

# ROCHESTER INSTITUTE OF TECHNOLOGY

## COLLEGE OF SCIENCE CHESTER F. CARLSON CENTER FOR IMAGING SCIENCE

### COS-IMGS-517\* Object-Oriented Software Design in Python

#### 1.0 Administrative information

When pasting information on this form from other documents or from online sources, paste only the text (without the original formatting) and use Ctrl V, then Ctrl, then T

#### a) Proposal and approval

Course proposed by	Carl Salvaggio
Effective term	2255
Required approval	Approval granted date
Academic unit curriculum committee	
Department chair/director/head	
College curriculum committee	
College dean	

#### b) This outline is for a:

<input checked="" type="checkbox"/>	New course
<input type="checkbox"/>	Revised course
<input type="checkbox"/>	Deactivated course

If revised course, check all that have changed

<input type="checkbox"/>	Course title	<input type="checkbox"/>	Prerequisites	<input type="checkbox"/>	Co-listed
<input type="checkbox"/>	Course number	<input type="checkbox"/>	Mode of delivery	<input type="checkbox"/>	Cross-listed
<input type="checkbox"/>	Credit hour	<input type="checkbox"/>	Course description		
<input type="checkbox"/>	Contact hour	<input type="checkbox"/>	Special designation		
<input type="checkbox"/>	Other (explain briefly):				

#### c) Special designations for undergraduate courses (if appropriate)

The appropriate Appendix (A, B and/or C) must be completed for each designation requested. Checking this box indicates you are SEEKING approval from the appropriate governing committee, not that the course has been approved. The Registrar will not designate the course until the appropriate committee grants approval. **IF YOU ARE NOT SEEKING SPECIAL COURSE DESIGNATION, DELETE THE ATTACHED APPENDICES BEFORE PROCEEDING WITH REVIEW AND APPROVAL PROCESSES.**

Check	Optional Designations	Approval date (by GEC, IWC or Honors)***
<input type="checkbox"/>	General Education	
<input type="checkbox"/>	Writing Intensive	
<input type="checkbox"/>	Honors	

#### d) Additional course information (check all that apply)

<input type="checkbox"/>	Repeatable for credit   How many times:
<input type="checkbox"/>	Allow multiple enrollments in a term
<input type="checkbox"/>	Required course   For which programs:
<input checked="" type="checkbox"/>	Program elective course   For which programs: Imaging Science, Motion Picture Science

\*; \*\* and \*\*\* Please see Endnotes section of this document

**e) Identify how this course will meet New York State education requirements for contact hours:**

<input type="checkbox"/>	Final exam or other education experience scheduled during final exam period
<input checked="" type="checkbox"/>	Alternative educational experience during semester above and beyond standard scheduled hours.

**If alternative is chosen, please describe:** (NOTE: Per Policy D11.0 any alternative education experience that replaces a scheduled experience during a final exam must be included in the course syllabus and approved by the department chair)

As a 1-credit, 5-week class, no final exam will be given. In its place, each student will be asked to perform an independent programming project of their choice in order to demonstrate their proficiency in the design of an object-oriented programming task.

**f) Other relevant scheduling information**

(e.g., special classroom, studio, or lab needs, special scheduling, media requirements)

n/a

## 2.0 Course information

**a) Catalog listing** (click [HERE](#) for credit hour assignment guidance)

Long course title (max 100 characters)	Object-Oriented Software Design in Python
Transcript title (max 30 characters)	OO Software Design in Python
Credit hours	1
Prerequisite(s)**	IMGS-180 or equivalent
Co-requisite(s)	none

**b) Terms(s) offered** (check at least one)

<input checked="" type="checkbox"/>	Fall
<input checked="" type="checkbox"/>	Spring
<input type="checkbox"/>	Summer
<input type="checkbox"/>	Other If "Other" is checked, explain:
<input checked="" type="checkbox"/>	Offered biennially

**c) Course Delivery Structure (components) and associated contact hours**

(click [HERE](#) for credit hour assignment guidance)

	Contact hours per week	Maximum students/section
Lecture	3	30
Lab		
Lecture/Lab		
Seminar		
Studio		
Critique		
Recitation		

Other (please specify, i.e. Clinical, Independent Study, Project, Research, Thesis etc.)		
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d) Anticipated Course Delivery Mode(s) (*check all that apply*):

<input checked="" type="checkbox"/>	In-person
<input checked="" type="checkbox"/>	Online
<input type="checkbox"/>	Blended

### 3.0 Course description *(as it will appear in the bulletin)*

This accelerated, project-based course introduces object-oriented software design using Python, intended for students with prior experience in object-oriented programming in another language (e.g., C++, Java, C#, JavaScript, Ruby, PHP, or Swift). The course emphasizes problems and Python modules relevant to imaging applications, which serve as the foundation for examples and projects. Students will revisit fundamental programming constructs—including object types, control flow, and iteration—while exploring idiomatic Python practices and features unique to the language. Modern Python topics such as structural pattern matching and type hinting will be introduced. The course will also cover formal class design in Python and the development of reusable, deployable modules. The course culminates in an independent capstone project to demonstrate object-oriented proficiency and module development.

### 4.0 Topics *(should be in an enumerated list or outline format)*

1. Python Basics and Object-Oriented Design
  - 1.1. Python syntax
    - 1.1.1. Object types
    - 1.1.2. Branching
    - 1.1.3. Repetition
  - 1.2. Methods and Method overriding
  - 1.3. Pythonic constructs (list comprehensions, unpacking, with statements)
  - 1.4. Intro to dataclasses
2. Class Design
  - 2.1. Class definition, methods, `__init__`, `__repr__`, and `__str__`
  - 2.2. Class hierarchies and inheritance
  - 2.3. `super()`
3. Modules, Packaging and Typing
  - 3.1. Organizing code into modules and packages
  - 3.2. Creating `pyproject.toml` (via Poetry or setuptools)
  - 3.3. Type hinting, typing, Self, and Literal
  - 3.4. Introduction to testing with `pytest`
4. Advanced Constructs and Debugging
  - 4.1. Structural pattern matching (`match/case`)
  - 4.2. `Enum`, `NamedTuple`, `TypedDict`
  - 4.3. Debugging with `pdb` or `breakpoint()`
  - 4.4. Using `black`, `ruff`, and `mypy` for code quality
5. Final Project Completion and Presentation
  - 5.1. Course capstone project: Build a reusable image-processing module/class hierarchy
  - 5.2. Documenting code and packaging
  - 5.3. Final presentations and live code walkthroughs

## 5.0 Possible resources (should be in an enumerated list or outline format)

1. Python 3.11+ (required)
2. pytest – for unit testing
3. black, ruff, mypy – for code quality enforcement
4. Pillow or OpenCV – optional for imaging-based projects
5. Git and GitHub – for version control and project submission

## 6.0 Course-level student learning outcomes and associated assessment methods

Include as many course-specific outcomes as appropriate, one outcome and associated assessment method(s) per row. Click [HERE](#) for guidance on developing course learning outcomes and associated assessment techniques.

Course student learning outcome	Assessment method
Apply object-oriented principles to design and implement Python class structures	Weekly assignments and capstone project
Construct and package reusable Python modules for imaging applications	Capstone project (code quality, structure, documentation)
Evaluate and improve Python code using type hints, unit testing, and automated code quality tools	Weekly assignments and capstone project

## 7.0 Program goals or student learning outcomes supported by this course (if applicable, as an enumerated list)

1. Develop the programming and visualization skills necessary using Python to solve problems in optics, color science, radiometry, image processing, computer vision, and all imaging-related mathematics
2. Develop proficiency in the modern Python programming language that is widely used in the imaging field (image processing, computer vision, remote sensing, color science)
3. Develop object-oriented design skills needed to develop and deploy reusable imaging-related modules

## 8.0 Colleges may add additional information here if necessary

(e.g., information required by accrediting bodies)

Course Pitch: Object-Oriented Software Design in Python (IMGS-517)

*Accelerated. Applied. Python for Imaging.*

This 1-credit, 5-week project-based course is your fast track to modern Python object-oriented programming—designed specifically for students with experience in languages like C++, Java, or C#. Through imaging-based examples and hands-on projects, you'll master Pythonic class design, modular development, and modern language features like structural pattern matching and type hinting. You'll also learn how to test, debug, and package your code using the same tools used by professionals.

*By the end, you'll not only write clean, modern Python—you'll build a reusable module you can actually use.*

*Ideal for Imaging Science and Motion Picture Science students looking to add Python to their programming toolkit.*

## **Endnotes:**

The file that contains this form should be named using the following convention:

**\* College-Alpha-Number-Name:**

- College is the college offering the course
- Alpha is the department or discipline code (PSYC, BIOL, etc.)
- Number is the course number
- Name is the title of the course no spaces, each word beginning with an upper case letter

\* Note: the suffix '-X' is used for cross-listed courses only and, if appropriate, must appear in this place on the form, but only in this place. The '-X' must be included in the course outline forms for both courses in such cases.

Cross listed courses are listed at both undergraduate and graduate level (typically 500/600).

Co-listed courses appear in more than one department.

\*\* **Prerequisites:** These may be: major, year within major, and/or completion of specific courses. Note that these are system-enforceable prerequisites, and a student will not be able to register for the course without meeting this exact prerequisite course or an equivalent that can be detected by the system. To list course prerequisites, use Course Alpha-Number (as in ISTE-101). If more general skill-based prerequisites are needed, they should be listed at the end of section 2, such as, "Note: One year of programming is helpful" or "Note: One semester of descriptive Statistics is recommended"

\*\*\* **Optional course designation; approval granted date:** This is the date the optional course designation curriculum committee approves a course for the requested optional course designation. The chair of the appropriate optional course designation curriculum committee is responsible to fill in this date.

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# APPENDIX A: GENERAL EDUCATION

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**Preliminary Notes:** This appendix is meant to highlight those facets of a course that are directly relevant to its General Education status, and if applicable, to provide course authors with an opportunity to elaborate on aspects of the course that locate it in one or more of the Perspective categories. The course description, course goals, and course learning outcomes (sections 2, 3, and 4 of the course outline) should clearly reflect the content of this appendix.

## I. Describe how this course fits the definition of general education:

According to the NYSED definition of general education, “the liberal arts and sciences comprise the disciplines of the humanities, natural sciences and mathematics, and social sciences.” The NYSED Policy Statement stipulates that “the required liberal arts core shall not be directed toward specific occupational or professional objectives.” Decisions about the general education status of RIT courses are guided by this definition and the examples of categories provided at the NYSED website ([click HERE](#)). RIT recognizes that a general education course might not fit neatly into any one of these categories. Course authors from all areas are encouraged to read not only the NYSED website, but also the mission statement at RIT’s General Education website ([click HERE](#)).

## II. General Education Essential Outcomes:

The Academic Senate approved the following proposal at the meeting of 16 April, 2015.

*Communication and critical thinking are essential to the general education of every student at RIT. Going forward, every course designated as general education by GEC will provide learning experiences designed to achieve at least one student learning outcome from each of these domains (Communication and Critical Thinking).*

The approved student learning outcomes are listed below.

### a. Communication

**a.1** Check one of the following **Communication** student learning outcomes for which: 1) the course content aligns closely with and, 2) the course includes at least one opportunity for students to demonstrate achievement of the selected outcome. If selecting more than one outcome, please bear in mind that the course will be included in RIT’s General Education assessment initiatives for all outcomes selected.

<input type="checkbox"/>	Express oneself effectively in common college-level written forms using standard American English
<input type="checkbox"/>	Revise and improve written products
<input type="checkbox"/>	Express oneself effectively in presentations, either in American English or American Sign language
<input type="checkbox"/>	Demonstrate comprehension of information and ideas accessed through reading

**a.2** In the space below, explain which aspects of this course lend themselves to the Communication outcome(s) indicated above, and how student achievement will be assessed.

**b. Critical Thinking**

**b.1** Check one of the following **Critical Thinking** student learning outcomes for which: 1) the course content aligns closely with and, 2) the course includes at least one opportunity for students to demonstrate achievement of the selected outcome. If selecting more than one outcome, please bear in mind that the course will be included in RIT's General Education assessment initiatives for all outcomes selected.

<input type="checkbox"/>	Use relevant evidence gathered through accepted scholarly methods and properly acknowledge sources of information
<input type="checkbox"/>	Analyze or construct arguments considering their premises, assumptions, contexts, and conclusions, and anticipating counterarguments
<input type="checkbox"/>	Reach sound conclusions based on logical analysis of evidence
<input type="checkbox"/>	Demonstrate creative and/or innovative approaches to assignments or projects

**b.2** In the space below, explain which aspects of this course lend themselves to the Critical Thinking outcome(s) indicated above, and how student achievement will be assessed.

**III. Perspectives**

Indicate which Perspectives (if any) this course is intended to fulfill.

*Keep in mind that perspectives courses are meant to be introductory in nature. [Click HERE](#) for descriptions of the General Education Perspectives and their associated student learning outcomes.*

The course will be included in RIT's General Education assessment initiatives for all approved Perspectives.

**Table A.1: Student Learning Outcomes**

(Check)	GE Perspective	Date Requested	Student Learning Outcome	Date Approved
<input type="checkbox"/>	Artistic		Interpret and evaluate artistic expression considering the cultural context in which it was created	
<input type="checkbox"/>	Ethical		Identify contemporary ethical questions and relevant positions	
<input type="checkbox"/>	Global		Examine connections among the world's populations	
<input type="checkbox"/>	Social		Analyze similarities and differences in human experiences and consequent perspectives	
<input type="checkbox"/>	Natural Science Inquiry		Demonstrate knowledge of basic principles and concepts of one of the natural sciences <b>AND</b> Apply methods of scientific inquiry and problem solving to contemporary issues or scientific questions	
<input type="checkbox"/>	Scientific Principles		Select applicable outcome(s): <input type="checkbox"/> Demonstrate knowledge of basic principles and concepts of one of the natural sciences <b>OR</b> <input type="checkbox"/> Apply methods of scientific inquiry and problem solving to contemporary issues or scientific questions	
<input type="checkbox"/>	Mathematical		Comprehend and evaluate mathematical or statistical information <b>AND</b> Perform college-level mathematical operations or apply statistical techniques	

**a. Explanation:** In the space below, explain how this course supports the student learning outcomes indicated above.

**b. Assessment:** In the space below, explain how student achievement in the specified student learning outcomes will be assessed.

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# APPENDIX B: WRITING INTENSIVE

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## Preliminary Notes:

*The Course Outline itself must include a student learning outcome related to writing (6.0) and a topic related to the discussion and teaching of writing (4.0) to illustrate that the teaching and learning of writing is part of the design of the course. Course outlines that do not already explicitly and clearly include a writing related-outcome in Section 6 and a writing-related teaching topic in Section 4 will need to be revised for approval as a writing intensive course.*

This appendix is meant to highlight the facets of a course directly relevant to Writing Intensive (WI) status. The information in the appendix should clearly reflect and elaborate on the writing-related content expressed in sections 4.0 (Topics) and 6.0 (Course-Level Student Learning Outcomes) in the Course Outline above.

Writing Intensive courses must go through Department and College Curriculum Committees before they are submitted to the IWC.

Information provided here will also be used to identify appropriate courses for inclusion in RIT's Learning Outcomes assessment cycle.

## I. Course Category: *Check at least one*

First Year Writing	
General Education (WI-GE)	
Program (WI-PR)	

A course can be both WI-GE and WI-PR.

## II. Nature of the Course:

Criteria that define Writing Intensive courses at RIT can be found at the Institute Writing Committee web site ([click HERE](#)).

### a. Writing-Related Course Learning Outcomes.

List the Course Learning Outcomes related to writing (copied from section 6.0).

### b. Writing-Related Course Discussion Topics

Class topics listed in Section 4.0 of the Course Outline must include instruction on specific writing strategies. List the writing-related topics (copied from section 4.0) and briefly describe the writing strategies discussed.

In-class instruction of writing strategies can include discussions of revision strategies, genre conventions, copyediting, concision, and clarity. For more information, ([click HERE](#)).

### **c. Informal and Formal Writing Assignments**

1. 1. Informal writing (commonly described as “writing to learn”) is distributed throughout the course as appropriate to its learning outcomes. Use the space below to describe briefly the informal writing assignments in the course and the distribution of those activities throughout the course.  
Informal writing includes activities such as free/quick-writing, lab notebooks, response/reading journals, and online discussions. For other examples, ([click HERE](#)).
2. Formal writing assignments (commonly described as “writing in the discipline”) engage students in the work of the discipline/s represented by the course. Use the space below to describe briefly the formal writing assignments in the course, and what students will learn by completing the assignment(s).  
Formal writing assignments include genres such as a research/project report, case study, and clinical observation. For more examples, ([click HERE](#)).

### **d. Revision Policy**

Students must receive feedback from instructors and have an opportunity to incorporate that feedback into a revision of the written work. Use the space below to describe briefly the kinds of feedback students are provided, and what opportunities students have to improve their writing based on that feedback.

Feedback can be given in many forms, including margin comments, summative end-comments, a 1-on-1 conference, scoring guides, and rubrics. For more information, ([click HERE](#)).

### **e. Writing Portion of Grade**

At least 20% of the overall course grade must be based on writing assignments that demonstrate the student’s ability to display writing competency in the revision and editing process of formal writing. What percentage of the overall course grade is based on formal writing?

	<20%
	20% or more

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# APPENDIX C: HONORS

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**Preliminary Notes:**

- Honors courses typically have a capacity of at most 20 students.
- Honors courses at RIT are designed to provide broader, deeper, or richer learning than standard courses, and to provide an experience of course content that is qualitatively different than the typical, standard course in a discipline.

**I. Curricular Position:**

Indicate the curricular role of the course by checking the appropriate box below.

(Check)	Course Type	Brief Description
<input type="checkbox"/>	First Year Seminar	<ul style="list-style-type: none"><li>• Must be a General Education course, but cannot be a perspective course</li><li>• Must run in the fall semester</li><li>• Must include curriculum of the university's standard first-year seminar</li></ul>
<input type="checkbox"/>	Elective	<ul style="list-style-type: none"><li>• Can be an entirely new course</li><li>• If this is an honors version of an existing course, it must have augmented learning outcomes, or the qualitative experience it provides to students</li></ul>
<input type="checkbox"/>	Research Seminar	<ul style="list-style-type: none"><li>• A course outline of this nature is typically a template that faculty can customize to their interests and expertise</li></ul>
<input type="checkbox"/>	Senior Seminar	<ul style="list-style-type: none"><li>• This 1-credit capstone experience helps students to synthesize and critically reflect upon their course work, service learning, and research.</li></ul>

**II. Learning Outcomes:**

Honors courses include at least one communication-related learning outcome and at least one learning outcome in critical thinking, typically located in the upper levels of achievement (often characterized as *analysis, evaluation, or synthesis*).

**a. Communication Outcome(s)**

In the space below, identify at least one learning outcome from the main body of this outline that is related to communication, explain which aspects of the course lend themselves to it, and describe how student achievement will be assessed.

**b. Critical Thinking Outcome(s)**

In the space below, identify at least one learning outcome from the main body of this course outline that is related to critical thinking, explain which aspects of the course lend themselves to it, and describe how student achievement will be assessed.

**III. Honors Experience:**

Ideally, an honors course is thoughtfully designed as a rich experience in which students are guided through sophisticated analysis of topics, and led to greater understanding of themselves and the world. Although *academic content and student experience* are often intertwined, this document treats them separately.

**a. Academic Content**

Honors courses provide broader, deeper, or more refined learning than standard courses. The list below includes representative examples of ways in which this might be achieved.

- Students address topics with a sophistication beyond what is found in standard courses.
- Students are taught to recognize and explain important nuances.
- Students investigate related conceptual frameworks and the context in which change happened.
- Students are confronted with ambiguity, and equipped to respond in meaningful ways.
- Students are led to understand phenomena at multiple scales or across time.
- Students make connections across subjects or disciplines.

Use the space below to provide a concise but thorough description of the ways that this course provides broader, deeper, or more refined learning than standard courses in this discipline, at this level.

**b. Student Experience**

Honors courses provide an experience of course content that is qualitatively different than standard courses. The list below includes representative examples of ways in which this might be achieved.

- Learning is accomplished through experience and critical reflection, rather than lecture.
- Class time is largely spent in seminar-style discussions of original source material.
- Learning is accomplished principally via guided-discovery experiences, or inquiry-based methods.
- This is a team-taught course that helps students explore the ways in which different disciplines or cultures approach the same problem or phenomenon.
- This course design promotes independent inquiry or creativity beyond standard courses.

Use the space below to provide a concise but thorough description of the ways that this course provides a student experience that is different than standard courses in this discipline, at this level.