ECE 448/548/592 Course Syllabus

Python in ECE

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INSTRUCTOR INFORMATION

Name	Office Phone	Mobile Phone	Email	Office Location
Rachana Gupta	919.515.6919		ragupta@ncsu.edu	Engineering Building II,2058

Office Hours

Instructor / TA Office Hours calendar link or by appointment via Email

Preferred Method of Communication

Moodle Forums, Emails, and assignment document comments.

Response Time

48 hours

COURSE INFORMATION

Course Website:
Course Credit Hours: 3

Meeting Time and Tool Used

Time: It will be published on Moodle course Page.

Prerequisites/Corequisites

Prerequisites:
- ECE 448: (ECE 209, ECE 211, ECE 212, ECE 220) or their equivalent. Restricted to ECE students.
- ECE 548: no prerequisites or restrictions.

General Education Program (GEP) Information

None

GEP Category Fulfilled

None

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GEP Corequisites

None

COURSE OVERVIEW

Catalog Description

The course provides broad exposure to Python programming to solve ECE-related problems. Course topics include basic mathematical operations, string /array operations, lists, functions, standard libraries in Python, files/folder operations, extracting and parsing data, data visualization techniques (graphs, tables, charts), and interfacing basic hardware such as sensors and microcontrollers for data collection and storage. The course will also have an introduction to the Python OpenCV library for computer vision, networking socket libraries, and machine learning libraries. Thus, the course is mainly designed for Electrical and Computer Engineering students at an advanced level of programming knowledge, not an introductory level of programming, and will differ from other programming and Python classes due to topics in embedded hardware interfacing, computer networking, and Computer Vision. Please see a detailed list of topics and learning outcomes to learn more about the course.

Structure

This course is in-person/hybrid and synchronous. It will be managed and administered via the course Moodle website. Course Lectures and other presentation materials will be posted on the Moodle site. Learning activities include attending lectures, watching short topic videos, narrated PowerPoint presentations, in-class coding workshops and discussions, discussion forums, homework, projects, and peer-based activities. Both ECE 448 and 548 will be managed via the same Moodle site, however, assignments for ECE 448 and 548 will be marked separately.

LEARNING OUTCOMES

Upon completing this course, students in both (ECE 448 / ECE 548) will be able to (**Only ECE 548 learning outcomes are marked separately from number 9 onwards**):

1. Use common Python data types and basic programming techniques in the command line and IDE mode. Document the Python code correctly using comments and invokable user code documentation.
2. Search through Python Library documentation to find the applicable library and built-in functions for writing code.
3. Perform data storage and access operations using text and CSV files, manage Linux/Windows/Mac OS folder structures, and manipulate directories.
4. Implement data extraction, data-parsing, and data interpretation using Python
5. Create static and dynamic multi-dimensional data visualizations using graphical representations (charts, graphs, tables.)
6. Implement basic image processing operations using Python OpenCV in-built library functions.
7. Demonstrate the usage of the Python networking socket library, multi-threading, and multi-client/server communication.

8. Demonstrate the usage of in-built micropython functions to interface hardware components (sensors, LEDs, buttons, microcontrollers) with a GPIO-based microprocessor system.
9. Interpret and analyze the data extracted from a file or a webpage and calculate data metrics such as average, distribution, and error.
10. Implement simple object detection based on object shape and color Python OpenCV.
11. Implement a data transfer functionality between two remote systems using the Python networking library.
12. Invoke, and verify a given Python code authored by someone else and its functionality. Determine and describe the functional flaws in the given code.
13. Create hardware-in-loop systems using multi-threading to interface multiple hardware components with a microprocessor-based system to achieve simultaneous and parallel functionality with a given timing precision.
14. Use Python tools and libraries to implement basic Machine Learning algorithms.

COURSE MATERIALS

Required Textbook and Software

NO textbook is required for this course. Software is optional for this course beyond what is provided by Engineering IT or freely available.

Optional Materials

Textbook for reference: "Python Cookbook" by David Beazley and Brian K. Jones.

TECHNOLOGY REQUIREMENTS

Hardware

NC State's Online and Distance Education provides technology requirements and recommendations for computer hardware. Students will be required to have access to a computer or a laptop.

Software

> [Moodle and Wolfware](#)
  ○ [Moodle Accessibility Statement](#)
  ○ [Moodle Privacy Policy](#)
  ○ [NC State Privacy Policy](#)
> [Adobe Reader](#) (for reading PDF files)
  ○ [Accessibility Statement](#)
  ○ [Adobe Privacy Policy](#)
> [Zoom](#):
  ○ [Zoom Accessibility Statement](#)
  ○ [Zoom Privacy Policy](#)
> [Panopto](#)

- ○ [Accessibility Features](#)
- ○ [Privacy Policy](#)
- > [G Suite](#)
  - ○ [Accessibility Statement](#)
  - ○ [Privacy Policy](#)
- > [Office 365](#)
  - ○ [Accessibility Statement](#)
  - ○ [Privacy Policy](#)
- > Headsets with microphone (optional for synchronous events)

Purchasing Parts and Materials

Students will be required to obtain or access some hardware components such as Microcontroller units and their accessories, breadboard, jumper wires, resistors, capacitors, LEDs, potentiometers, off-the-shelf sensors, etc. The exact Microcontroller unit, sensors, and accessories will be published before the class starts. ==ECE 448 and ECE 548 may have a different list of hardware components.==

Travel

Not applicable

Laboratory Facilities

ECE Makerspaces will be available when you need a lab workspace. The lab has secured access (by NCSU ID) and is governed by ECE Dept & NCSU University Environmental, Health, and Safety policies. All students are required to attend makerspace training to get access.

Minimum Computer and Digital Literacy Skills

- > Obtain regular access to a reliable internet connection
- > Proficient typing and word processing skills (MS Word, text editors, Google Docs)
- > Ability to use online communication tools, such as email (create, send, receive, reply, print, send/receive attachments), discussion boards (read, search, post, reply, follow threads), chats, and messengers.
- > Download and upload attachments
- > Knowledge of copy/paste and use of spell check
- > Use computer networks to locate and store files or data
- > Internet skills and ability to perform online research using various search engines and library databases. Visit [Distance Learning Services](#) at NC State Libraries for more information.
- > Properly cite information sources using MLA format

NETIQUETTE

Students should be aware that their behavior impacts others, even online. I hope we will all strive to develop a positive and supportive environment and be courteous to fellow students and your instructor. Due to the nature of the online environment, there are some things to remember when taking an online course and engaging with others.

Tips for Success:
- **>** **Do**: Follow the same standards of behavior that you subscribe to offline. Keep in mind that all online communication is documented and, therefore, permanent.
- **>** **Don't**: Flame others in discussion forums. Flaming is responding in a highly critical, sarcastic, or ridiculing manner – especially if done on a personal level. Remember that these discussions are meant for constructive exchanges and learning!
- **>** **Do**: Ensure you are responding to forums by the due date to leave time for peers to comment on your response.
- **>** **Don't**: Go for long periods without communicating with your instructors or classmates. It is important to stay a part of the online community!
- **>** **Do**: Remember to read over your posts before selecting "Submit."
- **>** **Don't**: Use slang, poor grammar, and other informal language in discussion forums or email messages to instructors or classmates.

GRADING

Grading Policy

The grade for this course will be composed of several individual homework and projects. A detailed description of each of the above categories is below. Grading differences between ECE 448 and 548 are highlighted

Homework Assignments 60%
There will be a total of 4 to 6 programming homework assignments. All homework will have equal grade weightage. All Homework will be programming assignments. Several homework assignments will have additional coding modules for ECE 548 students that support ECE 548 learning outcomes 9 to 13. For ECE 548 students, a number of homework assignments will also be required to be peer-graded. A detailed rubric for peer grading will be provided, and a 50% homework grade will be associated with the quality of peer grading for learning outcome 12.

Midterm Project: 20%:
There will be one Midterm project for this class. Creating a complete system based on the given functional requirements list will be a programming assignment. Midterm projects for ECE 448 and ECE 548 will differ in difficulty levels, expected outcomes, and coding complexity. Separate project descriptions and respective rubrics will be provided for both ECE 448 and 548 midterms. ECE 548 midterms will additionally cover learning outcomes 9 to 14 with a special emphasis on 9 and 14.

Final Project: 20%:
There will be one final project for this class. The project will be a programming assignment to create a complete hardware-in-loop system based on the given functional requirements list. Final Projects for ECE 448 and ECE 548 will differ in difficulty levels, expected outcomes, and coding complexity. Separate project descriptions and respective rubrics will be provided for both ECE 448 and 548 final projects. ECE 548 projects will include requirements that evaluate learning outcomes 9 to 14 with special emphasis on 11 and 13.

Bonus Points

There will be an opportunity to score bonus points as part of extra programming features in homework and projects for both ECE 448 and 548.

Grading Scale

This course uses this grading scale (grades are NOT rounded; 97.99 is an A):

Low	Letter	High
98 ≤	A+	≤ 100
94 ≤	A	< 98
91 ≤	A-	< 94
88 ≤	B+	< 91
85 ≤	B	< 88
82 ≤	B-	< 85
79 ≤	C+	< 82
76 ≤	C	< 79
73 ≤	C-	< 76
70 ≤	D+	< 73
67 ≤	D	< 70
64 ≤	D-	< 67
0 ≤	F	< 64

COURSE SCHEDULE

Tentative course schedule (ECE 448):
https://docs.google.com/spreadsheets/d/1WpTZYudYJ_A0V8Cz7KA-ycdBzbmCbs-ztJ7IRXaYIMk/edit#gid=1142965291
Tentative course schedule (ECE 548): Please note that ECE 548 currently is offered only via EOL
https://docs.google.com/spreadsheets/d/1MuT1lyF0rWRL2_QPD-Z08GhL48UcOrp3huJm3D_ddbU/edit?gid=290553810#gid=290553810
Please note: course schedule is subject to change.

COURSE POLICIES

Late Assignments

Late assignments without the instructor's approval will be accepted, with 10 points taken off for every day submitted late. Assignments submitted later than one week past the original due date will NOT be accepted. Students may contact the instructor within 48 hours of the deadline to seek approval for late submission without penalty with a reasonable explanation.

Incomplete Grades

Attendance and Participation

Attendance in the class is not required but highly recommended. The class will be taught in a hybrid format. Students will be required to watch short programming tutorial videos from the instructor as pre-class preparation. In-person lectures will hold code reviews, coding exercises, debugging, and question/answer sessions.

NC State's Attendance Policy: https://policies.ncsu.edu/regulation/reg-02-20-03-attendance-regulations/ and the Withdrawl Process: https://studentservices.ncsu.edu/your-classes/withdrawal/process/

UNIVERSITY POLICIES

Academic Integrity and Honesty

Students are responsible for reviewing the NC State University Policies, Rules, and Regulations (PRRs) which pertain to their course rights and responsibilities, including those referenced both below and above in this syllabus:
> Equal Opportunity and Non-Discrimination Policy Statement
https://policies.ncsu.edu/policy/pol-04-25-05 with additional references at
https://oied.ncsu.edu/divweb/policies/
> Code of Student Conduct https://policies.ncsu.edu/policy/pol-11-35-01."
Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02).
> Grades and Grade Point Average
> Credit-Only Courses
> Audits

Since Python is an open-source programming language with documentation, coding resources and libraries available freely online, this course includes some self-directed learning and seeking of information that may come from various sources such as open-source Python documentation, online Python tutorials, online Python libraries, examples, and more. It is acceptable to pull such information for your assignments and homework from external sources if
1) The source is referenced in your code documentation,
2) It is consistent with all copyright laws,

3) It is consistent with the license agreement if any associated with the material used,
4) The instructor is aware of the material source and agrees with the use,
5) The source is not as a result of a quid pro quo agreement that has not been disclosed. (E.g. you may not pay somebody to write code for you)

In any case, copying the entire or a large portion of assignment code from an external source is prohibited and will result in reporting to the student conduct office.

For use in courses where student information may be accessible to persons beyond the instructor and students in the course:
This course may involve electronic sharing or posting of personally identifiable student work or other information with persons not taking or administering the course. Students will be asked to sign a consent form allowing disclosure of their personally identifiable work. No student must sign the consent form as a condition of taking the course. If a student does not want to sign the consent form, he or she has the right to ask the instructor for an alternative, private means of completing the coursework.

Students with Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. To take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, Campus Box 7509, 919-515-7653 . For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01)

Trans-Inclusive Statement

In an effort to affirm and respect the identities of transgender students in the classroom and beyond, please contact us if you wish to be referred to using a name and/or pronoun other than what is listed in the student directory.

Basic Needs Security

Any student who faces challenges securing their food or housing or has other severe adverse experiences and believes this may affect their performance in the course is encouraged to notify the professor if you are comfortable in doing so. Alternatively, you can contact the Division of Academic and Student Affairs to learn more about the Pack Essentials program https://dasa.ncsu.edu/pack-essentials/

Mental Health

As a student, you may experience a range of personal issues that can impede learning, such as strained relationships, increased anxiety, alcohol/drug concerns, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may impact your ability to participate in daily activities. It is very important that you have a support system and that you ask for help when you are struggling. The Counseling Center at NC State offers confidential mental health services for full-time NC State students, including same-day emergency services. Please visit https://counseling.dasa.ncsu.edu/ to get connected.
https://counseling.dasa.ncsu.edu/
https://counseling.dasa.ncsu.edu/workshops-and-events/suicide-prevention/resources/
National Suicide Hotline: 1.800.273.TALK (8255) (24 hours/7 days a week)

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Hopeline: 919.231.4525 or 1.877.235.4525 (24/7 confidential local hotline)

COURSE EVALUATIONS

ClassEval is the end-of-semester survey for students to evaluate the instruction of all university classes. The current survey is administered online and includes 12 closed-ended and 3 open-ended questions. Deans, department heads, and instructors may add a limited number of their own questions to these 15 common-core questions.

Each semester students' responses are compiled into a ClassEval report for every instructor and class. Instructors use the evaluations to improve instruction and include them in their promotion and tenure dossiers, while department heads use them in annual reviews. The reports are included in instructors' personnel files and are considered confidential.

Online class evaluations will be available for students to complete during the last two weeks of the semester for full-semester courses and the last week of shorter sessions. Students will receive an email directing them to a website to complete class evaluations. These become unavailable at 8 am on the first day of finals.

> Contact ClassEval Help Desk: classeval@ncsu.edu
> ClassEval website
> More information about ClassEval

SYLLABUS MODIFICATION STATEMENT

Our syllabus represents a flexible agreement. It outlines the topics we will cover and the order we will cover them in. Dates for assignments represent the earliest possible time they would be due. The pace of the class depends on student mastery and interests. Thus minor changes in the syllabus can occur if we need to slow down or speed up the pace of instruction.