Code: **ME2T4, AE2T3**

PVP 12

I B.Tech-II Semester-Regular Examinations - July 2014

ENGINEERING MECHANICS-II
(Common for ME & AE)

Duration: 3 hours Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) Explain
   (i) speed and velocity of a body,
   (ii) kinematics and kinetics and
   (iii) acceleration and retardation of a particle. 7 M

   b) A particle moves with an acceleration of 2 m/s^2 for the first 2 seconds from start. The acceleration is reduced to 1 m/s^2 for the next 2 seconds. After this the particle moves with a retardation of 1.5 m/s^2 till it comes to rest. If the particle starts from rest find the total distance travelled, the total time of travel and the average velocity of travel. Draw also velocity-time diagram. 7 M

2. a) State work-energy theorem and write the equation of work-energy for rectilinear motion of a particle. List advantages of this theorem. 7 M

   b) If the masses of two balls be as 3:2 and their respective velocities before impact be as 2:3 and in opposite directions, and the coefficient of restitution is 2/3, show

that each ball after direct impact moves back with $2/3^{rd}$ of its original velocity. 7 M

3. a) Define curvilinear motion of a particle.
At the instant t = 0, a locomotive starts to move with uniformly accelerated speed along a circular curve of radius r = 600 m and acquires by the end of the first 60 seconds of motion a speed equal to 24 kmph. Find the tangential and normal accelerations at the instant t = 30 seconds. 7 M

b) A cannon fires its projectile with such an initial velocity and such an angle of elevation that the range is 'r' and the maximum height to which the projectile rises is h. Find the maximum range that can be obtained with the same initial velocity. 7 M

4. a) Explain the application of D'Alembert's principle to curvilinear translation of a particle through an example. 7 M

b) A circular ring has a mean radius r = 500 mm and is made of steel for which w = 77.12 kN/m^3 and for which the ultimate strength in tension is 413.85 MPa. Find the uniform speed of rotation about its geometric axis perpendicular to the plane of the ring at which it will burst. 7 M

5. a) Determine the moment of inertia of a homogeneous Rectangular plate. 7 M

b) Calculate the moment of inertia I_z of a right circular cone of uniform density, radius of base 'a', and attitude 'h', with respect to its geometric axis. 7 M

6. a) Obtain the governing equations for angular velocity and angular rotation of a rigid body about a fixed axis under the action of constant moment. 7 M

b) The wheel of a small gyroscope is set spinning by pulling on a string would around the shaft. Its moment of inertia is $I = 5562.5$ kg mm^2 and the diameter of the shaft on which the string is wound is 12.5 mm. If 750 mm of string is pulled off with a constant force of 53.4 N, what angular velocity will be imparted to the wheel? 7 M

7. a) Explain: relative velocity, relative acceleration, absolute velocity and absolute acceleration. 7 M

b) When a cyclist is riding towards west at 20 km per hour, he finds the rain meeting at an angle of angle of 45^0 with the vertical. When he rides at 12 km per hour, he meets the rain at an angle of 30^0 with the vertical. What is the actual velocity in magnitude and direction of the rain? 7 M

8. a) Explain kinetics of plane motion. 7 M

b) A small car of weight W has four solid disk wheels, each of weight W/4 and radius r. What acceleration will the car have in coasting down a straight track inclined to the horizontal by an angle α, if rolling resistance is neglected? Assume that the wheels roll without slip. 7 M