

Bachelor of Power Engg., 1<sup>st</sup> Yr. 2<sup>nd</sup> Semester Examination, 2017

## Subject: Engineering Mechanics-II

Full Marks: 100

Time: 3 Hours

Answer Q.No.1 and any five (5) from the rest.

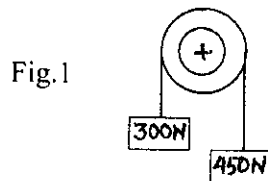
## 1. MCQ type questions.

Marks: 1 x 10 = 10

- (i) A rigid body possesses \_\_\_\_\_ degrees of freedom.  
a. One      b. Two      c. Four      d. Six
- (ii) A particle moves along a straight line such that distance (x) traversed in 't' seconds is given by  $x = t^2(t - 4)$ , the acceleration of the particle will be given by the equation  
a.  $6t^2 - 8t$       b.  $3t^2 + 2t$       c.  $6t - 8$       d.  $6t - 4$
- (iii) The range of a projectile is maximum, when the angle of projection is  
a.  $30^\circ$       b.  $45^\circ$       c.  $60^\circ$       d.  $90^\circ$
- (iv) Force which produces acceleration in body is equal to rate of change of  
a. velocity      b. acceleration      c. density      d. momentum
- (v) In any collision  
a. total momentum is not conserved.  
b. total kinetic energy is conserved.  
c. total momentum is conserved.  
d. total momentum is not conserved but total kinetic energy is conserved.  
e. total momentum and total kinetic energy are conserved and the masses are equal.
- (vi) A 30.00 kg mass falls from a height of 4.000 m. The momentum of the mass just before it hits the ground is  
a. 144.2 kg m/s.      b. 187.8 kg m/s.      c. 320.0 kg m/s.      d. 442.4 kg m/s.      e. 502.1 kg m/s.
- (vii) Two objects collide and stick together. Which of the following is false?  
a. momentum is conserved      b. kinetic energy is lost      c. kinetic energy is conserved  
d. momentum is lost
- (viii) A tennis ball approaches a racket with a momentum of 5 kg.m/s and bounces back with a momentum of 6 kg.m/s after the collision with the racket. What is the change in momentum of the tennis ball?  
a. 1 kg.m/s      b. 5 kg.m/s      c. 6 kg.m/s      d. 11 kg.m/s      e. 0 kg.m/s
- (ix) A cyclist moves in a circular track of radius 100m. If the coefficient of friction is 0.2, then the maximum speed with which the cyclist can take a turn without leaning inwards, is  
a. 14.0 m/s      b. 140 m/s      c. 1.4 m/s      d. 9.8 m/s
- (x) A ball of mass 150 gm moving with acceleration  $20 \text{ m/s}^2$  is hit by a force, which acts on it for 0.1 sec. The impulsive force is  
a. 1.2 N-s      b. 0.3 N-s      c. 0.1 N-s      d. 0.5 N-s

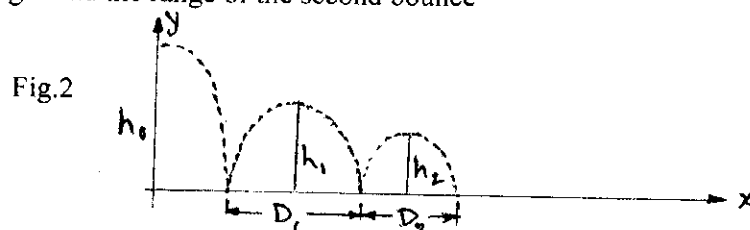
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2. A ball is dropped from the top of a tower 30 m high. At the same instant a second ball is thrown upward from the ground with an initial velocity of 15 m/sec. When and where do they cross and with what relative velocity? 18 Marks
3. A bullet is fired from a height of 120 m at a velocity of 360 kmph at an angle of  $30^\circ$  upwards. Neglecting air resistance, find
- Total time of flight.
  - Horizontal range of the bullet,
  - Maximum height reached by the bullet, and
  - Final velocity of the bullet just before touching the ground. 18 Marks
4. Two ships move from a port at the same time. Ship A has velocity of 30 kmph and is moving in  $N30^\circ W$  while ship B is moving in south-west direction with a velocity of 40 kmph. Determine the relative velocity of A with respect to B and the distance between them after half an hour. (Solve with figure) 18 Marks
5. Two bodies weighing 300N and 450N are hung to the ends of a rope passing over an ideal pulley as shown in Fig.1. With what acceleration the heavier body comes down? What is the tension in the string?



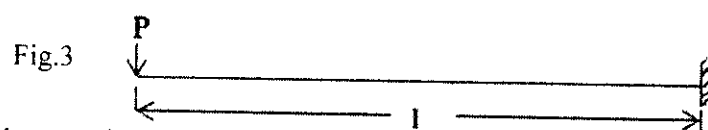
18 Marks

6. A body weighing 300N is pushed up a  $30^\circ$  plane by a 400 N force acting parallel to the plane. If the initial velocity of the body is 1.5 m/sec and coefficient of kinetic friction is  $\mu=0.2$ , what velocity will the body have after moving 6m? 18 Marks
7. A ball is dropped from a height  $h_0 = 1.2$  m on a smooth floor as shown in Fig.2. Knowing that for the first bounce,  $h_1 = 1$  m and  $D_1 = 0.4$  m, determine
- The coefficient of restitution
  - The height and the range of the second bounce 18 Marks



8. Draw the SFD and BMD for a cantilever beam subjected to a concentrated load at free end (Fig.3)

18 Marks



9. Derive the equation of trajectory for inclined projectile motion on level ground with assumptions and also find the time of flight of the projectile. 18 Marks