

Syllabus: Conceptual Physics

“Intellectual growth should commence at birth and cease only at death”

-----Albert Einstein

“The more I practice, the luckier I get”

- - - Golfer Gary Player

Instructor : Dr. Manju Prakash

Year: 2009-2010

Course Goals & Course Philosophy:

The focus of this course is to understand how and why natural phenomena occur around us. During the course, I will equip you with the necessary tools to comprehend the physical phenomena that you encounter on your day to day life. I also want to enhance your awareness of physical laws at work. There will be strong emphasis on understanding concepts without mathematics.

What Should I do to Succeed in the Course?

You should be an active participant in the learning process. With persistent and diligent work you will meet the goals of this course. To succeed in this course with a good grade you should follow these guidelines:

- Keep asking questions. Chances are very good that others are in the same situation as you.
- Take your homework seriously.
- Prepare your lab reports thoroughly. This will enable you to develop strong scientific vocabulary to describe physical phenomena.
- Try to identify key concepts while reading the textbook regularly and carefully.
- Focus on developing strong problem solving skills.

Course Requirements:

- Textbook, Conceptual Physics by Paul G. Hewitt (2009 edition)
- Large classroom notebook
- Large 3-ring binder (homework)
- Laboratory notebook
- Netbook & Scientific Calculator
- Open mind, alertness, and consistent work

Grading Procedure:

Your end of the year grade will be determined as follows:

First Trimester: 15%
Second Trimester: 25%
Third Trimester: 35%
Mid-term exam: 10%
Final cumulative exam: 15%

Each Trimester has a grade breakdown as follows:

Laboratory: 15%
Quizzes: 25%
Tests: 40%
Projects: 20%

The grade-scale scheme is as follows:

A+: 97-100	D+: 67-69
A: 93-96	D: 63-66
A-: 90-92	D- 60-62
B+: 87-89	F: 0-59
B: 83-86	
B- 80-82	
C+: 77-79	
C: 73-76	
C-: 70-72	

**Details on the projects as well as rubric will be provided during the trimesters.
Dates for the tests and quizzes will be announced a week before they are scheduled.**

Classroom Policies:

- Please do not talk during the lecture-it is rude and disturbs others.
- Be punctual, late arrival puts you at disadvantage and distracts others.
- Turn off your cell phone/pager/iPod during the classroom instruction.
- Come prepared and take charge of your learning process.
- Cheating or plagiarism may result in failing grade for the assessment. Such incidents may be reported to Honor Council

Homework Policies:

- Make a reasonable attempt at all assigned questions.
- Homework will be assigned everyday and will be due next day.
- Student groups can be effective. However, when a student submits an assignment, she is stating that the material submitted has been fully comprehended. Therefore, joint submissions and plagiarism are unacceptable.

- When returned, homework and all other submitted item (tests, quizzes, labs etc.) are to be saved in your 3-ring binder.
- All submitted assignments must begin with the student’s name and the homework assignment.

Trimester One

Week	Chapters	Topics
1	1	Scientific Process, Units, Dimensions, Graphing
2	18	Solids
3	19	Liquids
4	20	Gases
5	21, 22	Temperature, Thermal Expansion, Heat
6	22, 23	Heat Transfer and Phase Changes
7	9	Energy
8	4	Motion
*****	Parents Weekend *****	*****
9	6, 7	Forces, Newton’s Laws
10	32, 33	Electrostatics, Electric Fields
11	6,7, 32, 33	Review and Test

Trimester 2

Week	Chapters	Topics
1	33	Electric Field and Potential
2	34, 35	Currents & Circuits
3	36, 37	Magnetism & Electromagnetic Induction
4	25	Vibrations & Waves
5	25, 26	Waves and Sound
6	27, 28	Light & Color
7	28, 29	Color, Reflection, Refraction
8	30,31	Lenses, Optics, Diffraction and Interference
	*****Mid-Year Exam & Review	*****
10	8, 10	Momentum, Circular Motion
11	10, 11	Circular Motion, enter of Gravity, Rotational Motion
12	8, 10, 11	Review and Test

Trimester 3

Week	Chapters	Topics
1	38	Quantum Physics
2	38	Atomic Physics and Emission of Radiation
3	39, 40	Nuclear Physics
4	40	Nuclear Physics
5	13	Gravity
6	5	Projectiles
7	5	Projectiles
8	14	Satellites
9	15, 16	Special Relativity
10	All	Review
11	All	Review
12	All	Review and Final exam

Tentative Outline of Topics

1. States of Matter

A. Solids

- (a) Cubic Lattices
- (b) Density
- (c) Elasticity
- (d) Tension & Compression
- (e) Scaling, Surface Area to Volume Ratios

B. Liquids

- (a) Weight
- (b) Pressure
- (c) Buoyant Force
- (d) Floating
- (e) Pascal's Principle & Hydraulic Lifts

C. Gases

- (a) Layers of the Earth's Atmosphere
- (b) Mercury Barometers
- (c) Atmospheric Pressure
- (d) Boyle's Law
- (e) Bernoulli's Principle
- (f) Hot Air Balloons and Airplanes

2. Heat & Temperature

A. Temperature

- (a) Temperature Scales
- (b) Interpretation of Temperature

B. Heat

- (a) Heat Flows
- (b) Specific Heat
- (c) Calories
- (d) Climate Across the Continent

C. Thermal Expansion

- (a) Heat Transfer
 - i. Conduction
 - ii. Convection
 - iii. Radiation
 - (iiia) Blackbody Radiation
 - (iiib) Greenhouse Effect & Global Warming
- (b) Newton's Law of Cooling

D. Change of Phase

- a. Evaporation
- b. Condensation
- c. Boiling
- d. Freezing
- e. Latent Heat

3. Energy

A. Work & Energy

- (c) Work
- (d) Power
- (e) Kinetic Energy
- (f) Potential Energy
- (g) Conservation of Energy
- (h) Efficiency
- (i) Sources of Energy

B. Thermodynamics

- (a) First Law of Thermodynamics
- (b) Types of Thermodynamic Processes
 - (i) Adiabatic
 - (ii) Isothermal
 - (iii) Isochoric
- (c) Second Law of Thermodynamics
- (d) Heat Engines and Refrigerators
- (e) Entropy

4. Motion and Forces

A. Motion

- (a) Distance vs. Displacement
- (b) Speed vs. Velocity
- (c) Acceleration
- (d) Acceleration Due to Gravity
- (e) Air Resistance

B. Forces

- (a) Newton's First Law: Inertia
- (b) Newton's Second law
 - i. Mass and Acceleration
 - ii. Friction
- (c) Newton's Third Law

5. Electricity & Magnetism

A. Static Electricity

- (a) Electric Charge
- (b) Electric Force

- (c) Conductors & Insulators
 - (d) Induced Charge
- B. **Electric Fields**
 - (a) Electric fields
 - (b) Electric Potential Energy
 - (c) Voltage
 - (d) Van de Graaf Generators
- C. **Current**
 - (a) Electric Current
 - (b) Batteries
 - (c) Resistance
 - (d) Ohm's Law
 - (e) AC/DC
 - (f) Electric Power
- D. **Circuits**
 - (a) Series Circuits
 - (b) Parallel Circuits
 - (c) Compound circuits
- E. **Magnetism**
 - (a) Magnets and Magnetic Fields
 - (b) Domains
 - (c) Magnetic Fields & Electric Currents
 - (d) Magnetic Forces
- F. **Electromagnetic Induction**
 - (a) Generation of Electromotive Force
 - (i) Faraday's Law
 - (ii) Transformers and Power Transmission

6. Waves and Vibrations

- A. **Periodic Motion and Vibrations**
- B. **Waves**
 - (a) Period, Frequency, and Wavelength
 - (b) Wave Speed
 - (c) Transverse Waves
 - (d) Longitudinal Waves
- C. **Constructive & Destructive Interference**

7. Sound

- A. **Pressure Waves**
- B. **Speed of Sound**
- C. **Loudness & Pitch**
- D. **Standing Waves and Resonance**
- E. **Closed- Pipe Resonators and Open-pipe Resonators**
- F. **Musical Instruments**

8. Light

- A. What is Light?
 - (a) Light as Electromagnetic Wave
 - (b) The Speed of Light
 - (c) The Electromagnetic Spectrum
 - (d) Transparent Materials
 - (e) Opaque Materials
- B. Color
 - (a) Color Spectrum
 - (b) Color by Reflection
 - (c) Combining Colored Lights
 - (d) Complementary Colors
 - (e) Combining Colored Pigments
 - (f) Why is Sky Blue?
 - (g) Why Sunsets are Red?
 - (h) Why is Water Greenish Blue?
- C. Geometrical Optics
 - (a) Reflection
 - (b) Mirrors
 - 1. Plane Mirrors
 - 2. Concave & Convex Mirrors
 - (c) Refraction
 - (d) Total Internal Reflection
 - (e) Dispersion and Rainbows
 - (f) Polarization
 - (g) Lenses
 - (i) Concave Lens
 - (ii) Convex Lens
- D. Physical Optics
 - (a) Diffraction Through Slits
 - (b) Interference
 - (c) Thin Films

9. Momentum and Circular Motion

- A. Momentum
 - (a) Definition of momentum
 - (b) Impulse
 - (c) Conservation of Momentum
 - (d) Collisions
- B. Circular Motion
 - (i) Rotation vs. Revolution
 - (ii) Rotational Speed

- (iii) Centripetal Force
- (iv) Center of Gravity
- (v) Toppling
- C. Rotational Dynamics
- D. Torque
- E. Rotational Inertia
- F. Angular Momentum
- G. Conservation of Angular Momentum

10. Modern Physics

- A. Quantum Mechanics
 - (a) Quanta
 - (b) Photoelectric Effect
 - (c) Wave-Particle Duality
 - (d) De Broglie Wavelength
 - (e) Models of the Atom
- B. Photon Emission
 - (a) Incandescence
 - (b) Fluorescence
 - (c) Phosphorescence
 - (d) Lasers

11. Nuclear Physics

- A. Nucleus
- B. Isotopes
- C. Radioactive Decay
- D. Half-Life
- E. Carbon Dating

- F. Nuclear Fission
 - a. Fission Reactors
 - b. Mass-Energy Equivalence
 - c. Nuclear Fusion

12. Gravity

- (a) Universal Gravitation
- (b) Gravitational Fields
- (c) Tides
- (d) Black Holes
- (e) Projectile Motion

(f) Satellite Motion

13. Special Relativity

- (a) The Speed Of Light
- (b) Time Dilation
- (c) Length Contraction
- (d) Mass-Energy Equivalence
- (e) Relativistic Momentum
- (f) Relativistic Energy

Laboratory Experiments

- Determine Density
- Determine g.
- Coefficient of Friction
- Centripetal Force
- Conservation of Energy
- Specific Heat
- Period of a Pendulum
- Speed of Sound
- Resistor Addition