Fall Semester 2023, Course Outline: Principles of Physics – I.
Course # PHY 111 Section 15

Department of Mathematics and Natural Sciences
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Course Number:	PHY 111
Course Name:	Principles of Physics – I
Credit Hours:	03 (Three)
Section:	15
Lectures on:	Thursday/Saturday (11:00 am – 12:20 pm)
Class Meeting Place:	UB10104
Consultation Time:	Monday / Wednesday (11:00 am – 1:00 pm) (UB60604)

Course description: This is designed to introduce the principles of Newtonian mechanics and calorimetry at the freshmen level of the undergraduate study for engineering majors or equivalent. The key concepts to be developed throughout the semester are: vectors, equations of motions, Newton's laws, conservation laws of energy, momentum, the work- energy theorem, extension of linear motion to rotational motion including the conservation laws, gravitation, elasticity and their properties, SHM, waves, sound, fluid mechanics and calorimetry. In calorimetry, the emphasis will be given to the relation among work, heat and internal energy.

Course Aims: The aim of this physics course is to clarify the student with an understanding of the physical principles of the universe, to assist them develop critical thinking and quantitative reasoning skills, to empower them to think creatively and critically about scientific problems and experiments for students whose interests in here in research, teaching, industrial jobs or other sectors of our society.

Course Objective:

- To introduce the principles of Newtonian mechanics at the freshmen level of the undergraduate study for physics and engineering majors or equivalent.
- To help develop a mathematical foundation for solving mechanics problems using qualitative and quantitative reasoning.
- Students will have the ability to communicate mechanics reasoning in oral and in written form.
- Assist the students to attain the capability to experimentally verify mechanics principles.

Course Outcomes: Upon successful completion of this course, students will be able to**:**

- explain the introductory mechanics principles.
- apply introductory mechanics principles, together with logical reasoning to real life situations.
- analyze and solve mechanics problems with the aid of mathematics.
- acquire and interpret experimental data to examine the laws of physics.

Required Textbook: Principles of Physics. Author: Halliday, Resnick & Walker (10^{th}edition, Extended). (Any edition is sufficient. However, the topics may have different section numbers depending on the edition)

Recommended book: University Physics with Modern Physics. Author: Young & Freedman.

Marks Distribution: The total mark for this course is 100. The marks will be allocated as follows:

Attendance	Quiz	Lab	Assignments	Midterm	Final
5%	15%	10%	15%	20%	35%

Attendances policy: Arriving 15 minutes late or more is automatic absent. **If the total attendance (both lecture and lab classes) is less than 70% of the total number of classes, the student will not be allowed to appear in the mid-semester and semester final exams irrespective of the reason of absences, and he/she will be listed as an absentee.** 5% of the total marks allocated for class atendance will be awarded according to the following scheme.

Attendance	Marks
90% and above	5
85% - 89%	4
80% - 84%	3
75% - 79%	2
70% - 74%	1
Less than 70%	0(Absentee)

The grades and the grade points: The grades and grade points will be calculated as per the Brac University grading system which is as follows:

% of marks obtained	Letter grade	Grade sign	Grade points
97 - 100	A +	plus	4.00
90 - < 97	A	plain	4.00
85 - < 90	A -	minus	3.70
80 - < 85	B +	plus	3.30
75 - < 80	B	plain	3.00
70 - < 75	B -	minus	2.70
65 - < 70	C +	plus	2.30
60 - < 65	C	plain	2.00
57 - < 60	C -	minus	1.70
55 - < 57	D+	plus	1.30
52 - <55	D	plain	1.00
50 - <52	D-	minus	0.70
< 50	F	plain	0.00

Course dispension: It will mainly involve **two lectures of 1 hour and 20 minutes durations every week**. Different teaching aids e.g. power point presentation will be used when it will be deemed necessary. Class room discussion and problem solving sessions will supplement the lecture presentations.

Evaluation procedure: Evaluation of the students will be done on the basis of the marks distribution scheme described earlier. The **final examination** will be taken on the **entire syllabus**. The **mid-semester examination** will be **one hour long** and will be held around the middle of the semester. The quizzes are based on the lectures and there will be **no make-up for missed quizzes.** During quizzes, mid-term and final exam each student must work alone.

Make up exams for **mid-semester** and **semester final** are **strongly discouraged** but may be allowed under complelling situations like, serious illness supported by **authentic medical certificate endorsed by the university medical officer**. However, the candidate **must pay make up exam fee as per the university rule.**

Revised Make-UP Policy: "Make-up examinations will only be allowed to the students with extreme medical condition OR death in the immediate family during the semester". In such cases, allowing to sit for the make-up exam is to be recommended by the course teacher and approved by the parental departmental heads.

Lecture Details: The tentative course/lecture schedule is given below. Note that the order of the topics may be changed if necessary.

Lecture Delivery Plan

Lecture No.	Topics
Lecture - 1	Introduction. Scalars and Vectors: Definition and properties, Graphical presentations of vector sums, Relation between polar and Cartesian coordinates
Lecture - 2	Unit vectors and their properties, components of vectors, algebraic presentations of vector sums
Lecture - 3	Multiplication of vectors: scalar and vector products
Lecture - 4	Motion along a straight line in two and three dimensions: position, displacement, average velocity and speed, instantaneous velocity and speed , average and instantaneous acceleration, motion at constant acceleration and their graphical representations,
Lecture - 5	Free fall acceleration and projectile motions
Lecture - 6	Uniform circular motion, relative motion in one and two dimensions
Lecture - 7	Newton's laws of motion, type of forces in nature
Lecture - 8	Free body diagrams and application of Newton's law
Lecture - 9	Frictions, properties of friction, uniform circular motion and centripetal force
Lecture - 10	Kinetic energy and work, conservative and nonconservative forces, work done by constant and variable forces
Lecture - 11	Potential energy: different form of potential energies and conservation of mechanical energy
Lecture - 12	Center of Mass, center of mass of a system of particles and solid bodies, Linear momentum
Lecture - 13	Collisions, momentum and KE in collision, type of collisions in one and two dimensions, impulse
Midterm Exam	*Midterm Exam will be held during the midterm week. The date and time will be announced later.*
Lecture - 14	Rotational motion: kinematics, rotation with constant angular acceleration, relation between linear and angular variables, kinetic energy of rotation, calculating the rotational inertia of the different systems,
Lecture - 15	Rotational motion: dynamics, Newton's second law for rotation, Torque, Angular momentum, conservation of angular momentum
Lecture - 16	Newton's law of Gravitation, gravitation near earth surface, gravitation inside the earth, gravitational potential energy, escape velocity, orbital velocity
Lecture - 17	Kepler's law of planetary motion, satellites motion: orbits and energy
Lecture - 18	Fluid, density and pressure, Pascal's and Archimedes principle, buoyancy
Lecture - 19	Ideal Fluid in motion, equation of continuity, conservation law and the Bernoulli's equation with applications
Lecture - 20	Oscillation, Simple Harmonic Motion (SHM), force law for SHM, energy in SHM,
Lecture - 21	The simple and physical pendulum, damped Simple Harmonic Motion (SHM)
Lecture - 22	Types of waves, Transverse and longitudinal waves, Traveling wave equation and wave propagation, wave speed in a string, energy and power of a traveling waves
Lecture - 23	Wave equation, principle of superposition for waves, interference of waves, Standing waves and resonance
Lecture - 24	Temperature and heat, Zeroth law of thermodynamics, Temperature scales, heat capacities and specific heat

Lecture - 25	1st law of thermodynamics: Work and heat, definition of internal energy, some special case of first law of thermodynamics
Lecture - 26	Review (if time permits).
Final Exam	*Final Exam will be held during the final week.*

Suggested points and problems

Note: This list is intended only for practice. The exam question could be similar but would not be from this list.

The following chapter, problem number, etc refers to the 10th edition (Ex.) of the Resnick, Halliday and Walker's book.
Legend: CP = check point, SP = sample problem in the book (solved problems) on a particular page, Pr = unsolved problems in the book at the end of the chapter.

Chapter 2:
SP: 2.03, 2.05.
CP: 2, 5.
Pr: **5**, **15**, **18**, 20.

Chapter 3:
SP: 3.02, 3.03, 3.04, 3.05.
CP: 1, 2, 3, 4, 5.
Pr: **9**, **15**, 17, **30**, 35, 36, **37**, 50, 61, 63.

Chapter 4:
SP: 4.01, 4.02, 4.03, 4.04, 4.05.
CP: 1, 2, 3, 4, 5.
Pr: **11**, 14, **16**, 26, **27**, **28**, 32, 43.

Chapter: 5:
SP: 5.01, 5.02, 5.03, 5.04, 5.06, 5.07.
CP: 1, 2, 3, 4, 5.
Pr: **9**, 13, 17, **34**, 50, **53**, 55, **57**, 67.

Chapter: 6:
SP: 6.01, 6.02, 6.04, 6.05, 6.06.
CP: 1, 2.
Pr: 5, **10**, 16, **23**, 27, 47, **57**, **70**, 88.

Chapter 7:
SP: 7.01, 7.02, 7.03, 7.04, 7.05, 7.06, 7.08.
CP: 1, 2, 3.
Pr: 1, **11**, 15, 19, **24**, 61.

Chapter 8:
SP: 8.01, 8.02, 8.03, 8.04, 8.05, 8.06.
CP: 1, 2, 3, 4.
Pr: **6**, **22**, 29, 48, **53**, **57**, 62.

Chapter 9:
SP: 9.01, 9.04, 9.05, 9.06, 9.07.
CP: 1, 3, 4, 5, 6, 7, 8, 9.
Pr: 33, **38**, **45**, 46, 58, **60**, 61, **72**, **74**, 85, 101, 102.

Chapter 10:
SP: 10.01, 10.02, 10.03, 10.04, 10.06, 10.07, 10.10, 10.11.
CP: 1, 2, 3, 4, 5, 6, 7.
Pr: 6, **14**, 30, **41**, 45, **51**, 52, 53, 71, **104**.

Chapter 11:
SP: 11.01, 11.02, 11.03, 11.05, 11.06.
CP: 1, 2, 3, 4, 5, 6.
Pr: 7, 9, 11, 15, **25**, 27, 29, **37**, 41, **54**, 55, 66.

Chapter 12: (Elasticity)
SP: 12.01.
Pr: **43**, 50.

Chapter 13:
SP: 13.01, 13.02, 13.03, 13.04, 13.05.
CP: 1, 2, 3, 4.
Pr: **8**, 14, 23, **37**, **40**, 43, 45, 50, 53, 56, **63**, 64.

Chapter 14:
SP: 14.01, 14.02, 14.03, 14.04, 14.05, 14.06.
CP: 1, 2, 3, 4.
Pr: **4**, 10, 14, **32**, 34, **41**, 44, **48**, 71.

Chapter 15:
SP: 15.01, 15.02, 15.03, 15.04, 15.05.
CP: 1, 2, 3, 4, 5.
Pr: 6, 9, **13**, 22, 24, 35, **106**.

Chapter 16:
SP: 16.01, 16.02, 16.03.
CP: 1, 2, 3, 5, 6.
Pr: 5, **9**, 10, **17,** 45, **53** 57, **65**, 67, 87.

Chapter 17:
SP: 17.05, 17.07.
CP: 3, 4.
Pr: 7, 11, **55,** 56.

Chapter 18:
SP: 18.01, 18.02, 18.03, 18.04, 18.05.
CP: 1, 2, 3, 4, 5, 6, 7.
Pr: 7, 11, 12, **24**, 39, **43**, 47, 50, **58**, 59, 63, **95**.