Baba Banda Singh Bahadur Engineering College
Fatehgarh Sahib-140407 PUNJAB
DEPARTMENT OF ELECTRICVAL ENGINEERING

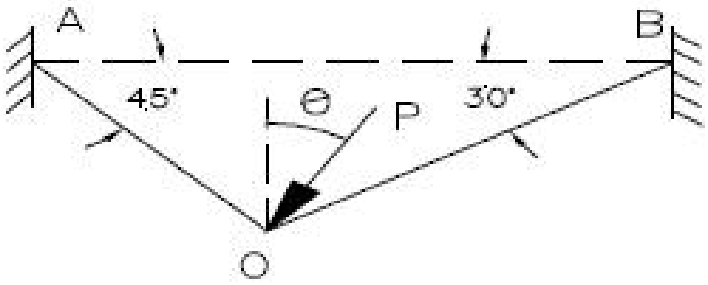
BRANCH: ELECTRICAL **YEAR / SEMESTER:** III

UNIT 1 – PART-A (02 MARKS)

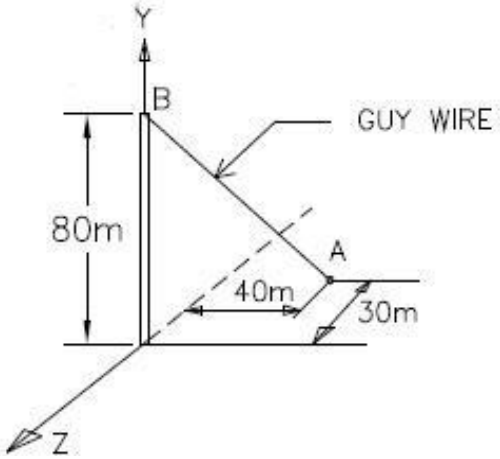
1. State Newton's three laws of motion?
2. Write the equations of equilibrium of a coplanar system of forces.
3. State Lami's theorem with a neat sketch?
4. State the Parallelogram law of forces?
5. State the triangular law of forces?
6. Define principle of transmissibility.
7. Distinguish the following system of forces with a suitable sketch. a) Coplanar b) Collinear.
8. Discuss about the necessary and sufficient condition for static equilibrium of a particle in 2-D.
9. What differences exist between Kinetics and Kinematics
10. Can you provide an example of units and dimensions
11. Solve the following: A force vector F= 700i + 1500j is applied to a bolt. Determine the magnitude of the force and angle it forms with the horizontal.
12. Solve the following: A force of magnitude 50 KN is acting along the line joining A (2,0,6) and B (3,-2,0)m. Write the vector form of the force.
13. Solve the following: Two forces of magnitude 50 KN and 80 KN are acting on a particle, such that the angle between the two is 135°. If both the force are acting away from the particle, calculate the resultant and find its direction.
14. Compare 'Resultant' and 'Equilibrant'
15. Compare and contrast between particle and rigid body
16. Compare and contrast Vector and Scalar
17. Design the free body diagram.
18. Imagine if the resultant of an 800N force acting towards eastern direction and a 500N force acting towards north eastern direction.
19. A 100N force acts at the origin in a direction defined by the angles $\theta x = 75°$ and $\theta y = 45°$. Determine θz and the component of the force in the Z-direction.
20. Determine the magnitude of the two forces such that if they act at right angles, their resultant is 10N. But if they act at 60° their resultant is 13N.

UNIT I -PART-B (5 MARKS)

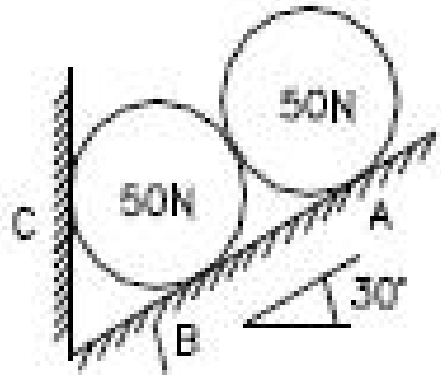
1. A force P is applied at 'O' to the string AOB as shown in fig. If the tension in each part of string is 50 N, Find the direction and magnitude of force P for equilibrium conditions.



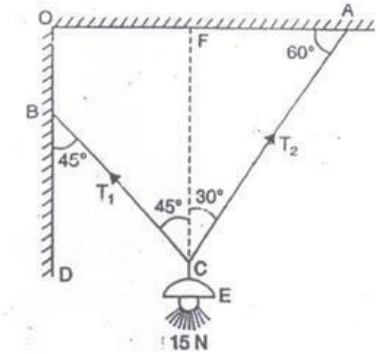
2. A tower guy wire shown below is anchored by means of a bolt at A as shown. The tension in the wire is 2500kN. Find (a). The components Fx, Fy & Fz of the force acting on the bolt (b). The angles _x, _y, _z defining the direction of the force



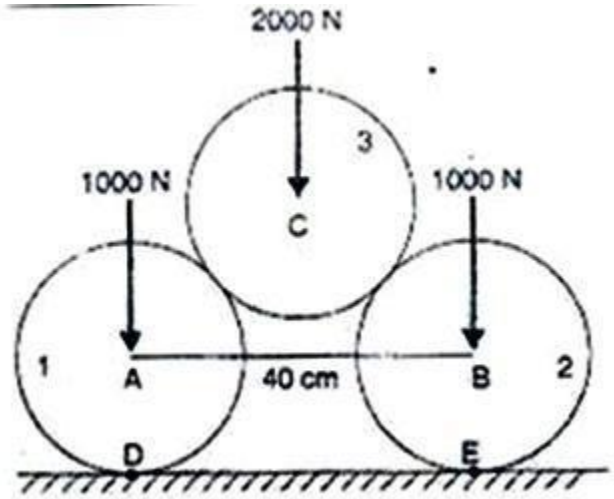
3. Two identical rollers each of weight 50N are supported by an inclined plane and a vertical wall as shown in fig. Find the reactions at the points of supports A, B, and C.



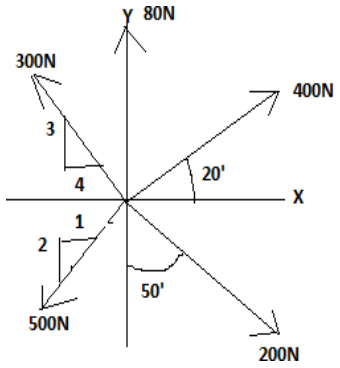
4. Predict the tension in each cable for the given Figure



5. Two smooth circular cylinders each of weight 1000 N and radius 15 cm are connected at their centers by a string AB of length 40 cm and rest upon a horizontal plane, supporting above them a third cylinder of weight 2000 N and radius 15 cm as shown in Figure. Predict the force S in the string AB and reactions on the floor at the points of contact D and E.

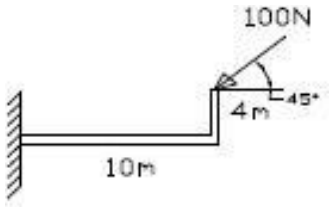


6. Determine the resultant of system of forces acting as shown in fig.

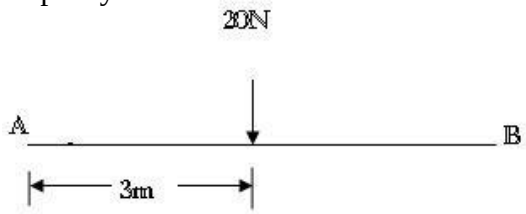


UNIT II - PART-A (02 MARKS)

1. State Varignon's theorem.
2. What is a couple?
3. What is a moment of a couple?
4. A force vector F has the components Fx = 150N, Fy= -200N and Fx = 300N. Determine the magnitude "F" and the angle made by the force with coordinate axes.
5. Design the different types of supports.
6. Write down the conditions of equilibrium of a particle in space.
7. A force vector of magnitude 100N is represented by a line of coordinates A (1, 2, 3) and B (5, 8, 12). Determine components of the force along X, Y and Z axes.
8. Predict how you will reduce a force into an equivalent force-couple system with an example.
9. Design the moment of the 100 N force about point A and B
10. List the different types of beams?



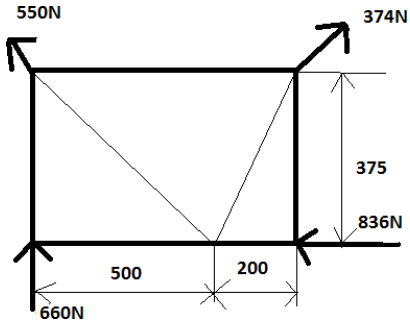
11. Predict how you will reduce a force into an equivalent force-couple system.
12. A force 27N makes an angle of 30˚, 45˚ and 80˚ with x,y and z axes. Solve the force vector
13. Solve the given system into a force-couple system at A.



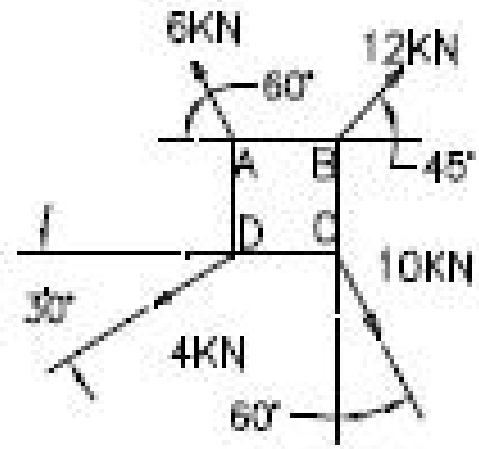
14. Discuss about the equation of equilibrium of a rigid body.
15. What are the reactions at a fixed support of a plane beam that are possible?
16. Distinguish between couple and moment.
17. Define force-couple system.
18. Construct a moment of force is zero and maximum about a point.
19. Explain free body diagram with one example.
20. Explain the effect in applying couple moment?

UNIT II - PART-B (5 MARKS)

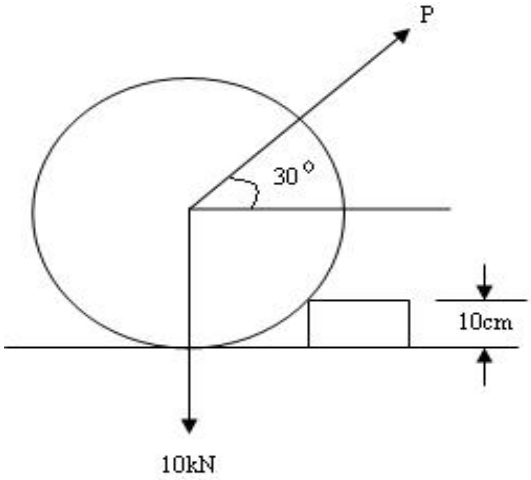
1. Four forces act on a 700mm X 375mm plate as shown in fig. a) Find the resultant of these forces b) Locate the two points where the line of action of the resultant intersects the edge of the plate.



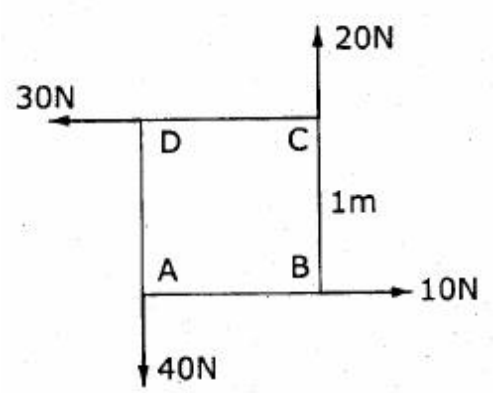
2. Four coplanar non concurrent non parallel forces act on a square plate of side 2m as shown in fig. Find the resultant forces.



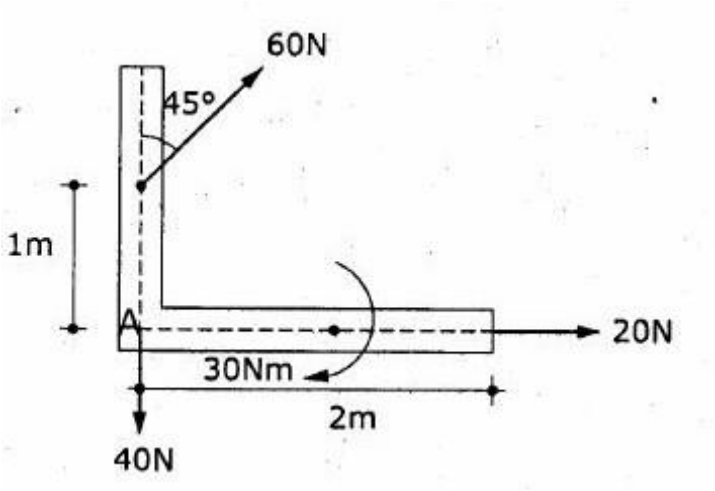
3. A cylindrical roller has a weight of 10kN and it is being pulled by a force which is inclined at 30˚ with the horizontal as shown in fig. While moving it comes across an obstacle of 10cm height. Predict the force required to cross this obstacle when the diameter of the roller is 70cm.



4. Four forces act on a square of side 1 m as shown in fig. Predict the force system into an equivalent force – couple system at A.



5. Illustrate the system of forces shown in fig to a force – couple system at A

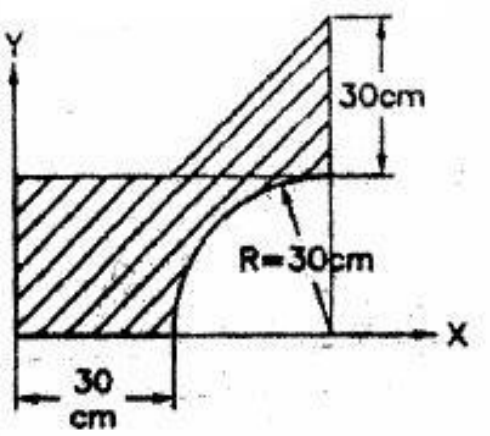


UNIT III - PART-A (02 MARKS)

1. State parallel axis theorem.
2. State perpendicular axis theorem.
3. Find the polar moment of inertia of a hollow circular section of external diameter ‘D’ and internal diameter ‘d’
4. Define principal axes and principal moment of inertia.
5. Locate the centroid and solve the moment of inertia about centroidal axes of a semicircular lamina of radius 2m.
6. A semicircular area having a radius of 100 mm is located in the XY-plane such that its diameter coincides with Y-axis. Determine the X-coordinate of the center.
7. Distinguish between centroid and center of gravity.
8. Define polar moment of inertia.
9. Differentiate between ‘Mass moment of inertia’ and ‘Area moment of inertia’
10. Discuss about the expression for finding mass moment of inertia of a cylinder of radius ‘R’ and height ‘h’ about its base.
11. State Pappus guildinus area theorem
12. Analyze the Pappus guildinus volume theorem
13. Discuss about the Polar moment of Inertia and state its significant
14. Compare and contrast the Area moment of Inertia with mass moment of inertia.
15. Design Radius of gyration
16. Determine MI of an isoceles triangle with base 150mm and sides of 125mm about its base
17. Solve the following: three couples 16Nm, -45Nm and 120Nm are acting in the xy, yz and xz planes respectively. Find the resultant moment vector of these three couples.
18. Compare and contrast moment and second moment about an axis.
19. Solve the following: A semicircle of radius ‘a’ is defined in the first and fourth quadrants. Find its co-ordinates of centroid
20. Create the centroidal distances of a sector of radius ‘r’

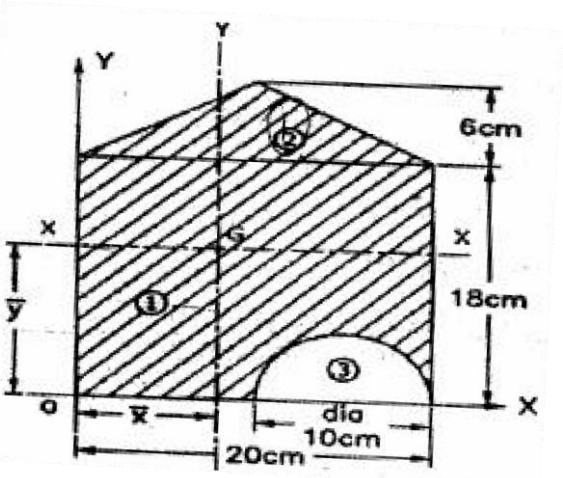
UNIT III - PART-B (5 MARKS)

1. Determine the co-odinates of centroid of the shaded area shown in figure.

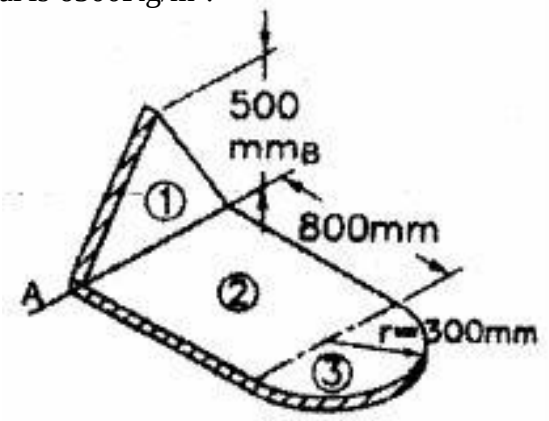


2. A Cylinder of height of 10 cm and radius of base 4 cm is placed under sphere of radius 4 cm such that they have a common vertical axis. If both of them are made of the same material, find the centre of gravity of the combined unit.

3. Find the moment of inertia of the section shown in the figure about its horizontal centroidal axis.

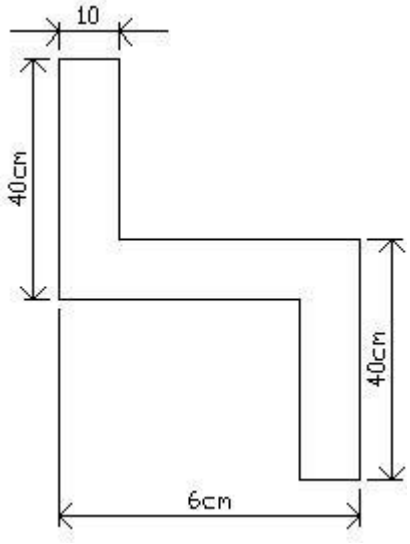


4. Find the mass momemt of inertia of the plate shown in fig with respect to the axis AB. Thickness of the plate is 5mm and density of the material is 6500Kg/m^3.

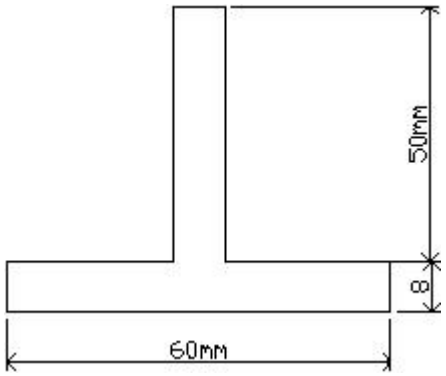


5. Discuss expression form mass moment of inertia of prism along three axes.

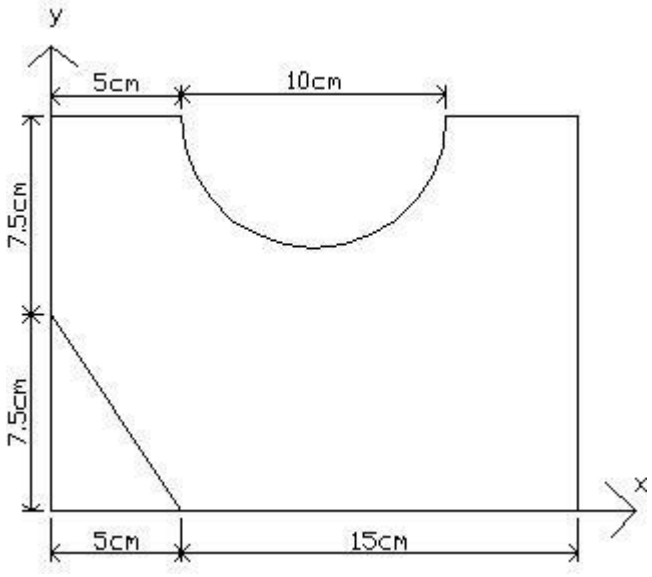
6. Design Moment of Inertia about the co-ordinate axes of plane area shown in fig. Also find Polar Moment of Inertia.



7. Determine the principal moments of inertia and find location of principal axes of surface shown in fig.



8. Illustrate Moment of Inertia and radius of gyration of surface about x axis shown in fig. Also find MOI about centroidal x axis.



UNIT IV - PART-A (02 MARKS)

1. Define D'Alembert's principle
2. Discuss about the equations of motion of a particle under gravitation.
3. A car accelerates uniformly from a sped of 30 Km/Hr to a speed of 75 Km/Hr in 5 secs. Determine the acceleration of the car and the distance traveled by the car during 5 secs.
4. Design dynamic equilibrium conditions.
5. State the law of conservation of momentum.
6. A car starts from rest with a constant acceleration of 4m/sec2. Determine the distance traveled in the 7th second.
7. A point P moves along a straight line according to the equation x= 4t3+2t+5, where x is in meters and t is in secs. Solve the velocity and acceleration at t=3 secs.
8. Solve the following: A stone is projected in space at an angle of 45° to horizontal at an initial velocity of 10 m/sec. Find the range of the projectile.
9. What is work energy principle
10. Illustrate the impulse momentum equation?
11. Distinguish between kinetics and kinematics.
12. Distinguish between impulse and impulsive force.
13. Analyze the impulse momentum equation.
14. Compare and contrast the rectilinear and curvilinear motion.
15. Design a projectile?
16. Define inertia force.
17. What differences exist between impulse and momentum
18. Compare and contrast the impact and elastic impact.
19. Define Co-efficient of restitution.
20. State Newton's law of collision of elastic bodies.

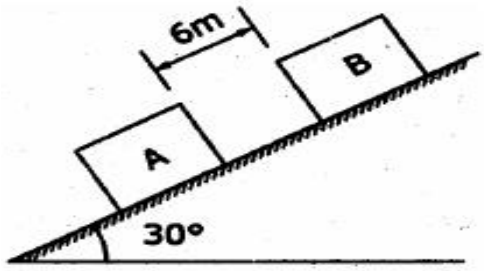
UNIT IV - PART-B (5 MARKS)

1. A train is traveling from A to D along the track shown in fig. Its initial velocity at A is zero. The train takes 5 min to cover the distance AB, 2250 m length and 2.5 minutes to cover, the distance BC, 3000 m in length, on reaching the station C, the brakes are applied and the train stops 2250 m beyond, at D (i) Find the retardation on CD, (ii) the time it takes the train to get from A to D, and (iii) its average speed for the whole distance.

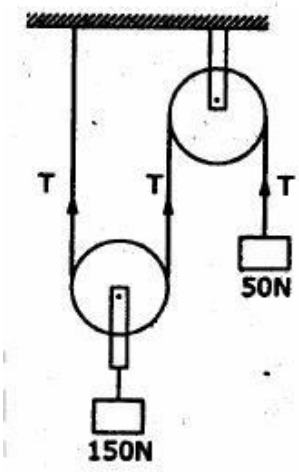
2. The position of the particle is given by the relation S=1.5t3-9t2-22.5t+60, where S is expressed in meters and t in seconds. Determine (i) the time at which the velocity will be zero (ii) the position and distance traveled by the particle at that time (iii) the acceleration of the particle at that time and (iv) the distance traveled by the particle from t = 5s to t = 7s.

3. A particle is projected with a initial velocity of 12m/s at an angle M with the horizontal. After sometime, the position of the particle is observed by its x and y distances of 6m and 4m respectively from the point of projection. Find the angle of projection.

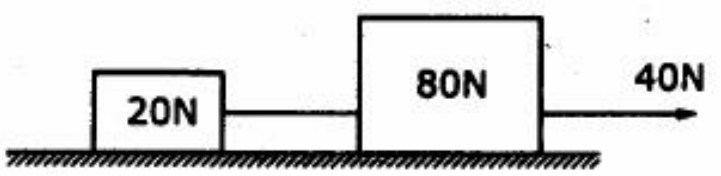
4. Two Blocks A and B of weight 100 N and 200 N respectively are initially at rest on a 30° inclined plane as shown in figure. The distance between the blocks is 6 m. The co efficient of friction between the block A and the plane is 0.25 and that between the block B and the plane is 0.15. If they are released at the same time, in what time the upper block (B) reaches the Block (A).



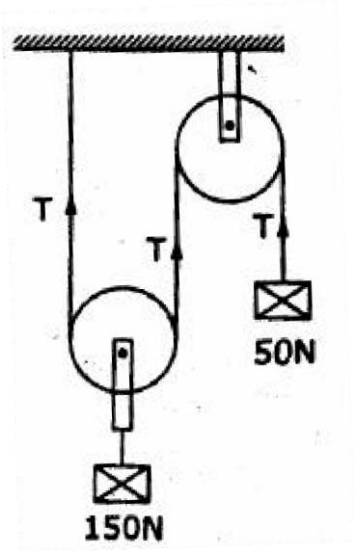
5. Two blocks of weight 150 N and 50 N are connected by a string and passing over a frictionless pulley as shown in figure. Predict the acceleration of blocks A and B and the tension in the string.



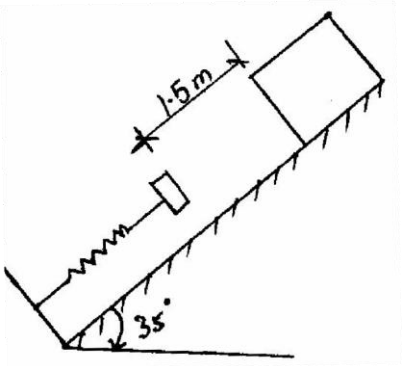
6. Two weights 80 N and 20 N are connected by a thread and move along a rought horizontal plane under the action of a force 40 N, applied to the first weight of 80 N as shown in figure. The coefficient of friction between the sliding surfaces of the wrights and the plane is 0.3. Design the acceleration of the weights and the tension in the thread using work-energy equation.



7. Two blocks of weight 150N and 50N are connected by a string, passing over a frictionless pulley as shown in fig. Predict the velocity of 150N block after 4 seconds. Also calculate the tension in the string.



8. A block of mass 50 kg slides down a 35° incline and strikes a spring 1.5 m away from it as shown in Fig. The maximum compression of the spring is 300 mm when the block comes to rest. If the spring constant is 1 kN/m, Solve the coefficient of kinetic friction between the block and the plane.



UNIT V – PART A (02 Marks)

1. Show that the mathematical definitions of velocity and acceleration.
2. A Car traverses half of a distance with a velocity of 40 Kmph and the remaining half of distance with a velocity of 60 Kmph. Determine the average velocity.
3. Define friction and classify its types.
4. Classify the types of friction.
5. Discuss about the limiting friction.
6. Discuss about the coefficient of static friction.
7. Discuss about the coulomb's laws of dry friction.
8. Define rolling resistance.
9. Discuss coefficient of rolling resistance?
10. Analyze the coefficient of friction and express its relationship with angle of friction.
11. If x=3.5t3– 7 t2, determine acceleration, velocity and position of the particle, when t = 5 sec.
12. Imagine the wheel rolling on a straight track. Illustrate the characteristics of general plane motion.
13. Design work energy equation of rigid body and mention the meaning for all parameters used in the equation.
14. What are general plane motions? Give some examples.
15. Define Limiting friction.
16. Compare Co-efficient of friction and angle of friction
17. Define coulomb's laws of dry friction.
18. Define impending motion.
19. Define angle of repose.
20. Compare and Contrast Ladder friction and Wedge friction.