

Code No: 111AC**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD****B.Tech I Year Examinations, June - 2014****ENGINEERING MECHANICS****(Common to CE, ME, CHEM, MCT, MMT, MEP, AE, AME, MIE, MIM, PTE, CEE, MSNT, AGE)****Time: 3 hours****Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

- 1.a) State parallelogram law. [2m]
- b) Give equations of equilibrium in space. [3m]
- c) Define the efficiency of screw jack. [2m]
- d) Draw different types of flat belt drives. [3m]
- e) State theorem of Pappus. [2m]
- f) What is radius of gyration? [3m]
- g) Derive the equation $S = ut + \frac{1}{2}at^2$, where S is the distance travelled, u is initial velocity a is acceleration and t is time. [2m]
- h) Derive an equation for the acceleration of a body moving down a rough inclined plane. [3m]
- i) Define frequency simple harmonic motion. [2m]
- j) Derive work – energy equation. [3m]

PART B

2. Two spheres, A and B rest in a vertical channel with their centres in a vertical plane. If weight of sphere A is 1000 N and that of sphere B is 400 N, radius of sphere A is 1m and that of sphere B is 0.6m, width of channel is 2.4 m, find the contact forces assuming all surfaces to be smooth.

OR

3. Four forces of magnitude 10kN, 15kN, 20kN and 40kN are acting at a point O as shown in figure 1. The angles made by 10kN, 15kN, 20kN and 40kN with x-axis are 30° , 45° , 60° and 90° respectively. Find the magnitude and direction of the resultant force.

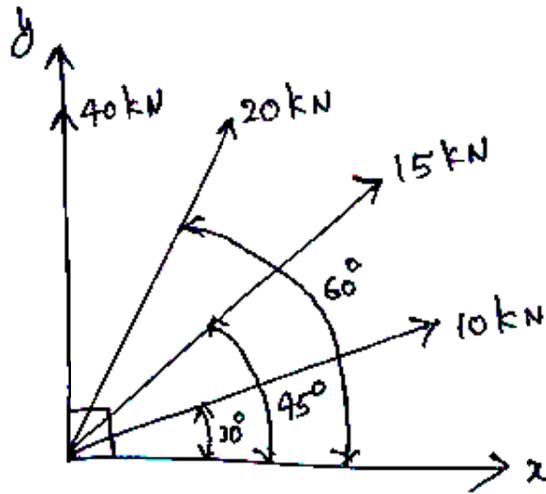


Figure: 1

4. A screw jack has a square thread of mean diameter 6 cm and pitch 0.8 cm. The coefficient of friction at the screw thread is 0.09. A load of 14 kN is to be lifted through 15 cm. Determine the torque required and the work done in lifting the load through 15 cm. Find the efficiency of the jack also.

OR

5. Determine the maximum power that can be transmitted using a belt of $105 \text{ mm} \times 15 \text{ mm}$ with an angle of lap of 160° . The density of belt is 10^3 kg/m^3 and coefficient of friction is 0.35. The tension in the belt should not exceed 1.5 N/mm^2 .
6. Determine the values of I_{xx} and I_{yy} for the shaded area bounded by the parabolic curve shown in figure 2.

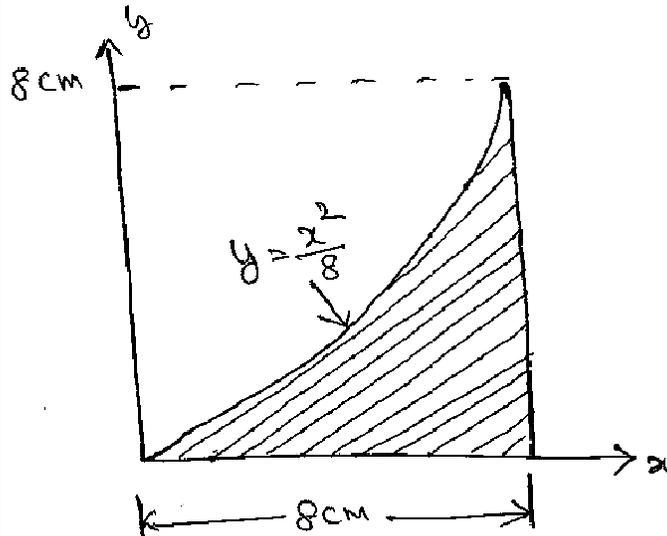


Figure: 2

OR

7. Find the mass moment of inertia of a solid cylindrical body of radius 'r' and height 'h' about its centroidal axes.

8. Two smooth inclined planes whose inclination with horizontal are 30° and 20° are placed back to back. Two weights 100 N and 60 N are placed on the planes of 20° and 30° respectively and are connected by a cord passing over a smooth pulley. Find the acceleration of the system, tension in the string and force acting on the pulley.

OR

9. The acceleration of a particle is given by $a = 6 - 2t^2$ m/sec² the particle starts at $t = 0$, $V_0 = 0$ and $S = 8$ m. Determine:
- Velocity at $t = 5$ seconds
 - Position at $t = 5$ seconds
 - Distance travelled from $t = 0$ to $t = 5$ seconds.

10. A vertical shaft 5 mm in diameter and 1.2 m in length has its upper end fixed to the ceiling. At the lower end it carries a rotor of diameter 180 mm and weight 30N. The modulus of rigidity for the material of the rotor is 0.85×10^5 N/mm². Calculate the frequency of torsional vibrations for the system.

OR

11. A bullet fired from a gun and travelling horizontally with a velocity of 800 m/s and weighing 0.4 N strikes a wooden block of weight 100N resting on a rough horizontal floor. The coefficient of friction between the floor and the block is 0.3. Find the distance through which the block is displaced from its initial position.
