KENNESAW STATE UNIVERSITY

SYLLABUS
COLLEGE OF SCIENCE AND MATHEMATICS
DEPARTMENT OF PHYSICS
PHYS3500K: COMPUTATIONAL PHYSICS I
SPRING 2023

Course Information

Class meeting time and Location:
Tuesday and Thursday at 15:30 -16:45 Marietta Campus, Academic Bldg, Room 250.
Tuesday and Thursday at 17:00 -18:15 Marietta Campus, Academic Bldg, Room 250.
Modality: Face to Face course;
Syllabus: posted in D2L

Instructor Information

Name: Dr. Marco Guzzi
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Office Location: Kennesaw Campus, Science Bldg, 4th floor, Room SC436
Office phone: 470-578-4783
Office Hours: By appointment
Preferred method of communication: e-mail
(When e-mailing, please put "PHYS3500K" in the subject line along with the subject of your message.
Do Not use D2L or other email providers to send emails, you will not get a reply. We all must adhere to the
KSU safety protocols.)

Course Description

2 Class Hours 3 Laboratory Hours 3 Credit Hours
Prerequisite: Grades of "C" or better in PHYS 2212/2212L

This course utilizes introductory computer programming to analyze situations that are unique to physics.
Students will enhance their computational thinking by using these methods and learn to obtain high-
accuracy approximate solutions to physics problems that are not solvable by analytic means. No prior
programming knowledge will be assumed and the basics of one or more of the standard programming
languages C/C++, Fortran, Python will be included in the course instruction.

Course Materials

The material is presented in multiple ways: Projector, Whiteboard, Power Point presentations. Videos will
also be shown. Students are expected to take notes in class, save their work on a flash drive during each
class meeting. Students are responsible to catch up with the material if they miss lectures.

Required Textbook:
For C/C++: http://www.cplusplus.com/ (free of charge)

For Fortran: https://www.tutorialspoint.com/fortran/index.htm (free of charge)

Recommended Textbooks:

``Classical Fortran: Programming for Engineering and Scientific Applications'', 2nd Edition, by M. Kupferschmid,

``C Programming: A Modern Approach'', 2nd Edition, by K. N. King.

``C++ Primer'', 5th Edition, by Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo.

Technology requirements: Class time consists of both lectures and programming exercises. Students are encouraged—but not required—to bring a computer to each class. There are computer labs on the KSU campus. Students are expected to save copies of their programs and back them up to other media (such as a flash drive or external hard drive).

Learning Outcomes

C/C++/Fortran are a general-purpose, procedural computer programming languages that are especially suited to numeric computation and scientific computing. The main learning outcomes are listed below:

1) Students demonstrate knowledge of language syntax and the ability to structure code.

2) Students will be able to solve physics problems involving linear equations using numerical methods.

3) Students will learn basic numerical techniques to solve integral and differential equations in physics.

4) Students will be able to perform numerical integration and discuss the accuracy of the result for applications in physics.

Course Requirements and Assignments

Students are expected to attend all lectures, take all tests and exams, and complete all homework assignments.

Evaluation and Grading Policies

Three tests will be given during the semester. Grades will be determined according to student's performance on the three tests.

Homework: **10%**
Tests: **60% (3 tests, 20% each)**
Final Exam: **30%**
Grading Scale: **A: 90% - 100%; B: 80% - 89%; C: 70% - 79%; D: 60% - 69%; F: 0 - 60%.**

Tests and exams are graded by assigning points for:
- writing a code that compiles, runs, and generate the correct output.
- writing a code using an optimized syntax implementation.

D2L (Internet-based utility)
Course information, homework solutions and announcements will be available "D2L".
PHYS3500K course information system is accessible from http://d2l.kennesaw.edu/
To sign on, use your KSU Local Area Network (LAN) username and password.
Students are expected to check D2L for announcements at least once a day.

Course Policies (Important!)

1. Regular lecture and programming exercise attendance is essential for success in this class. If students must miss class, it is their responsibility to get notes/material from another student.
2. Be on time for the lecture.
3. Cellular telephones, pagers, and similar devices must be turned off or placed in silent mode during class. Use of cell phones should be restricted to emergencies.
4. The usage of any other external devices (other than the assigned computer) which can connect to the internet is strictly forbidden. That is considered cheating.
5. During lectures, students must avoid conversations and other disruptions that may distract other students from listening and learning. If students have a question or comment, they should direct it to the instructor.
6. Occasionally, it may be necessary for the instructor to make corrections or changes to the syllabus. Corrections or changes to the syllabus will be announced on the KSU D2L website and in class: students are expected to check D2L for announcements at least once or twice a day.

Homework Assignments

Homework will be assigned during the lectures. Solutions to problems will be discussed in class during lectures and will be posted on D2L. Students must hand in their homework through D2L. Repositories in the ``Assignments'' section in D2L will be created for each assignment.

Withdrawal, Last day of class, and Final Exam

- First day of classes: Tue, January 10, 2023.
- Last day to withdraw without academic penalty: Tue, March 14, 2023, at 11:45pm.
- Last day to withdraw with a WF: April 25, 2023.
- The last day of Classes: Mon, May 1, 2023.
- Final exam: Thu, May 4, 2023, 3:30pm - 5:30pm.

(These must be double checked again on the KSU office of registrar website.)

Department or College Policies

The university's withdrawal policy is explained at:

https://registrar.kennesaw.edu/academic-records/academic-standing-appeals/withdrawal-appeal.php

The Academic Standing Appeal policy is explained at:

https://registrar.kennesaw.edu/academic-records/academic-standing-appeals/index.php

Students are solely responsible for managing their enrollment status in a class.
Nonattendance does not constitute a withdrawal.

Make-up Exam policy

Make-up exams will not be given. If students know ahead of time that they have a conflict, they must let the instructor know. If students miss an exam because of an illness (student or a family member) or some other unforeseeable event, students must contact the instructor as soon as possible. They can e-mail the instructor or call the Physics Dep. Office at 470-570-4205. Students must provide documentation showing the reason for missing the exam. Final make-up exam is **ONLY** for documented and excused emergencies or for scheduling conflicts with other final exams.

Institutional Policies

Federal, BOR, & KSU Course Syllabus Policies:
http://curriculum.kennesaw.edu/resources/federal_bor_ksu_student_policies.php

Student Resources:
http://curriculum.kennesaw.edu/resources/ksu_student_resources_for_course_syllabus.php

Academic Integrity Statement:
http://scai.kennesaw.edu/codes.php

Students with Disabilities

Any student with a documented disability or medical condition needing academic accommodations of class-related activities or schedules must contact the instructor immediately. Written verification from the KSU Student Disability Services (http://sds.kennesaw.edu/) is required. No requirements exist those accommodations be made prior to completion of this approved University documentation. All discussions will remain confidential.

KSU Student Resources

This link contains information on help and resources available to students:
https://curriculum.kennesaw.edu/resources/ksu_student_resources_for_course_syllabus.php

Course Delivery

KSU may shift the method of course delivery at any time during the semester in compliance with University System of Georgia health and safety guidelines. In this case, alternate teaching modalities that may be adopted include hyflex, hybrid, synchronous online, or asynchronous online instruction.

Covid-19 Illness

If you are feeling ill, please stay home and contact your health professional. In addition, please email your instructor to say you are missing class due to illness. Signs of COVID-19 illness include, but are not limited to, the following:

· Cough
· Fever of 100.4 F or higher
· Runny nose or new sinus congestion
· Shortness of breath or difficulty breathing
· Chills
· Sore Throat
· New loss of taste and/or smell

COVID-19 vaccines are a critical tool in "Protecting the Nest." If you have not already, you are strongly encouraged to get vaccinated immediately to advance the health and safety of our campus community. As an enrolled KSU student, you are eligible to receive the vaccine on campus. Please call (470) 578-6644 to schedule your vaccination appointment or you may walk into one of our student health clinics.

For more information regarding COVID-19 (including testing, vaccines, extended illness procedures and accommodations), see KSU's official Covid-19 website.

Face Coverings

Based on guidance from the University System of Georgia (USG), all vaccinated and unvaccinated individuals are encouraged to wear a face covering while inside campus facilities. Unvaccinated individuals are also strongly encouraged to continue to socially distance while inside campus facilities, when possible.

Course (Tentative) Schedule

Week1
Introduction to Programming Languages

Week2
Syntax Basics

Week 3
Math, Strings, and Variables

TEST 1 Thursday Feb 2, 2023

Week 4
Basic Input and Output

Week5
Strings, Arrays, Functions

Week 6
Numerical techniques in Physics: Introduction/overview

Week 7
Linear Systems of Equations

Week 8
Non-Linear Equations and Systems

TEST 2: Thursday March 2, 2023

Week 9
Introduction to the Runge-Kutta method: Simple and nonlinear pendulum

Week 10
Numerical Integration

Week 11
Orthogonal Polynomials

Week 12
Simple Harmonic motion (Quantum Mechanics)
- Schrödinger equation: numerical solutions in presence of an elastic potential and of a generic potential.
- Numerov's algorithm

Week 13
Symbolic Calculus with Mathematica/Maple/MatLab:

- Matrices applied to 2-Dim Translations and Rotations
- Matrices applied to the Moment of Inertia Tensor

TEST 3: Thursday April 6, 2023

Week 14
Symbolic Calculus with Mathematica:
- Electric and Magnetic Fields
- Quantum Dynamics in 1 Dim.

Week 15
- 2-Dim Graphics: Mathematica, Gnuplot, ROOT
- Parametric plots

Final Exam: Thursday, May 4, 2023, 3:30pm - 5:30pm