Assignment 0

Problems:

1. Derive the equation of the line $y = mx + b$.

2. A force of 10 N acts on an object at an angle of 30 degrees to the x-axis. Resolve the force into its components.

3. A spring with a spring constant of 10 N/m is stretched by 5 cm. Calculate the potential energy stored in the spring.

4. A mass of 2 kg is attached to a spring with a spring constant of 5 N/m. The mass is pulled 3 cm beyond its equilibrium position and released. Calculate the maximum kinetic energy of the mass.

5. A pendulum of length 1 m and mass 0.5 kg is released from a height of 2 m. Calculate the maximum speed of the pendulum at its lowest point.

6. A satellite with a mass of 200 kg is in a circular orbit 500 km above the Earth's surface. Calculate the orbital speed of the satellite.

7. A block of mass 5 kg is compressed in a spring having a spring constant of 200 N/m. The block is then released and moves horizontally on a frictionless surface. Calculate the maximum speed of the block.

8. A charged particle with a charge of 3 C and a mass of 2 kg is projected with an initial velocity of 10 m/s at an angle of 30 degrees to the horizontal. Calculate the range and the maximum height of the particle.

9. A DC motor is connected to a battery and a resistor in series. The motor has a resistance of 5 ohms and a back EMF of 10 V. Calculate the current in the circuit.

10. A parallel plate capacitor has a plate area of 1 m² and a plate separation of 1 mm. A charge of 50 C is placed on the capacitor. Calculate the capacitance of the capacitor.

11. A pendulum of length 1 m and mass 0.5 kg is in simple harmonic motion. Calculate the period of the pendulum.

12. A wave on a string with a mass per unit length of 2 kg/m and a tension of 50 N is propagating to the right with a speed of 10 m/s. Calculate the wavelength of the wave.

13. A spring having a spring constant of 100 N/m is attached to a wall. A force of 10 N is applied to the other end of the spring. Calculate the displacement of the spring.

14. A parallel-plate capacitor has a plate separation of 2 mm and a plate area of 1 m². A charge of 50 C is placed on the capacitor. Calculate the capacitance of the capacitor.

15. A mass of 2 kg is attached to a spring having a spring constant of 100 N/m. The mass is pulled 3 cm beyond its equilibrium position and released. Calculate the maximum kinetic energy of the mass.

16. A charged particle with a charge of 5 C and a mass of 2 kg is projected with an initial velocity of 10 m/s at an angle of 30 degrees to the horizontal. Calculate the range and the maximum height of the particle.