**Forman Christian College**

**Physics 100 (BA/BS Hons.): SYLLABUS – ‘2023Spring’**

**This course meets the Bachelor of Arts and Bachelor of Sciences degree requirements.**

**Course Prerequisites:**

This course is **NOT** recommended for students who have passed physics in Intermediate or A–levels or equivalent. Knowledge of elementary mathematics/pre–calculus is preferable.

**Professor:** Dr. Laila Zafar Kahlon

**Class meeting Time:**

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| --- | --- | --- | --- |
| Sec | Lessons | Lab | e–mail /Office |
| **E** | 1 contact hour each  **T, R**  **12:30-13:45** (S027) | Two contact hours  **W**  11-12:50 (S027B) | **S–025 Armacost Science Block**  042–9231581–88  ext:596  [**lailakahlon@fccollege.edu.pk**](mailto:lailakahlon@fccollege.edu.pk) |
| Contact Hours | | **M, W**  11:00–1:00 |

**Availability outside Office Hours: –** By appointment only (send an e–mail or text message)

**Goals:**

Introduction to physics lays emphasis on basic concepts that can be treated with elementary mathematics. These include applications of physics in everyday life to which the student can relate with.

**Laboratory:**

Familiarisation with measuring instruments and related experimentation.

**Course content:**

Introduction to physics, lays emphasis on basic concepts that can be treated with elementary mathematics (knowledge of calculus .is preferable but not essential)

These include applications of physics in everyday life to which the student can relate with.

Concepts to be taken up are: Scope of Physics, Communications, Basic Electricity, Kinematics and bodies in motion or Medical Physics or Elements of Astrophysics

This course is designed to provide students with a working knowledge of the elementary physics principles mentioned above, as well as their applications, and to enhance their conceptual understanding of physical laws.

**Evaluation:**

Course evaluation is based on a blend of regular homework/assignment sets and/or quizzes, reports from the lab/activity period, midterm and final exam quiz and other evaluative tools.

**Duration:**

One 16–week semester (6 weeks in summer) including examinations and preparation time.

# **Learning Outcomes:**

By the end of this course it is hoped that students will be able to:

1. Understand and appreciate that most of the natural phenomena can be explained using fundamental laws of physics.
2. Develop understanding of the material studied by solving applicable problems.
3. Become familiar with physics principles applicable in other fields of science.
4. Become familiar with the techniques used in measurement and measuring instruments.

**Note:**

* Work in this Course is Set and Graded CONTINUOUSLY: Thus, to excel in this Course, you need to engage in sustained hard work. To gain maximum benefit you should lookup material **before** Classes.

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| **Credits:** | | Total |
| Theory/ Lab | Attendance/Participation | **10** |
| Tests/Quiz/ Assignments | * Minimum 5 Quiz/Assignments * Practical Notebook counted as 1 assignment at end of course | **35** |
| **Mid–Term Test/Exam** | | **20** |
| **Final Examination** | 20% Lab Exam  80% Final Exam | **35** |
| **Total** |  | **100** |

**Gradable Course Work comprises:**

* A minimum of 6 – 8 pieces of Class work, which are likely to be in the form of 20 – 50–minute quiz of either TF/MCQ or – questions or a combination, one being the midterm and the last being the final exam.
* All examination, tests and assignments shall be **CUMULATIVE*, i.e. may or may not contain material from previous assignments and tests.***

**Homework:**

* 2 pieces of Homework, which are likely to be in the form of 2 papers of questions from the text. The solutions to Homework may be reached independently or collaboratively (your choice). However, ALL Homework MUST be written up in your OWN words (see section below on **Academic Honesty**). As already mentioned, Homework assignments can be done in teams, but all team members **MUST** turn in an individual set of homework solutions neatly written or typed (not via e–mail).
* A set of Lab work, which involves your participation within and writing up of about 10 – 12 sessions of laboratory experiments. **Laboratory Notebook**:

**Setting and Marking of Gradable Work:**

Each piece of Gradable Work is set within ONE WEEK of time indicated on the syllabus. The rules by which marks are allocated are identified each time a piece of Gradable Work is set. You will achieve maximum marks if you:

**A) Demonstrate excellence in the following Learning Outcomes:**

Thorough appreciation of the Course Content

* Understanding of how to use basic concepts and fundamental laws of physics to explain natural phenomena and apply the knowledge to solve numerical problems.
* Ability to use basic measuring instruments for the purposes of experimentation.
* Utilise, AS A MATTER OF ROUTINE, correct handling practices relating to physical quantities and data.
* Ability to self–learn criticise and report.

**B) Demonstrate excellence in the following aptitudes:**

* Use of the medium of English
* Legible writing, neat drawing, and neat calculations and graphing.
* You MUST bring into each Lab, or class, where appropriate, your OWN calculator to perform and check calculations.

**Materials List Required:**

**A NON–GRAPHING scientific calculator is required**. Use of calculators on cell phones, PDA’s, etc. is not permitted. Graph paper and graphing tools (pencil, eraser, ruler etc.)

**Note:** It is **NOT** permitted for you to share items during Gradable Class work.

Since the experiments which will be performed by the class comprise the core of the course, **attendance is mandatory**, and will be recorded. Students must organize their work or [Laboratory Worksheets in a Folder](http://instructor.physics.lsa.umich.edu/106/courseinfo_lorenzon.html#Laboratory Notebook:#Laboratory Notebook:) (to be graded independently of other assignments).

**Required Work:**

* Attend ALL classes. Arrive on time and stay the entire period.
* Perform all laboratory work and submit all homework assignments on time.
* Take the quizzes and both exams.
* Explore, be attentive, interact – pose questions to me or to each other and figure things out.

**Note:**

1. An assignment/quiz will be posted/given to the class fortnightly on the average (see syllabus below).

2. The Notebook/Lab Worksheets will be collected weekly.

3. Absences will be approved ONLY in the case of extenuating circumstances. Non–approved absences will quickly erode your course grade.

4. **Note that this Syllabus does NOT provide for makeup exams, re–sits, rescheduling and/or extensions.**

5. You can bring only a one A4 page of notes to the two examination and no other references.

6. Bring your own calculators to quizzes and exams – **MOBILE PHONES CANNOT SUBSTITUTE CALCULATORS**

**Midterm and Final exam**

The exams will be given according to the university schedule, with questions similar to the quizzes in format.

**Required Text:**

**Physics in Context**, W. J. Zealney, M. Hynoski et al, Oxford University Press (ISBN: 0 19 550776 2) [2 vol. set] 2002

**Optional Text:**

**Fundamentals of Physics** Extended version, David Halliday, Robert Resnick and Walker, Jerel, (7th Edition) John Wiley & Sons, 2002

**University Physics with Modern Physics**, Hugh D. Young, Roger A. Freedman, (eleventh edition) (ISBN 81–297–0464–1) Pearson Education Ltd. [LPE] Addison–Wesley, 2004

**Physics for Scientists and Engineers**; Paul A. Tipler; W. H. Freeman & Company, 6th Edition, 2007

**Syllabus**

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| --- | --- | --- | --- |
| **Weeks** | **Chapter** | **Topics** |  |
| **1 – 2** | **Introduction and Breadth of Physics** | **Vol I** chapter 1 | Quiz/Assignment |
| **3 – 5** | **Communication Physics** | **Vol I** chapter 2 | Quiz/Assignment |
| **6 – 8** | **Elements of electricity** | **Vol I** chapter 3 | Quiz/Assignment |
| **8** | **Mid Term Examination** | | |
| **9 – 10** | **Elements of electricity** | **Vol I** chapter 3 | Quiz/Assignment |
| **11 – 15** | **(One of the following)**  **Motion and kinetics/**  **Astrophysics/**  **Medical Physics**  **Revision** | **Vol I** chapter 4 /  **Vol I** chapter 5 /  **Vol II** chapter 4 | Quiz/Assignment |
|  | **Final Examination** |  | |

**Attendance and Participation:**

In line with the University’s expectation of % attendance, this Course rewards attendance and participation. Your Instructor will maintain a full record of Class and Lab attendance. Your 10 Attendance Credits are progressively reduced towards 0 if you Miss Classes. Missing Classes poses other dangers; for example, you may miss a piece of Class work, or a Homework deadline. Missed Class works and Homework, or a piece of Lab work means you get no Credits for that piece of work, but there are also penalties for attending, but NOT fully participating.

**Academic dishonesty, including plagiarism:**

FCC does NOT allow activities, and acts stated above, to ensure that honest students are not disadvantaged. I will be vigilant of offences. I REQUIRE you to use your OWN words when answering questions in pieces of Class work. If, you HAVE committed **Academic dishonesty, including plagiarism**, you will be penalised as described in the Baccalaureate Student Handbook. But honesty is infinitely preferable to losing letter grades or failing. Thus:

* During graded work only allowing you to have at your desk, any Items provided by me (E.g. Question Paper, blank paper etc.).
* Not allowing you to have at your desk all other UNNECESSARY Items. These include (but are not limited to) BAGS, NOTES and **MOBILE PHONES**. All such UNNECESSARY Items MUST be switched off and placed in your bags or left with the instructor at the front of the class.
* Requiring you to sit in seats of MY choice.
* Not allowing all forms of communication (verbal, written, electronic etc.) – The only exception is that you may raise your hand if you need my attention.
* Requiring you to complete all washroom activities IN ADVANCE.

The penalty for breaking these rules depends on its severity. Use of a mobile phone during a quiz, for example, results in (ZERO) marks for that piece of work AND you will be required to leave the room. In other cases, you may first receive a warning.

**Concessions:**

* Days when lab is held, are also counted as Attendance days.
* Homework and Gradable written work will ONLY be accepted if EITHER given to me OR posted under my Office Door by the **end of the working day of the deadline**. Late homework will NOT be accepted unless it is accompanied by proof of an extenuating circumstance.
* If Gradable Work is MISSED for unplanned reasons, concessions may be given, but ONLY in EXCEPTIONAL circumstances – e.g. DOCTOR’S NOTE indicating serious illness, but other reasons may be accepted at the discretion of the instructor.

## **Minimum Technical Skills:**

As University students are expected to demonstrate competency in Computer Technology. To be successful in this course, you will need the following technical skills:

* Use electronic mail with attachments.
* Access and use the University LMS (Moodle and EMPOWER) and embedded software (Big Blue Button)
* Save files in commonly used word processing formats.
* Copy and paste text, graphics or hyperlinks.
* Open and access PDF files.

**Lab PHYS 100:**

**Experiments (Actual ones if changed shall be notified):**

1 Laboratory practices safety and other instructions

2 measurement of a volume of a cuboid/ prism/ sphere, using a Vernier calliper

3 Measurement of the volume of a sphere/piece of wire using a micrometre screw gauge

4 Verify the law of mass and the law of amplitude for a simple pendulum

5 Verify the law of lengths for a simple pendulum

6 Find the critical angle of a glass prism and hence find its refractive index

7 Verify that intensity of light and distance have an inverse square relationship

8 Learn the essential workings of the AC/DC laboratory kit and use of a electric measuring instruments i.e. a voltmeter/ammeter/Multimeter etc.

9 Measure current and resistance in a circuit and verifying Ohm’s Law

10 Measure the resistance of resistors in series

11 Measure the resistance of resistors in parallel

12 Measure the resistance of resistors in combination of series and parallel

## **Evaluation of the Course:**

Students will be provided an opportunity to evaluate instruction in this course using the University's standard procedures, which are administered online by the Office of Institutional Research and Quality Assurance Cell (QEC) in the two weeks before the Finals.

Additional informal formative surveys may also be administered, by me, within the course as an optional evaluation tool.

**Introduction**

The primary purpose of this introduction is to help prepare you for this structured program in introductory physics.

**The Program of Study**

When you take this course, here is what you will be doing. Here is the sequence of the scheme:

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|  | **Content** | **Learning Objectives** | **Online methods and resources** | **Assessment** |
| Week 1 to 4 | Students develop understanding about the need of an experimentally validated scientific method and a measurement system of Units (SI system) | Listed in detail weekly plan | Moodle uploaded PowerPoint and also sent via e–mail to students who already have reference text with them  Links to on–line resources | Quiz on Moodle/campus |
| Week 5 –8 | Students develop understanding about Wave motion, reflection and Refraction of Waves | Listed in detail weekly plan | Moodle uploaded PowerPoint and also sent via e–mail to students who already have reference text with them  Links to on–line resources | Assignment on questions from textbook supplemented with some from other textbooks Quiz on Moodle/ campus |
| **Mid Term Examination** | | | | Quizzes on Moodle/ campus or written exam (if possible) |
| Week 9 – 12 | Sources of Energy, Basics of Electricity – Current, Voltage, circuits with one power source etc. | Listed in detail weekly plan | Moodle uploaded PowerPoint and also sent via e–mail to students who already have reference text with them  Links to on–line resources | Assignment on questions from textbook supplemented with some from other textbooks Quiz on Moodle/ campus |
| Week 12 + | Medical Physics or Motion and kinetics / Revision | Listed in detail weekly plan | Moodle uploaded PowerPoint and also sent via e–mail to students who already have reference text with them  Links to on–line resources | Assignment on questions from textbook supplemented with some from other textbooks Presentation |
| **Final** |  |  |  | Quizzes on Moodle or written exam (if possible) |

**Lab Work** – Demonstration of Experiments (if feasible) otherwise link to online experiments that are opensource relating to content and questions concerning the experiments (plotting graphs and extrapolating data – even if physical measurement is not possible) - use of online simulator software.

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| **Week** | **Learning Outcomes** | **Methods and Resources** | **Assessment** |
| **Week 1 and 2** | **Week 1 and 2 – Introduction and Breadth of Physics** | This consists of on campus and video lecture from the resource set (downloadable) Power point presentations and discussions. | A Quiz would culminate this segment. |
|  | You would learn about the Scientific Method and  recognise the role played by physics as a fundamental science  identify the relevance of physics to modern society.  analyse the roles of observation, measurement, recording and theory in the process of scientific investigation  recognise the need to test theory against observations  recognise physical laws as concise statements about how nature is observed to function.  recognise the nature of fundamental quantities and the need for standardised units of measurement (System International)  appreciate the range of masses, length and time intervals commonly found in our Universe  review the use of exponential notation and prefixes in expressing observational data.  discuss about measurement and uncertainties in measurement.  Be able to convert measurements made in non–standard units to SI units.  recognise the necessity for valid and reliable data  recognise that repeated measurements show a spread or uncertainty about an average or mean value  calculate absolute and relative errors of measurement  compare results within their uncertainties. | <https://ocw.vu.edu.pk/Videos.aspx?cat=Humanities+Distribution&course=GSC101> (lectures 1, 2,) |  |
| **Lab 1 and 2:** | Introductory Laboratory practices and measurement; | Vernier callipers and Micrometre (<https://www.youtube.com/watch?v=XQT6RSNN9sA>) | Lab Reports |
| **Week 3 to 5 – Communication Physics** | You would learn to  describe the energy transformations  describe waves as a transfer of energy disturbance that may occur in one, two or three dimensions, depending on the nature of the wave and the medium  identify that mechanical waves require a medium for propagation whereas electromagnetic waves do not  define and apply the following terms to the wave model: medium, displacement, amplitude, period, compression, rarefaction, crest, trough, transverse waves, longitudinal waves, frequency, wavelength, velocity  describe the relationship between particle motion and the direction of energy propagation in transverse and longitudinal waves  quantify the relationship between velocity, frequency and wavelength for a wave: v = fλ  identify that sound waves are vibrations or oscillations of particles in a medium.  explain an echo as a reflection of a sound wave  describe the principle of superposition and compare the resulting waves with the original waves.  describe electromagnetic waves in terms of their speed in space and their lack of requirement of a medium for propagation  identify the electromagnetic wavebands, especially Radio, Microwave, Visible, UV, X–rays and gamma ray  identify methods for the detection of wavebands in the electromagnetic spectrum  explain that the relationship between the intensity of electromagnetic radiation and distance from a source is an example of the inverse square law: | This consists of video lecture from the resource set (downloadable) Power point presentations and discussions  <https://phet.colorado.edu/sims/html/pendulum-lab/latest/pendulum-lab_en.html> | . One or more Quiz would be administered weekly and would culminate this segment |
| **Lab 3, 4** | (Inverse square Law – Intensity decreases as square of resistance  **Periodic Motion – Laws of pendulum** | <https://www.youtube.com/watch?v=y2gNj6whIMk>)  <https://phet.colorado.edu/sims/html/pendulum-lab/latest/pendulum-lab_en.html> | Lab Reports |

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| **Week 6 to 9 –** | You would learn to  discuss how the main sources of domestic energy have changed over time  assess some of the impacts of changes in, and increased access to, sources of energy for a community  discuss some of the ways in which electricity can be provided in remote locations  discuss the environmental impact of certain sources that are used to generate electricity (renewable and non–renewable sources of energy)  describe the behaviour of electrostatic charges and the properties of the fields associated with them  define the unit of electric charge as the coulomb  define the electric field as a field of force with a field strength equal to the force per unit charge at that point, E = F/q  define electric current as the rate at which charge flows (coulombs/second or amperes) under the influence of an electric field | **Elements of electricity**  This consists of video lecture from the resource set (downloadable) Power point presentations and discussions | One or two Quiz and Mid-Term Test would culminate this segment. |

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| **Week 6 to 9 – Cont** | identify that current can be either direct with the net flow of charge carriers moving in one  direction, or alternating with the charge carriers moving backwards and forwards periodically  describe electric potential difference (voltage) between two points as the change in potential energy per unit charge moving from one point to the other (joules/coulomb or volts)  discuss how potential difference changes at different points around a DC circuit  identify the difference between conductors and insulators  define resistance as the ratio of voltage to current for a particular conductor R= V/I  describe qualitatively how each of the following affects the movement of electricity through a conductor  length  cross–sectional area  temperature  material.  **Students shall also learn to:**  identify the difference between series and parallel circuits  compare parallel and series circuits in terms of voltage across components and current through them  identify uses of ammeters and voltmeters.  explain why ammeters and voltmeters are connected differently in a circuit  explain why there are different circuits for lighting, heating, and other appliances in a house  explain that power is the rate at which energy is transformed from one form to another  identify the relationship between power, potential difference and current  identify that the total amount of energy used depends on the length of time the current is flowing and can be calculated using energy = V x l x t  explain why the kilowatt–hour is used to measure electrical energy consumption rather than the joule. | This consists of video lecture from the resource set (downloadable) Power point presentations and discussions | One or two Quiz would culminate this segment. |

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| **Lab** | **Required: On–line circuit Lab (You might have to create a free account)** | **Lab – manual available on Moodle – for download**  Lab Experiments on electrical circuits using the on–line circuit simulator [https://phet.colorado.edu/sims/html/circuit–construction–kit–dc–virtual–lab/latest/circuit–construction–kit–dc–virtual–lab\_en.html](https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html) | Lab Reports |
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| **Week 10–14** | **Moving about (Motion and kinetics)** |  |  |
|  | You would learn to  identify that a typical journey involves speed changes  distinguish between the instantaneous and average speed of vehicles and other bodies  distinguish between scalar and vector quantities in equations  compare instantaneous and average speed with instantaneous and average velocity  define average velocity as displacement divided by time.  define and work in reference frames  differentiate and represent scalar and vector quantities  be able to plot and extract data from position–time, velocity–time and similar graphs.  solve problems involving uniform accelerated motion.  Solve problems using vector manipulation – head to tail rule and/or trigonometric methods to resolve vectors into components and add and subtract vectors.  describe the motion of one body relative to another  identify the usefulness of using vector diagrams to help in solving problems  explain the need for a net external force to act in order to change the velocity of an object  describe the actions that must be taken for a vehicle to change direction, speed up and slow down  describe the typical effects of external forces on bodies including friction between surfaces and air resistance (calculations of friction coefficient are omitted)  define average acceleration as the change of velocity over time  define the terms ‘mass’ and ‘weight’ with reference to the effects of gravity  outline the forces involved in causing a change in the velocity of a vehicle when: coasting with no pressure on the accelerator, pressing on the accelerator, pressing on the brakes, passing over an icy patch on the road, climbing and descending hills; following a curve in the road.  interpret Newton’s Second Law of Motion and relate it to the equation: **F = ma**  identify the net force in a wide variety of situations involving modes of transport and explain the  consequences of the application of that net force in terms of Newton’s Second Law of Motion.  define momentum as: p = mv  define impulse as the product of force and time  explain why momentum is conserved in collisions in terms of Newton’s Third Law of Motion.  Solve problems of conservation of momentum for collisions – problems requiring coefficient of restitution are not required to be done. | <https://ocw.vu.edu.pk/Videos.aspx?cat=Humanities+Distribution&course=GSC101> (lectures 1, 2, 3, 5, 6 7, 8, and 9) | One or more Quiz and Final Cumulative Exam/ project would culminate this segment. |
| **Lab** | **Vector manipulation** | https://phet.colorado.edu/sims/html/vector-addition/latest/vector-addition\_en.html | Lab Reports |
| **Week 15 –** | **Revision** | **Week 15 – Revision** |  |