Module 06

Dynamics in Two Dimensions

QUESTIONS

Question 1 (LV1): A 10,000-kg airplane accelerates forward at a rate of 1 m/s^2 on the way to its destination. Then, a head wind at angle of 80° with respect to the airplane's direction of motion applies a constant force of 1000 N on the airplane. Find the magnitude of the airplane's acceleration.

Question 2 (LV2): A 60-kg student goes on a ride in a Ferris Wheel of radius 45 m. What is the apparent weight of the student at the highest point on the wheel, if she moves with a speed of 5 m/s at that point?

Question 3 (LV3): The Earth revolves around the Sun in an orbit that can be approximated by a circle of radius 149.6 million kilometres. What is the free-fall acceleration towards the Sun at the location of Earth's orbit?

Question 4 (LV4): A particle is constrained to move in a circle of radius 1 m. At one instant, the speed of the particle is 2 m/s, increasing at a rate of 1 m/s^2. Calculate the angle between the velocity of the particle and its acceleration.

PROBLEMS

Problem 1 (LV): A highway turn is banked at 10°, and the coefficient of static friction between the tires and the road is 0.3. If the turn has a radius of 200 m, what is the safe speed limit at which a car can take the turn?

Problem 2 (LV): A 10000-kg space ship orbits the Earth once every two hours. If the radius of the orbit is 7,000 km, find the radial acceleration and the radial force acting on the space ship.