Course Name: PHY-130 Engineering Physics

Date Updated: 4/2022

Credit Hours/week: 4 hrs./wk. – 4 cr.

BEGINNING: SPRING 2022

Catalog Description: This is the first course of a three-semester, calculus-based physics sequence. Topics include particle kinematics and dynamics in one and in two dimensions, work and energy, impulse and momentum, rotational motion, kinematics and dynamics of rigid bodies and elements of thermodynamics.

Prerequisite: MAT 131 – Analytic Geometry and Calculus I

Corerequisite: MAT 132 – Analytic Geometry and Calculus II

Text: Young & Freedman, Sears & Zemansky's University Physics - Volume I, latest edition, Addison-Wesley (ISBN-13: 978-0321973610, ISBN-10: 0321973615)

Supplementary Material: None

Syllabus:

1. Standards & System International Units, Conversions; Scalars & Vectors
2. Subtraction; Components & Addition; Unit Vectors; Vector Products (overview)
3. Motion; Displacement; Average Velocity; Graphs; Graphical Addition
4. Instantaneous Velocity; Acceleration; Uniform Acceleration & Kinematic Equations
5. Strategies; Free Fall
6. Two-Dimensional Motion; Kinematic Vectors
7. Projectile Motion; Concepts & Applications
8. Projectile Motion Examples; Uniform Circular Motion; Relative Motion
9. Two-Dimensional Relative Motion; Examples; Force Concept; Newton's First Law; Inertia; Inertial of Reference
10. Newton's Second Law; Units; Mass & Weight and Their Measurements
11. Newton's Third Law; Free-Body Diagrams; Applications of Newton's First
12. Concepts, Strategies & Examples of Newton's Laws
13. Friction; Applications
14. Examples of Friction; Dynamics of Circular Motion; Misconceptions; Examples
15. Forces in Nature; Work with Constant Forces; Dot Product
16. Kinetic Energy; Work-Energy Theorem; Concepts & Examples
17. Work with Varying Forces; Hooke's Law & Work; Work-Energy Theorem for Varying Forces
18. Power; Potential Energy; Conservation of Mechanical Energy
19. Gravitational Potential Energy; Elastic Potential Energy; Applications
20. Expanded Overview of Energy; Conservative & Nonconservative Forces
21. Miscellaneous Concepts; Finding Force from Energy; Energy Diagrams; Momentum
22. Impulse; Impulse-Momentum Theorem; Newton's Second Law; Conservation of Momentum
23. Concepts of Conservation of Momentum; Collisions

24. Inelastic Collisions; Elastic Collisions & Equations
25. Special Cases; Examples of Collisions; Weighted Averages
26. Center of Mass; Velocity & Momentum of Center of Mass; Newton's Second Law
27. Momentum Form of Newton's Second Law; Rotation Properties; Kinematic Quantities for Rotation
28. Vectors for Rotation; Uniform Angular Acceleration; Linear & Angular Kinematics
29. Rotational Kinetic Energy; Moment of Inertia; Concepts, Cross Product; Torque; Concepts
30. Newton's Second Law for Rotation; Work with Torques
31. Rotational Work-Energy Theorem; Power; Angular Momentum; Rotational Forms of Newton's Second Law

Students are expected to adhere to the policies of the County College of Morris. These can be accessed at: (insert link here)

Statement of Expected Course LEARNING OUTCOMES

- Use the scientific method to analyze and derive conclusions from collected data and information
- Explain the difference between a hypothesis, a theory and a law as they are used in science
- Use Newton's third law to construct a set of free-body diagrams and subsequently solve for any required unknown masses, forces, or accelerations using Newton's first and second laws.
- Use the mathematics of vector quantities to compute any required unknown displacements, velocities, and accelerations for a point-mass with a given set of initial conditions and subject to a given force.
- Solve problems by applying fundamental conservation laws, making appropriate distinctions between applications to conservative processes and applications to non-conservative processes.
- Analyze systems that are given to exhibit circular motion for the purpose of determining any required unknown masses, forces, velocities, or accelerations.
- Apply principles of dynamics and kinematics to the analysis of the motion of described rigid bodies to determine any required unknown parameters such as torques, moments of inertia, forces, displacements, velocities, accelerations, momenta, or energies.