I. CATALOG DESCRIPTION

A. Division: Science
Department: Physics
Course ID: PHYSIC **101**
Course Title: **Basic Physics**
Units: 4
Lecture: 3 hr per week
Laboratory: 3 hr per week

Prerequisites: Math 090 (or high school algebra)
Advisory Skills: ENGL 015 *or* eligibility for ENGL 101

B. Course Description:
A first course in physics. Topics include motion, forces, energy, waves, light, electricity, magnetism and concepts of modern physics.

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II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES FOR STUDENTS:

Upon successful completion of the course the student should be able to do the following.

- read and critically evaluate scientific literature involving basic concepts
- apply basic scientific principles to new situations
- describe basic physical concepts
- construct models of physical systems
- draw and label diagrams of physical systems
- solve simple problems use the concepts of physics
- explain mathematical equations in words
- establish a connection between mathematical representations and physical descriptions
- understand and use the metric measurements of length, mass and time
- use and manipulate laboratory apparatus
- construct physical systems
- make and analyze measurements of real systems

IV. CONTENT:

Topics are drawn from the following (The instructor should *not* attempt to cover all these topics):

1. Mechanics
   - measurement
   - motion
     - velocity
     - acceleration
   - force
     - Newton's laws
     - gravity
   - two-dimensional motion
   - *typical experiments: Free Fall*
     Force Table
     Vectors
2. Conservation Laws
   - momentum
   - energy
   - *typical experiments: Collisions*
     Conservation of Energy

3. Heat and Thermal Energy
    - kinetic theory of gases
    - temperature
    - states of matter
    - conduction, convection, radiation
    - the law's of thermodynamics
    - *typical experiments:* *Calorimetry*
      Change of Phase
4. Relativity
    - relative motion
    - reference frames
    - special theory of relativity
    - general theory of relativity
5. Waves
    - periodic motion
    - wave motion
    - periodic waves
    - superposition
    - standing waves
    - interference
    - diffraction
    - sound
    - *typical experiments:* *Waves on Water – Ripple tank*
      Speed of Sound
6. Light
    - speed of light
    - reflection
    - refraction
    - image formation
    - optical devices
    - wave model of light
    - color and spectra
    - *typical experiments:* *Reflection*
      Simple Lenses
      Color
7. Electricity and Magnetism
    - charge
    - static electricity
    - electric field
    - electric potential
    - current
    - potential difference
    - resistance
    - power
    - magnetic field
    - sources of the magnetic field
    - interaction of fields and current
    - electromagnetic waves
    - *typical experiments:* *Static electric interactions*
      Simple Circuits
      Ohm's Law
      Magnetism

8. Atoms and Nuclei
    - the electron
    - atomic spectra
    - the nucleus - Rutherford atom
    - quantum theory
        - black body radiation (optional)
        - photoelectric effect
        - deBroglie waves
    - energy level diagrams
    - model of the atom
    - neutron and proton
    - nuclear energy
    - isotopes
    - radioactive decay
    - fission
    - fusion
    - *typical experiments:* *Random Behavior*
      Atomic Spectra
      Half-life
      Nuclear collisions simulation

V. METHODS OF INSTRUCTION:

Instructors will include some or all of the following instructional components:

- Classroom lecture. May be accompanied by activities such as demonstrations, video, film, and computer simulations. Specific reading assignments to reinforce and extend classroom presentations.
- Demonstration experiments evoking discussion and problem solving.
- Computer aided instruction.
- Written assignments involving the solution of problems illustrative of various physical situations.
- Students will utilize critical thinking in performance of specific problem solving strategies.
- Laboratory experimentation. Students work toward specific goals of observation and analysis.
- Students write and summarize their laboratory observations. Writing includes background, data analysis, and documentation of principles and apparatus.
- Other written assignments such as library research including analysis of current popular scientific literature.

VI. TYPICAL ASSIGNMENTS:

- **Forces:**

  We study Newton's Three Laws of Motion. The concept of net force leads us to a special way of adding arrows called vectors. We also introduce two special forces: weight and friction.

  Read: Chapter on Forces

  Learning Goals: You should understand:

  The concepts of vector and scalar, and be able to distinguish between them.
  How to add and subtract vectors
  What is meant by inertia.
  Newton's First Law.
  The concept of momentum: $\boldsymbol{p} = m\boldsymbol{v}$.
  Newton's Second Law in the general form $\boldsymbol{F}_{net} = \Delta\boldsymbol{p}/\ \Delta t$, and $\boldsymbol{F}_{net} = m\boldsymbol{a}$ as a special case.
  Newton's Third Law
  What is meant by net force, and be able to find the net force for a given set of forces.
  The units used for mass and force.
  The concept of weight.
  How friction affects the motion of objects.
  The application of Newton's Laws to simple situations.

Vocabulary:force, inertia, mass, Newton's laws, friction, kilogram, newton, weight
Physics on your own – force : p. 30 (breaking threads), p.43 (use your textbook, loop a string through the middle and attach a rubber band, observe the force needed to start the block moving compared to the force needed to maintain constant velocity motion)
End of Chap. Questions: (examples of 10 -15 assigned questions)

- If you give a book a shove so that it moves across a tabletop, it slows down and comes to a stop. How can you reconcile this observation with Newton's first law.?
- What happens to the acceleration of a rocket if the net force on it is doubled?

End of Chap. Exercises: (examples of 5 –10 assigned exercises)

- Find the net force produced by a 5 N and 9 N force for each of the following arrangements: (a) forces in the same direction; (b) forces in opposite directions; (c) forces at right angles to each other.
- The net force on a 1000 kg car is 3000 N. What is the acceleration of the car?
- A space explorer "weighs" a standard 1 kg mass on planet X. If the weight of the standard mass is 6.3 N, what is "*g*" on the planet's surface?

VII. EVALUATION:

A. Methods of Evaluation:

- Grading may be comparative (scaling, curve) or based on an absolute standard.
- Questions are designed to evaluate student comprehension of the learning goals enumerated in item IV above. Students will be asked to identify basic principles, recognize and apply common terminology, and apply fundamental knowledge to real world situations.
- Methods of evaluation will vary with the instructor, and may include some or all of the following components.
    - Objective tests which may include true-false, multiple choice, and matching items.
    - Subjective tests which may include completion items and essay questions.
    - Laboratory performance
    - Problem solutions
    - Projects
    - Home experiments
    - Written assignments

B. Frequency of evaluation:

- There are typically three to five exams during the semester.
- Other, more frequent evaluation techniques, such as quizzes, may be utilized.

C. Typical exam questions:

- A ball is thrown upward with an initial velocity of 25 m/s from the edge of a cliff. When does the ball reach it highest point? *Show all work for credit.*
- Which of the following features must an atomic model have *to explain* the way alpha-particles pass through a thin, gold foil? (Multiple choice)
    a. an atom must contain electrons
    b. an atom must have a small, positively-charged, massive nucleus
    c. electrons must have a negative charge
    d. an atom must have definite energy levels
    e. all of these
- Write the equation describing the law of gravitation. Draw a diagram labeled with the appropriate symbols used in your equation. Describe in words the law of gravitation.
- What are the two basic concepts on which Einstein based special relativity.

VIII. TYPICAL TEXT(S):

Physics, A World View, 3rd ed., Kirkpatrick and Wheeler, Saunders College Publishing, 1998
The Physics of Everyday Phenomena, 2nd ed., Griffith, William C. Brown, 1999
Physics by Inquiry, McDermott, Wiley, 1996

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

- laboratory notebook
- protractor
- ruler
- calculator