**NV College Physics Syllabus**

**(Chapters listed are from the Halliday and Resnick text)**

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| Unit | Chapter (s) | Week (s) | Topics | Labs |
| 1 | 1 | 1 | **Math and Measurement**  - Math review, intro to the fundamentals of calculus.  - Units of measurement  - Dimensional analysis | **Propagation of Error** – Students calculate the speed of a cart on an air track using a high-speed camera and propagate error through all calculations to find and estimate of the speed. |
| 2 | 2 | 2-3 | **Motion in 1 Dimension**  – Vectors and scalars  - Position and displacement, speed and velocity, - acceleration (definition)  - Equations of motion for constant acceleration  - Motion with varying acceleration  - Free-fall  - Displacement vs. time graphs, velocity vs. time graphs and the interpretations of their slopes and “areas under.” | **Acceleration** – a cart is allowed to side down an air track that is inclined at an angle. Students analyze the motion and determine the acceleration by linearization of a displacement vs. time graph. |
| 3 | 3 | 4 | **Vectors in 2 Dimensions**  - Representing vectors graphically  - Adding, subtracting vectors graphically  - Representing vectors mathematically  - Adding, subtracting vectors mathematically  - Scalar or dot product  - Cross product | **Linearization** – An exercise in linearization of data in various functions with random error included in sample data sets. Log-log plots are used. |
| 4 | 4 | 5-6 | **Motion in 2 and 3 Dimensions**  - Position and displacement as 2, 3D vectors  - Projectile motion  - Uniform circular motion  - Relative motion | **Projectile Motion** – motion of a projectile in horizontal and vertical dimensions is analyzed using a high-speed camera, velocity vs. time graphs are created for motion in both dimensions and acceleration is calculated. |
| 5 | 5 | 7-8 | **Force and Motion**  - Definition of force  - Newton’s first and second laws  - Forces and Multiple masses  - Newton’s third law | **Inquiry Lab:Force and Acceleration** – An inquiry lab conducted at the start of the unit. Students determine experimentally the proportionality of net force and acceleration. |
| 6 | 6 | 9-10 | **Force and Motion Part 2**  - Friction between solids  - Friction in fluids  - Force and uniform circular motion | **Air Resistance** – Students determine an appropriate model for air resistance on a stack of coffee filters dropped from a height. Physical parameters are then determined. |
| 7 | 7 | 11-12 | **Work and Energy**  - Definition of work and kinetic energy  - Work – KE theorem  - Work done by gravity and springs  - Power | **Kinetic Friction** – The coefficient of kinetic friction between two surfaces is determined by a choice of methods. Uncertainty in calculations is tracked. |
| 8 | 8 | 12-13 | **Potential Energy, Conservation of Energy**  - Conservative vs. nonconservative forces  - Work and Potential energy  - Potential energy for constant gravitational force  - Potential energy for elastic forces  - Potential energy functions and graphs  - Force and potential energy functions  - Equilibrium and ranges of motion in relation to potential energy functions | **Challenge Lab: Car Launch** – Students launch a toy car from a ramp and determine its trajectory position on landing by applying knowledge of conservation of energy, work done by friction and projectile motion. |
| 9 | 9-10 | 14-15 | **Momentum and Systems of Particles**  - Isolated systems, internal vs. external forces  - Center of mass, definition and techniques of calculation  - Newton’s laws and systems of particles  - Linear momentum, definition and alternate view of Newton’s laws  - Conservation of momentum  - Collisions in 1 and 2 dimensions  - conservation of energy in collisions, elastic vs. inelastic collisions and mathematical methods for analyzing elastic collisions  - Systems with varying mass  - External force and internal energy | **Inquiry lab: Force and Rotation** – students investigate the relationships between force, angle and distance from an axis of rotation. Hopefully they derive the equation for torque on their own. |
| 10 | 11 | 16-17 | **Rotation**  - Position and displacement in polar coordinates  - Angular velocity, angular acceleration  - Equations of motion for angular quantities  - Relationships between angular and linear quantities  - Kinetic energy of rotation  - Torque and rotational inertia | **Rotational kinetic energy** – students use the conservation of energy to determine relationship between angular velocity and rotational kinetic energy. Motion of a solid disk is analyzed using a high-speed camera. |
| 11 | 12-13 | 18-20 | **Torque and Angular Momentum, Statics**  - Torque and angular momentum  - Angular momentum for systems of particles and rigid bodies  - conservation of angular momentum  - rolling with and without slipping  - energy of rolling objects  - Force, torque and rolling objects  - Statics and equilibrium: force, torque and stationary objects | **Challenge Lab: Target practice with a rolling ball –** students apply their knowledge of energy conservation and rotational kinetic energy to launch a projectile from an incline so that it strikes a target. |
| 12 | 14 | 21-22 | **Gravity**  - Newton’s Law of Gravitation  - Principle of superposition  - Gravity in relation to earth’s surface, on the surface, below and far beyond.  - Gravitational potential energy  - Kepler’s laws  - Satellites and orbits | **Inquiry Lab: Period of Motion** – Students investigate the relationship between the mass, the spring constant and displacement from equilibrium and the period of a mass oscillating while suspended by a spring. |
| 13 | 16 | 23-24 | **Oscillations**  - Oscillations  - Simple harmonic motion defined  - Forces and SHM  - Energy and SHM  - Pendulums and mass-spring systems  - Applied forces, damping forces and resonance | **Ballistic Pendulum:** Students, already familiar with the concept, construct a ballistic pendulum to determine the speeds of various projectiles. They design their own method of gathering and analyzing data from the pendulum. |