**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. |