Code : 011101

B.Tech 1st Semester Exam., 2015

ENGINEERING MECHANICS

Time : 3 hours

Full Marks : 70

Instructions :

(i) All questions carry equal marks.

(ii) There are **NINE** questions in this paper.

(iii) Attempt **FIVE** questions in all.

(iv) Question No. **1** is compulsory.

1. Choose the correct alternative (any *seven*) :

   (a) The motion of a particle round a fixed axis is

      (i) translatory as well as rotary

      (ii) translatory

      (iii) rotary

      (iv) circular

   (b) The minimum force required to slide a body of weight W on a rough horizontal plane is

      (i) $W \sin \theta$

      (ii) $W \cos \theta$

      (iii) $W \tan \theta$

      (iv) None of the above

(2)

   (c) The point, through which the whole weight of the body acts, irrespective of its position, is known as

      (i) centre of mass

      (ii) moment of inertia

      (iii) centre of percussion

      (iv) centre of gravity

   (d) The rate of change of momentum is directly proportional to the impressed force and takes place in the same direction in which the force acts. This statement is known as

      (i) Newton's third law of motion

      (ii) Newton's first law of motion

      (iii) Newton's second law of motion

      (iv) None of the above

   (e) Which of the following is a scalar quantity?

      (i) Acceleration

      (ii) Velocity

      (iii) Speed

      (iv) Force

(f) The principle of transmissibility of forces states that, when a force acts upon a body, its effect is

(i) minimum, if it acts at the centre of gravity of the body

(ii) different at different points on its line of action

(iii) same at every point on its line of action

(iv) maximum, if it acts at the centre of gravity of the body

(g) Non-coplanar concurrent forces are those forces which

(i) do not meet at one point and their lines of action do not lie on the same plane

(ii) meet at one point, but their lines of action do not lie on the same plane

(iii) meet at one point and their lines of action also lie on the same plane

(iv) do not meet at one point, but their lines of action lie on the same plane

(h) Which of the following is vector quantity?

(i) Linear velocity

(ii) Linear displacement

(iii) Linear acceleration

(iv) All of the above

(Turn Over)

(i) Concurrent forces are those forces whose lines of action

(i) meet at one point

(ii) meet on the same plane

(iii) lie on the same line

(iv) None of the above

(j) According to the law of moments, if a number of coplanar forces acting on a particle are in equilibrium, then

(i) their lines of action are at equal distances

(ii) the algebraic sum of their moments about any point is equal to the moment of their resultant force about the same point

(iii) their algebraic sum is zero

(iv) the algebraic sum of their moments about any point in their plane is zero

2. Two forces P and Q act at O such that their resultant acts along X axis as shown in Fig. 1 below :
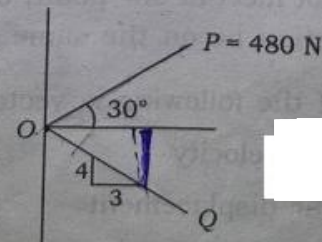

Fig. 1

Determine the magnitude of Q and hence their resultant.

(Continued)

3. A motorist travelling at a speed of 90 kmph suddenly applies the brake and come to rest after skidding 100 m. Determine the time required for the vehicle to stop and coefficient of kinetic friction between the tires and road.

4. A ball of mass M hits directly to a similar ball of mass m which is at rest. The velocity of first ball after impact is zero. Half of the initial kinetic energy is lost in impact. Find the coefficient of restitution.

5. For an unequal I section as shown in Fig. 2 below, calculate the moment of inertia of the section along horizontal and vertical axes :
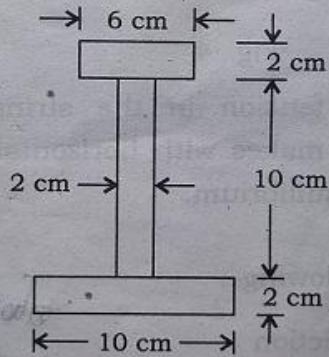

Fig. 2

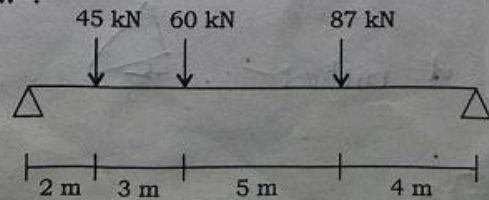6. Find the reaction at support as shown in Fig. 3 below :

Fig. 3

(Turn Over)

7. Describe briefly the Chasle's theorem.

8. Two rollers weight P and Q are connected by a flexible string AB. The rollers are at rest on mutually perpendicular planes DE and EF as shown in Fig. 4 below :
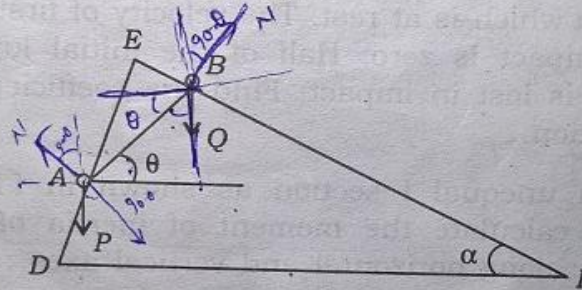

Fig. 4

Calculate the tension in the string and the angle θ that it makes with horizontal when the system is in equilibrium.

9. Explain the following :

(a) Laws of friction

(b) Transmissibility of force

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