' with a constant acceleration 'a₁', runs at this speed for a time, and finally comes to rest with a constant deceleration 'a₂'. If the total distance travelled is 'S' find the total time 't' required. 7 M

- 2 a) State the principle of conservation of energy and solve the following:

A bullet losses 1/25th of its velocity in passing through a plank. Find how many such uniform planks it would pass through before coming to rest, assuming the resistance of the planks to be uniform. 7 M

- b) What is coefficient of restitution? A sphere collides directly on an equal sphere which is at rest. If the coefficient of restitution be 'e' show that their velocities after the impact are as $(1 - e) : (1 + e)$. 7 M
- 3 a) Explain angle of projection and horizontal range. Also derive an expression from first principles to find the horizontal range and duration of flight of a projectile. 7 M
- b) A projectile is aimed at a mark on the horizontal plane through the point of projection and falls 12 meters short when the angle of projection is 15° , while it overshoots the mark by 24 meters when the angle of projection is 45° . Find the angle of projection to hit the mark. Assume no air resistance. 7 M
- 4 a) What is a conservative system? Is the law of conservation of energy is applicable to the system of particles that perform curvilinear motion? Explain. 7 M
- b) The coefficient of friction between wet asphalt pavement and the tyres of an automobile is found to have the value $\mu = 0.20$. At what constant speed v can the automobile travel around a curve of radius $r = 240$ m without skidding if the road is level? 7 M

5 a) State parallel axes theorem and derive an equation for moment of inertia of a rectangular lamina about its centroidal axis. 7 M

b) Obtain an expression for the moment of inertia of a solid sphere about a diameter. 7 M

6 a) A wheel rotates with uniform angular acceleration. If the angles turned during the third and sixth second be 8 radians and 11 radians respectively, determine the initial angular velocity of the wheel and the angular acceleration. 7 M

b) At the end of 20 seconds a flywheel reaches a speed of 15 radians per second starting from rest. If the angular acceleration be uniform, find the angular displacement during the 16th second. 7 M

7 a) What is instantaneous centre of rotation? Explain. 7 M

b) Two ships 'S₁' and 'S₂' are at a given instant 6 km away from each other and S₂ is travelling at 20 km/hour due North. Determine (i) the velocity of S₂ relative to S₁, (ii) the shortest distance between the two ships and (iii) the time when the two ships are nearest. 7 M

8. A cylinder of mass M and radius R rolls freely down on inclined plane whose inclination to the horizontal is θ . Find the acceleration with which the cylinder will move.

14 M