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

Total number of printed pages – 3

B. Tech

BENG 1101 (Old)

Second Semester (Back) Examination – 2013

MECHANICS

BRANCH : ALL

QUESTION CODE : B491

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) Establish the expression for the moment of a force about a line.

   (b) To turn right, the steering wheel of a Hyundai Santro is to be rotated by applying a force of 12 N. The diameter of the wheel is 0.4 m. Compute the required moment.

   (c) Differentiate between a just-rigid and an over-rigid truss.

   (d) Differentiate between angle of static friction and angle of limiting friction. What is wedge friction ?

   (e) What is radius of gyration ? Where and for what purpose is it used ?

   (f) A 16 m long thin metallic wire is bent into an isosceles triangle with base being 6 m. Locate its centroid.

   (g) A particle starts from rest and moves along a straight line with constant acceleration á. If it acquires a velocity v = 4 m/sec, after having travelled a distance of S = 12 m, find the magnitude of acceleration.

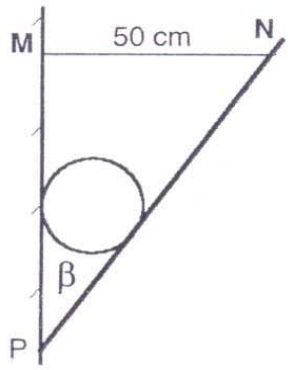
   (h) Where should the slope of velocity curve be maximum ? Justify your answer.

   (i) What is natural frequency ?

   (j) What do you mean by coefficient of restitution ? Enumerate its values for different types of impact.

P.T.O.

2. A circular log of weight 1 kN and radius 16 cm is supported on a pair of bracket as shown in Fig. 1. Bar PN hinged at P and held by a string MN of length 50 cm. To induce minimum tension in MN, determine the angle β as shown, for equilibrium. Consider all contact surfaces as smooth. Also find the value of minimum tension. 10

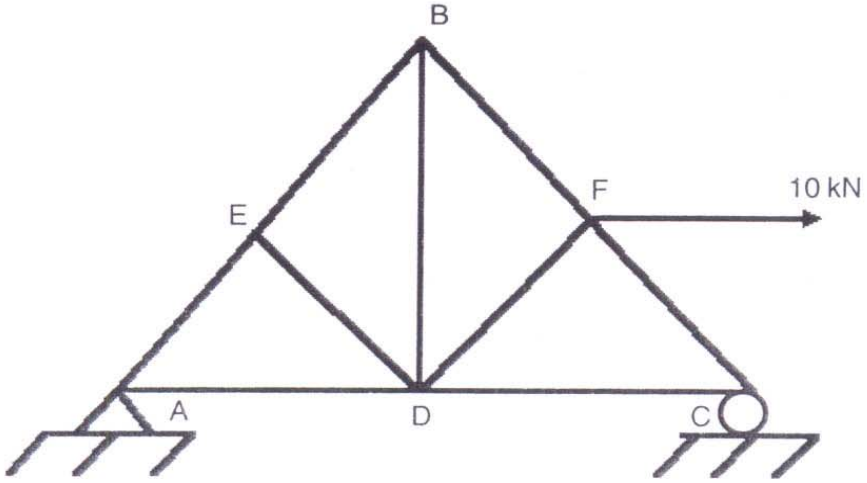


(Fig. 1)

3. (a) A uniform ladder, of weight 250 N and length 5 m, rests on a floor, with one end against a smooth vertical wall. The foot of the ladder is at a distance of 2.5 meters from the wall. Find the friction between the ladder and wall. 5

   (b) A beam ABC of 7 m span is hinged at A and supported on a roller at B which are 4 m apart and has an overhang BC of 3 m beyond the support B. It is loaded with a uniformly varying load whose intensity varies from zero at A to 10 kN/m at C. Find the reactions at the supports A and B. 5

4. A pin jointed simply supported truss ABC is hinged at A and supported on a roller at C. It is loaded as shown in Fig. 2. AB = BC = CA = 3 m. D, E and F are mid points of AC and BC. Find the forces in the members of the truss. 10



(Fig. 2)

5. Locate the centroid and determine the moment of inertia about the centroidal x-axis and y-axis of the area enclosed between curves $y = x^3/3$ and $x = y^3/4$. 10

6. (a) A man weighing 500 N jumps into a swimming pool from a tower of height 20 m. He was found to go down in water by 2.5 m and then started rising. Find the average resistance of water. 5

   (b) A ball is dropped vertically from a tower-top. During last 1 second of motion, it falls through 65% of the height. Determine the height of the tower. 5

7. (a) A wheel that can rotate freely about an axle, but cannot move in any other way. It is initially spinning at a rate of $\omega = 25$ rad/sec but the friction at the axle produces a torque T= 6 Nm about the axle. How long does it take the wheel to come to a stop ? Mass of the wheel is 5 kg and radius of gyration is 0.9 m. 5

   (b) A tennis ball is dropped from a 3 m high ceiling of a room. After bouncing twice, the ball attains a height of 0.75 m measured from the floor. Determine the coefficient of restitution in this situation. 5

8. (a) The distance between the rails of the track is 1.65 m. How much the outer rail be elevated for a curve of 250 m radius, in order that the resultant force may be normal at a speed of 50 kmph ? 5

   (b) A clock provided with a seconds pendulum is gaining 120 seconds a day. Find how much the length of the pendulum should be increased, so as to correct the clock. 5