Grande Prairie Regional College

Department: Academic Upgrading

Course Outline – Fall 2009-10

PC 0130 5(5-0-1.5) Physics Grade 12 Equivalent

Credit/Contact Hours:

PC 0130 is a 5-credit course with 5 hours/week lecture and 1.5 hr/week lab component.

Instructor: Dr. Desh Mittra **Phone:** 780-539-2981

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Office Hours: by appointment

Prerequisite(s)/corequisite(s):

PC 0120 or equivalent, and MA 0120 or equivalent, or MA0130 placement.

A sound knowledge of vectors is required(a module will be provided).

Textbook / Resource Materials:

COLLEGE PHYSICS by WILSON & BUFFA (Seventh Edition) **Suggested**

PHYSICS; ISBN: - 0135050480 A Pearson Publication **RECCOMENDED**

Course Description:

The major concepts to be covered in this course include: Momentum and its conservation; Electric forces and fields; Current electricity; Magnetic forces and fields; Electromagnetic radiation; and Atomic Physics. Problem solving is emphasized

Attendance and Classroom Decorum:

Regular attendance is expected of all students which is crucial to good performance in the course. Any interruption due to lateness or use of cell phones or otherwise will not be permitted. **You may be debarred from the final exam if you miss 15% (10 days) of classes.**

Tests and Exams: All tests and exams MUST be written at the scheduled times. A missed test (exam) will result in a score of **ZERO** on that test (exam).

Labs:

Labs are compulsory part of the course. If you miss a lab then make-up labs **CANNOT** be guaranteed.

Labs reports must be handed in within prescribed time. Late lab reports will result in penalties. **Late submissions will not be graded unless PRIOR permission.**

Evaluation:

The final grade in the course will be based on the following components.

5 Tests	25%
Midterm Exam	20%
Labs	15%
Final Exam	30%
Assignments	10%

Grades will be assigned on the Letter Grading System as follows

Alpha Grade	4-point Equivalent	Percentage Guidelines	Designation
A^+	4	**90-100**	**EXCELLENT**
A	**4**	**85-89**	
A^-	**3.7**	**80-84**	**FIRST CLASS STANDING**
B^+	**3.3**	**76-79**	
B	**3**	**73-75**	**GOOD**
B^-	**2.7**	**70-72**	
C+	**2.3**	**67-69**	**SATISFACTORY**
C	**2**	**64-66**	
C^-	**1.7**	**60-63**	
D^+	**1.3**	**55-59**	**MINIMAL PASS**
D	1	**50-54**	
F	0	**0-49**	**FAIL**

COURSE OBJECTIVES

UNIT 1 MOMENTUM (About two weeks)

Upon completing this unit, the student should be able to

a. Define and explain momentum, and state its units. Calculate the momentum of a moving body
b. Resolve momentum into components
c. Calculate the change in the momentum of a body after it undergoes a collision or experiences an external force
d. Explain conservation of momentum, and state conditions under which conservation is maintained
e. Define elastic and inelastic collisions giving examples
f. Derive a general formula for the final velocities of the two bodies when a moving body with a known mass and initial velocity collides head on with a stationary body with known mass.
g. Discuss special cases for the above
h. Calculate the loss in kinetic energy when two bodies undergo an inelastic collision
i. Explain glancing, and calculate the final velocities of the two bodies when a moving body glances with a stationary body provided enough information about the two bodies is known
j. Discuss a completely inelastic collision between two bodies and calculate the final velocity of the single mass
k. Solve related problems
l. Define and explain impulse. State units of impulse, and use Newton's laws to relate impulse to force
m. Solve problems related to impulse
n. Explain the role of momentum and impulse in the design and function of rockets and thrust systems
o. Explain the application of momentum and its conservation and that of impulse in the design and use of injury-preventing devices

TEST# 1

UNIT 2 - ELECTIC FORCES AND FIELDS (About two weeks)

Upon completing this unit, the student should be able to

a. Explain the two types of charges — positive and negative, and state the units in terms of the electron and the proton charges.
b. Define the Coulomb as the unit of charge
c. Explain the attractive and the repulsive forces between charges
d. Explain conductors and insulators giving examples

e. Explain the conservation of charge, and how a body can be charged by friction, by induction, and by polarization
f. Describe the working of the electroscope, and explain how charges can be detected by it
g. State Coulomb's law, and apply it to determine the force between charges of different configurations. Solve related problems
h. Compare Coulomb's law to Newton's law of gravitation
i. Explain qualitatively the principles pertinent to Coulomb's torsion balance experiment
j. Define electric field in terms of lines of electric force and explain uniform electric field
k. Discuss the distribution of charge on the surface of conductors of different shapes, and of an insulator
l. Define the strength of electric field, and state its units
m. Calculate electric field strength at a given point due to two or three charges lying in a plane
n. Compare and contrast the experimental designs used by Coulomb and Cavendish in terms of the role that technology plays in advancing science
o. Explain electrical potential energy, and calculate the same for different charge configurations
p. Define electrical potential difference, and state its units. Derive the relationship between electric field strength and potential difference
q. Calculate electrical potential difference between two points in a uniform electric field. Explain quantitatively electrical interactions in terms of conservation of energy. Solve related problems
r. Describe Millikan's oil-drop experiment and its significance relative to charge quantization
s. Assess how the principles of electrostatics are used in industrial devices like photocopiers, electrostatic air cleaners, lightening rods, and so on
t. Explain qualitatively how the problem of protecting sensitive components of the computer are solved from electric fields

UNIT 3 - CURRENT ELECTRICITY **(About 1.5 weeks)**

Upon completing this unit, the student should be able to

a. Define electric current and state its units
b. Label all the parts of the battery, and explain its working
c. Define electromotive force (EMF), and potential difference. State their units and give the relationship between the two
d. Define resistance and state its units. State the factors that affect the resistance of a conductor. Solve related problems
e. Describe and draw an electric circuit showing all its parts and the direction of the conventional current
f. State Ohm's law and apply it to electric circuits. Solve related problems
g. Explain series and parallel connections, and be able to analyze electric circuits in terms of the two types of connections. Also be able to draw series or parallel

circuits, and circuits involving both types of connections

h. Calculate the resultant resistance, and resistance in parts of an electric circuit involving both types of connections. Calculate electric current in any part of such a circuit. Solve related problems
i. Define electric power and state its units. Explain Joule heat, efficiency, and loss in power. Solve related problems
j. Explain how to cut losses in electric energy on an industrial scale. Define KWH and electron-volt

TEST# 2

MIDTERM EXAM THIS WEEK

UNIT 4 - MAGNETIC FORCES AND FIELDS (About 2.5 weeks)

Upon completing this unit, the student should be able to

a. Define magnetism, magnetic poles, and the law of poles. Explain magnetic field and its direction
b. Calculate the force experienced by a moving charge in a magnetic field, and state the rule to determine its direction. Apply the rule to determine the direction of the force
c. Solve related problems
d. Describe how the discoveries of Oersted, and Faraday form the foundations of the theory of relating magnetism to moving charges (electric currents)
e. Define the strength of a magnetic field in terms of the force experienced by a moving charge in a magnetic field. State its units (strength of magnetic field). Solve related problems
f. Describe qualitatively that a moving charge is a source magnetism, and predict the orientation of the magnetic field from the direction of motion
g. State the relationship between the magnetic field and electric current in (i) a straight wire (ii) in a closed loop (iii) in a solenoid. Solve related problems
h. Explain quantitatively how uniform magnetic and electric fields affect a moving electric charge when motion and field directions are mutually perpendicular to each other
i. Describe and explain qualitatively the interaction between a magnetic field and a current-carrying conductor
j. Describe qualitatively the effects of moving a conductor in an external magnetic field
k. Describe qualitatively the torque experienced by a current-carrying loop in a magnetic field, and explain how this effect is used in the construction of a dc motor. Solve related problems
l. Define magnetic flux giving its units. Discuss qualitatively how a change in magnetic flux produces an electric current in a closed conducting loop.
m. State Faraday's law and give the quantitative relationship between the change in magnetic flux and the EMF produced in a closed loop

n. Explain the construction and working of an ac and a dc generator. Solve related problems
o. Explain the construction and working of transforms. Solve related problems
p. Investigate the mechanism that causes atmospheric auroras

TEST# 3

UNIT 5 - ELECTROMAGNETIC RADIATION (About 3 weeks)

Upon completing this unit, the student should be able to

a. Explain the physical nature, origin, and means of propagation of electromagnetic waves, and describe the properties and uses of various types of electromagnetic waves
b. Define and explain the concepts of wave fronts and waves
c. Compare and contrast the constituents of the electromagnetic spectrum on the basis of frequency and wavelength
d. Explain qualitatively various methods of measuring the speed of EMR (electromagnetic radiation) including Michelson's method
e. Explain the phenomenon of reflection and state the law of reflection
f. Explain refraction in terms of Snell's law and the index of refraction. Give examples of refractive phenomena. Solve related problems
g. Explain total internal reflection, and discuss its application in fiber optics
h. Describe qualitatively and quantitatively how refraction supports wave model of EMR
i. Explain how images are formed in plane mirrors. Describe characteristics of such images
j. Distinguish between converging and diverging spherical mirrors, and describe images formed by these mirrors and their characteristics. Determine the characteristics of the images formed from ray diagrams and the spherical mirror equation
k. Solve related problems
l. Distinguish between converging and diverging lenses, and describe the images and their characteristics formed by these lenses
m. Find image locations and characteristics by using ray diagrams and the thin-lens equation
n. Explain how Young's Double-Slit experiment demonstrated the wave nature of light. Compute the wavelength of light from experimental results. Solve related problems
o. Describe how thin films can produce colorful displays. Give examples of practical applications of thin-film interference
p. Define optical flats, and discuss their use to produce Newton's rings
q. Define diffraction, and discuss single-slit diffraction. Give mathematical relation between the width of the slit, the angle of diffraction and the wavelength of light for dark fringes. Solve related problems
r. Discuss diffraction through diffraction gratings and state the

conditions required for diffraction to be observed. Solve related problems

s. Discuss the role of diffraction gratings in spectroscopy, and compare and contrast the visible spectra produced by diffraction gratings and triangular prisms

t. Define the photon as a quantum of EMR and calculate its energy. Classify the regions of the electromagnetic spectrum by photon energy

u. Explain photoelectric effect qualitatively and quantitatively and solve related problems involving energy conservation. Use the phenomenon to support the wave-particle duality of EMR.

v. Explain Compton's effect and use the phenomenon to support dual theory of EMR. Solve related problems based on conservation of energy and momentum

TEST# 4

UNIT 6 ATOMIC PHYSICS **(About two weeks)**

Upon completing this unit, the student should be able to

a. Describe matter as containing discrete positive, negative and neutral particles
b. Explain how the discovery of cathode rays contributed to the development of atomic models
c. Explain Thompson's experiment and the significance of the results for both science and technology
d. Explain qualitatively the significance of the results of Rutherford's scattering experiment
e. Discuss Bohr model of the atom, and how it is supported by the atomic spectra of elements
f. Explain radioactivity, and write nuclear equations for alpha, beta, and beta-positive decays including the appropriate neutrino and antineutrino
g. Use the law of conservation of charges and mass to predict the particles emitted by a nucleus
h. Define decay constant and half-life period. Perform simple half-life calculations. Solve related problems
i. Explain the principle of carbon dating and calculate the age of an artifact. Solve related problems
j. Explain mass defect, and use the concept to calculate the energy released during a nuclear reaction
k. Define fission and fusion reactions, and compare and contrast their characteristics
I. Explain the strong nuclear force, and the quark model of the atom

TEST# 5

FINAL EXAM