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

Total number of printed pages – 3

B. Tech
BE 2104

First Year Special Examination – 2014

MECHANICS

BRANCH(S) : AEIE, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, EC, EEE, ELECTRICAL, ETC, FASHION, IEE, IT, MANUFACT, MECH, MME, PLASTIC, TEXTILE

QUESTION CODE : G 558

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) Sketch the free body diagram of a car moving in a curve.

(b) State whether the statement 'according to the principle of transmissibility of forces, the effect of a force upon a body is maximum when it acts at the centre of gravity of the body' is true or false with justifications.

(c) Differentiate between 'centre of volume' and 'centre of gravity'.

(d) How does D' Alembert's principle differ from Newton's law ?

(e) When do you think that 'method of sections' is preferable over 'method of joints' ?

(f) A projectile is fired with a velocity of 200 m/s for maximum range across a level plain. Determine the time of flight.

(g) How will be the shape of a velocity ~ time diagram when a particle moves with constant acceleration ?

(h) Define the term 'coefficient of restitution'. What is its value for a plastic collision ?

(i) Write the equation of motion of rigid bodies in plane motion.

(j) What are the basics involved in the 'Principle of virtual work' ?

P.T.O.

2. A smooth circular cylinder of radius 1 m is lying in a triangular groove, one side of which makes 30° angle and the other 60° angle with the horizontal. Find the reactions at the surfaces of contact, if there is no friction and the cylinder weighs 50 kN. 10

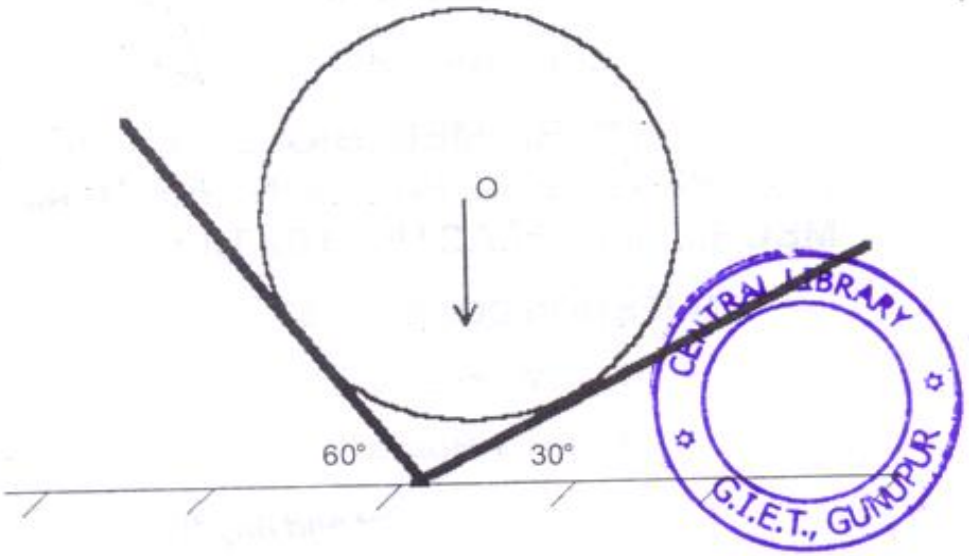

Figure 1

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

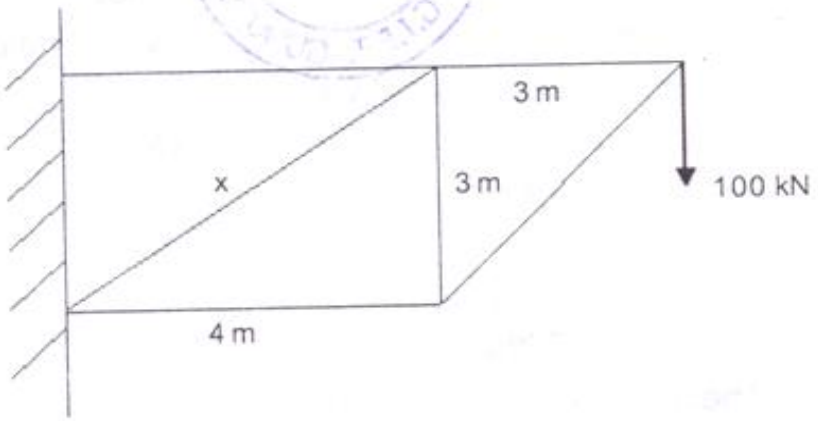

Figure 2

4. (a) Determine the centroid of the area between curves $y = 2x$ and $y = x^2$. 5

   (b) Determine the moment of inertia of a T-section (flange 16 mm × 4 mm) and web (4 mm × 20 mm) about its centroidal x-axis. 5

5. Using the principle of virtual work, find the reaction at D for the system shown in Figure 3 for any position of a vertical load P on the beam AC as defined by its distance x from A. 10

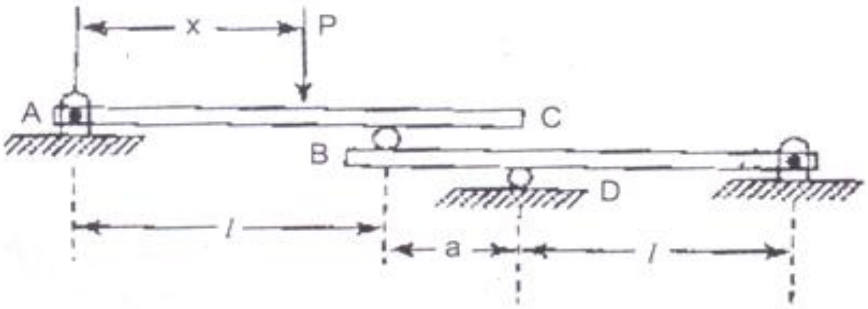

Figure 3

6. (a) At the turn of a cross road, a car driver running at 30 m/sec notices a puppy on the road 75 m ahead. To save it he instantly applied the brake and stops the car within 15 m of the puppy. Determine the deceleration and the time required to stop the car. 5

   (b) A rifled gun fires a bullet with muzzle velocity of 237 m/sec. To strike the enemy at horizontal distance of 5 km and at a height of approximately 350 m, what will be the angle of projection ? 5

7. (a) A particle travels with constant speed 10 m/sec along a parabolic path defined by the equation $y = 3x^2$. Find the maximum acceleration of the particle. 5

   (b) A rotor decreases uniformly from a rotating speed of 1800 rpm to rest in 320 sec. Determine the angular deceleration and the number of radians rotated before coming o rest. 5

8. (a) A simple pendulum bob of weight 23 grams oscillates 7 times when the string is l meter long. Another pendulum having string length $l + 0.45$ meters oscillates 5 times within the same time interval. Determine the magnitude of l. 5

   (b) A glass ball is dropped on smooth horizontal floor from a height H meters and after first bounce it attains a height of 11.2 m and after successive fourth bounce, it attains a height of 2.9 m. Determine the coefficient of restitution and the magnitude of H. 5