Total No. of printed pages = 5

ME-201/EM/2nd Sem/Common/2013

ENGINEERING MECHANICS

Full Marks – 70

Pass Marks – 28

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *three* questions from the rest.

1. (a) Write down the units of the following quantities in SI system : ½×10=5

   (i) Acceleration

   (ii) Length

   (iii) Force

   (iv) Energy

   (v) Work

   (vi) Moment of inertia

   (vii) Moment

   (viii) Pressure

   (ix) Torque

   (x) Stress

[Turn over

(b) Define the following as used in mechanics :

(i) Mechanical advantage

(ii) Law of machine

(iii) Equilibrium

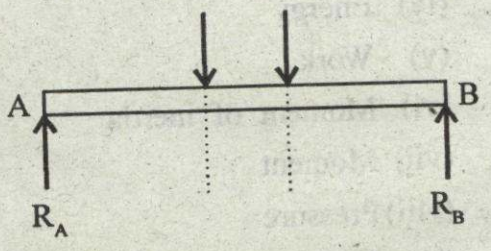
(iv) Resolution of forces

(v) Angle of friction

(vi) D' Alembert's principle. $2\times6=12$

(c) State the conditions of equilibrium of a number of co-planar forces. 3

(d) A beam AB of span 10m is carrying two point loads of 400N and 500N at distances of 4m and 8m respectively from end A. The length of the beam is 12m. Determine the reactions R_A and R_B. 5



(e) A body resting on a rough horizontal plane required a pull of 180N inclined at 30° to the plane just to move it. It was found that a push of 220N inclined at 30° to the plane just moved the body. Find the weight of the body and co-efficient of friction. 5

(f) Find the law of machine in which an effort of 15.5N raised a load of 70N and an effort of 19.5N raised a load of 90N. Find the effort required to lift a load of 100N. 3+2=5

(g) Find the magnitude of the two like parallel forces acting at a distance of 240 mm, whose resultant is 200N and its line of action is at a distance of 60 mm from one of the forces. 5

2. (a) Find the magnitude and direction of the resultant of the concurrent forces of 8N, 12N, 15N and 20N making angles of 30°, 70°, 120°15' and 155° respectively with a fixed line.

(b) State Newton's 2nd law of motion.

(c) A force of 200N acts on a body of mass 500 kg initially at rest. Find the velocity of the body after the force has been acting for 5 seconds. Also calculate the distance through which the body will travel in these 5 seconds.

4+2+(2+2)=10

3. An I section has the following dimensions :

(a) Bottom flange = 320 mm × 120 mm

(b) Top flange = 160 mm × 60 mm

(c) Web = 300 mm × 60 mm

Determine the position of the Center of Gravity. 10

4. A bullet moving at a speed of 240 m/sec is fired into a thick target and penetrates upto 480 mm. If it is fired into 100 mm thick target, find the exit velocity of the bullet considering the resistance to be uniform in both the cases. 10

5. A stone is dropped from the top of a tower 120m high. Another stone is projected upward at the same time from the foot of the tower and meets the first stone at a height of 50m. Find the velocity with which the second stone is projected upwards. 10

6. (a) What is the basic difference between mass and weight ?

(b) The straight line motion of an object is given by

$S = 12t + 3t^2 - 2t^3$

where S = displacement in meters and t = time in seconds.

Calculate the displacement, velocity and acceleration after 2 seconds.

2+8=10

7. Write short notes on any *two* : 5×2=10

(a) Effect of friction on moving parts of machines

(b) Law of polygon of forces

(c) Reversible machine and self locking machine

(d) Lami's theorem

(e) Angle of repose

(f) Laws of kinetic friction

(g) Simple machines.