Registration No. : | | | | | | | | | | |

Total number of printed pages – 4

B. Tech
BE 2104

First Semester Special Examination – 2014

MECHANICS

BRANCH(S) : B. TECH

QUESTION CODE : H 458

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2 ×10

(a) The resultant of two forces is equal to each of the force. What is the angle between them ?

(b) What is a wedge ? How does it help us ?

(c) 'The position of center of gravity of a slender wire does not depend upon the shape of the curve of its axis'. Whether the statement is true or false ? Justify your answer.

(d) Define 'a partially constrained body' and 'degrees of freedom'.

(e) What is plane truss ? Discuss with an example.

(f) Explain velocity-time diagram.

(g) What is the value of normal acceleration, if a particle moves in a straight line ?

(h) Is the law of conservation of energy is applicable to the system of particles that perform curvilinear motions ? Justify your answer.

(i) State and explain the principle of impulse-momentum.

(j) What are the basics involved in the 'Principle of virtual work' ? In virtual work principle, what is the work done by a body of weight 1 kN when its centre of gravity moves horizontally by a distance of 1 m ?

P.T.O.

2. A ball of weight W = 1 kN is suspended from the string of length l = 1 m and is pulled by a horizontal force Q. The weight is displaced by a distance d = 0.2 m from the vertical position as shown in Figure 1. Find the angle á, the force Q required and the tension S in the string in the displaced position using the first principles, if the ball is in equilibrium. 10

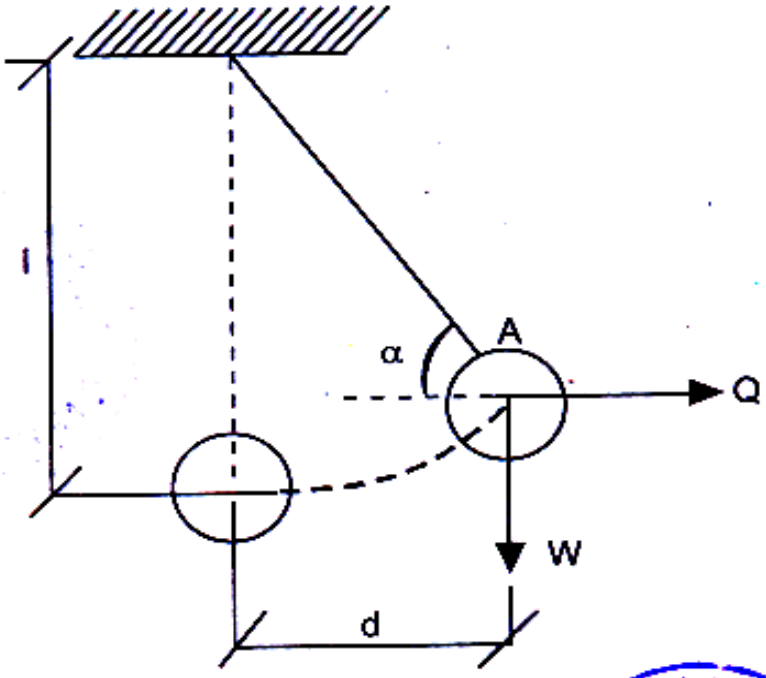

Figure 1

3. Find the forces in all the members of the pin jointed truss as shown in Figure 2 by method of joints. Check your result for the member x by method of sections. 10

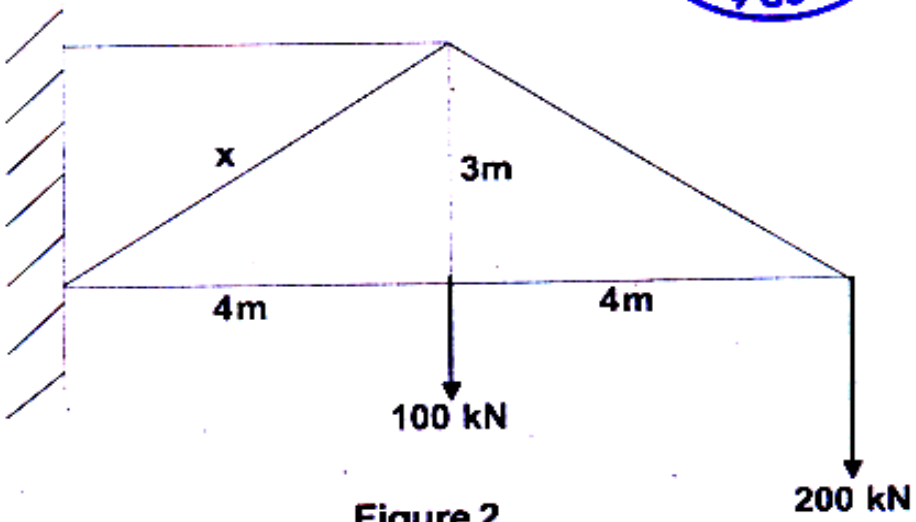

Figure 2

4. (a) Determine the centroid of the area between curves $y = (b/a)x$ and $y = kx^3$ where both the curves meet at points (0, 0) and (a, b). Find the ratio a/b for which the x and y coordinates of the centroid will be equal. 5

(b) Determine the moment of inertia of a T-section (flange 12 mm × 4 mm) and web (4 mm × 20 mm) about its centroidal x-axis. 5

5. Using the principle of virtual work, determine the force F required to hold the frame shown in Figure 3 in equilibrium under the load P = 500 N at $\theta = 60^0$. Each link is of length 2a = 0.8 m. 10

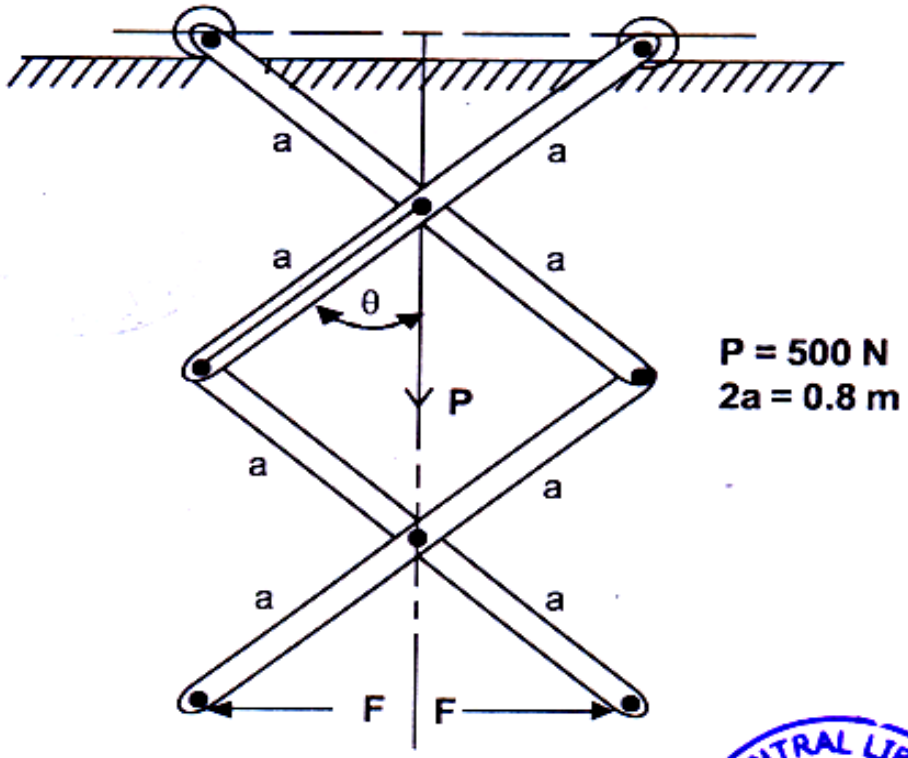

Figure 3

6. (a) A particle of weight W is dropped vertically into a medium that offers resistance proportional to the square of the velocity of the particle. The buoyancy of the medium is negligible, and the resisting force is 1 when the velocity is 1 m/sec. What uniform velocity will the particle finally attain ? 5

(b) A ball is projected on horizontal plane at an angle of 40^0 with an initial velocity of 70 km/hr. Determine the

(i) horizontal range,

(ii) maximum height attained by the particle,

(iii) total time of flight, and

(iv) time taken to reach the highest position of path. 5

7. (a) Considering only rotation of the earth, determine the resultant acceleration of a point on its surface at the latitude 47° North. Assume the radius of the earth as R = 6400 Km. 5

(b) A rotor decreases uniformly from a rotating speed of 2000 rpm to rest in 300 sec. Determine the angular deceleration and the number of radians rotated before coming to rest. 5

8. (a) Determine the moment of inertia I_x of a homogeneous rectangular parallelepiped having dimensions a, b and c with respect to a centroidal axis parallel to the edges of length c. 5

(b) A tennis ball is dropped from a 5 m high ceiling of a room. After bouncing thrice, the ball attains a height of 1 m measured from the floor. Determine the coefficient of restitution in this situation. 5