Appendix A: Syllabi 2017-2018

Computer Science Program

Revised by Dr. Hamam, Dr. Akbas, and Dr. Al-Nashif

On May 31, 2018

Contents

1 Freshman, Fall Semester . . . 1
- 1.1 ENC 1101 - English Composition 1: Expository and Argumentative Writing . . . 2
- 1.2 MAC 2311 - Analytic Geometry and Calculus 1 . . . 4
- 1.3 IDS 1380 - Introduction to STEM . . . 6
- 1.4 BSC 1010 - Biology 1 . . . 8
- 1.5 BSC 1010L - Biology 1 Laboratory . . . 10
- 1.6 CHM 2045 - Chemistry 1 . . . 12
- 1.7 CHM 2045L - Chemistry 1 Laboratory . . . 14
- 1.8 SLS 1106 - First Year Experience . . . 16

2 Freshman, Spring Semester . . . 18
- 2.1 COP 2271C - Introduction to Computation and Programming . . . 19
- 2.2 ENC 2210 - Technical Writing . . . 21
- 2.3 MAC 2312 - Analytic Geometry and Calculus 2 . . . 23
- 2.4 PHY 2048 - Physics 1 . . . 25
- 2.5 PHY 2048L - Physics 1 Laboratory . . . 27
- 2.6 EGN 1007C - Concepts and Methods for Engineering and Computer Science . . . 29

3 Sophomore, Fall Semester . . . 31
- 3.1 PHY 2049 - Physics 2 . . . 32
- 3.2 PHY 2049L - Physics 2 Laboratory . . . 34
- 3.3 MAD 2104 - Discrete Mathematics . . . 36
- 3.4 COP 2272C - Computer Programming 1 . . . 38
- 3.5 MAS 3114 - Computational Linear Algebra . . . 40
- 3.6 COP 3353C - Introduction to Unix . . . 42

4 Sophomore, Spring Semester . . . 44
- 4.1 STA 2023 - Statistics 1 . . . 45
- 4.2 DIG 2520 - Digital Media Production . . . 46
- 4.3 COP 3330C - Computer Programming 2 . . . 48
- 4.4 COP 3710 - Database 1 . . . 50
- 4.5 CDA 2108 - Introduction to Computer Systems . . . 52
- 4.6 EEL 3702C - Digital Logic Design . . . 54

5 Junior, Fall Semester . . . 56
- 5.1 CNT 3004C - Introduction to Computer Networks . . . 57
- 5.2 COP 4415 - Data Structures . . . 59
- 5.3 COP 4531 - Algorithm Design & Analysis . . . 61
- 5.4 IDS 4941 - Professional Experience Internship . . . 63
- 5.5 MAP 2302 - Differential Equations . . . 64
- 5.6 MAD 3401 - Numerical Analysis . . . 66

6 Junior, Spring Semester . . . 68
6.1 CEN 4010 - Software Engineering . . . 69
6.2 CAP 4630 - Artificial Intelligence . . . 71
6.3 EEL 4768C - Computer Architecture and Organization . . . 73
7 Senior, Fall Semester . . . 75
7.1 COP 4610 - Operating Systems Concepts . . . 76
7.2 COP 4934C - Senior Design 1 . . . 78
8 Senior, Spring Semester . . . 80
8.1 IDS 2144 - Legal, Ethical, and Management Issues in Technology . . . 81
8.2 COP 4020 - Programming Languages . . . 83
8.3 COP 4935C - Senior Design 2 . . . 85
9 Cyber Gaming Concentration . . . 87
9.1 CAP 4034 - Computer Animation . . . 88
9.2 CAP 4052 - Game Design and Development 1 . . . 90
9.3 CAP 4056 - Game Design and Development 2 . . . 92
9.4 CAP 4730 - Computer Graphics . . . 94
10 Information Assurance & Cyber-Security Concentration . . . 96
10.1 CIS 4203 - Digital Forensics . . . 97
10.2 CIS 4204 - Ethical Hacking . . . 99
10.3 CIS 4362 - Applied Cryptography . . . 101
10.4 CIS 4367 - Computer Security . . . 103
11 Software Engineering . . . 105
11.1 CEN 4073 - Software Requirements Engineering . . . 106
11.2 CEN 4065 - Software Design and Architecture . . . 108
11.3 CEN 4070 - Software Verification and Quality Assurance . . . 110
11.4 CEN 4724 - User Interface and User Experience . . . 112
12 Computer Science Electives . . . 114
12.1 CAP 4122 - Virtual Reality . . . 115
12.2 CAP 4410 - Computer Vision . . . 117
12.3 CAP 4612 - Machine Learning . . . 119
12.4 CAP 4830 - Modeling and Simulation . . . 121
12.5 CEN 4088 - Software Security Testing . . . 123
12.6 CEN 4213 - Embedded Systems Programming . . . 125
12.7 CEN 4721 - Human Computer Interaction . . . 127
12.8 CIS 4369 - Web Application Security . . . 129
12.9 CNT 4409 - Network Security . . . 131
12.10 CNT 4526 - Wireless and Mobile Networking . . . 133
12.11 COP 2034C - Introduction to Programming Using Python . . . 135
12.12 COP 3530 - Data Structures & Algorithms . . . 137
12.13 COP 3834C - Web Application Development . . . 139
12.14 COP 4520 - Introduction to Parallel and Distributed Computing . . . 141
12.15 COP 4620 - Compilers and Interpreters . . . 143
12.16 COP 4656 - Mobile Device Applications . . . 145
12.17 COP 4930 - Special Topics . . . 147
12.18 EEL 4664 - Autonomous Systems and Robotics . . . 149

13 Arts and Humanities 151
13.1 ARH 2000 - Art Appreciation 152
13.2 PHI 2010 - Introduction to Philosophy 154
14 Social Sciences 156
14.1 AMH 2010 - American History to 1877 157
14.2 AMH 2020 - The United States Since 1877 159
14.3 AMH 2930 - American Popular Culture 161
14.4 PSY 2012 - General Psychology 163
14.5 ECO 2013 - Principles of Macroeconomics 165
14.6 ECO 2023 - Principles of Microeconomics 167

Freshman, Fall Semester

ENC 1101 - English Composition 1: Expository and Argumentative Writing

- Course Description:

This course focuses on the principal elements of writing clearly, efficiently, and effectively. Logical arguments, building research skills, and developing critical thinking through reading, writing, and discussion are also presented. This course meets communication/writing-intensive requirements.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. C. Wylie Lenz

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Lester Faigley and Jack Selzer, Good Reasons: Researching and Writing Effective Arguments, 6th ed., ISBN 978-0-321-90674-8

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Apply critical reading	f
Write to the specifications of a writing assignment, including subject, rhetorical situation, method(s) of organization, and length	f
Form a research question, develop a thesis, locate and select credible sources relevant to the thesis, and write an essay of the assigned length that supports the thesis statement	f
Evaluate a text using specific criteria	f

- Topics:

1. Argumentation
2. Narrative arguments
3. Rhetorical analysis
4. Essay structure
5. Thesis statements
6. Definition arguments
7. Proposal arguments
8. Academic research and documentation
9. Presentations

MAC 2311 - Analytic Geometry and Calculus 1

- Course Description:

This course is an introduction to analytic geometry; limits; continuity; differentiation of algebraic, trigonometric, exponential and logarithmic functions; applications of the derivative; inverse trigonometric functions; differentials; introduction to integration; and the fundamental theorem of calculus.

- Credits: 4 cr
- Lecture: 4 cr
- Lab: 0 cr

- Instructor(s):

- Dean Burbank

- Prerequisite(s):

Any of the following:

- a grade of C in a MAC course numbered 1147 or higher. **OR**
- AP credit for MAC 2311 Analytic Geometry and Calculus 1. **OR**
- IB credit for a MAC course numbered 1147 or higher.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Thomas' Calculus: Early Transcendentals; by George Thomas, Maurice D. Weir, and Joel Hass; 14th edition, Pearson. ISBN: 978-0-13-443902-0. The textbook is required for the course.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Calculate the limits of functions algebraically.	a
Calculate derivatives of polynomials, algebraic functions, trigonometric functions, inverse trigonometric functions, exponential functions, and logarithmic functions.	a
Compute the extrema of polynomials using the first and second derivative test.	a
Evaluate definite integrals involving functions with known antiderivatives via the Fundamental Theorem of Calculus.	a
Calculate a Riemann sum of a function on a closed interval.	a

- Topics:

1. Limits and continuity – rates of changes, limit of functions
2. Limits and continuity – continuity, asymptotes
3. Derivatives – tangents, definition of derivative
4. Derivatives – differentiation rules, rates of changes
5. Derivatives – chain rule, inverse function derivatives
6. Derivatives – inverse trigonometric functions, linearization
7. Applications of derivatives – optimization, mean value theorem
8. Applications of derivatives – monotonicity, graph sketching, indeterminate forms
9. Applications of derivatives – applied optimization, Newton's method
10. Integral – antiderivatives, area estimation
11. Integral – methods of integration, Fundamental Theorem of Calculus

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IDS 1380 - Introduction to STEM

- Course Description:

This foundation course is an introduction to areas of study and the basic competencies common to all STEM fields, and includes skills in these areas: mathematical methods for problem solving, creative thinking, software and calculator techniques, technical report writing and oral presentations, and professional practice and responsibility. Students will be introduced to teaming and leadership skills and participate in hands-on team projects using basic skills from various STEM disciplines. Information literacy in STEM fields, professional ethics, and social and environmental concerns will also be explored though interactive exercises.

- Credits: 3 cr
- Lecture: 0 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Mary B. Vollaro

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. NA

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Explore the fundamental topic areas and contemporary issues in STEM fields	j
Apply knowledge of math, science, and engineering with applications using fundamental calculator and software skills	a
Review the codes and canons of professional and ethical responsibility.	e
Gain insight to the impact of STEM solutions in a global, economic, environmental and/or societal context.	h
Function in teams to productively work on small specific projects	d
Communicate effectively through written reports and/or documents and oral presentations	g

- Topics:

1. What is STEM?
2. STEM: Problem Solvers - analysis
3. STEM in current events
4. STEM: Creativity
5. STEM: Global, environmental, and social considerations (option for Thurs. class)
6. Professional success: Deliverables with focus on homework format
7. Professional success: Deliverables with focus dimensions and conversations
8. Professional success: Deliverables with focus significant figures and time; Team writing skills with meeting minutes
9. Professional success: Deliverables with focus on teaming and writing
10. Teaming & Leadership: Fundamentals and understanding your letters
11. Teaming & Leadership: Using your 'letters' in in-class experience
12. Intro to design process & scientific method
13. Team writing skills with agenda and meeting minutes
14. Excel & calculator skills
15. Writing, oral presentation skills, and team work
16. Oral presentations
17. Teaming and Leadership: Advanced skills
18. Team writing skills with charter, agenda and meeting minutes and report
19. Professional success: Information literacy
20. Teaming with information literacy
21. Professional Skills: Introduction to standards
22. Professional Skills: Professional ethics
23. STEM: Global, environmental, and social considerations

BSC 1010 - Biology 1

- Course Description:

In this course students will study the chemistry of life, cell structure and function, photosynthesis, cellular respiration genetics, evolution, and the diversity of life.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Melba Horton

- Prerequisite(s):
None.

- Co-requisite(s):

- BSC 1010L- Biology 1 Laboratory

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Biology, Tenth Edition, Campbell, Reece, Urry, Cain, Wasserman, Minorsky, Jackson Lab Textbook: Investigating Biology Laboratory Manual, Eighth Edition, Judith Giles Morgan and M. Eloise Brown Carter

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Evaluate scientific studies and be able to determine if a study's design is sound.	g
Detail examples of adaptations in the animal body which structure fits function at the cellular and whole body level.	g
Describe the properties of life and explain how life has evolved.	g
Describe how genes relate to proteins and how genetic information is copied and inherited.	g
Able to apply information from biology to other scientific applications.	g

- Topics:

1. Evolution, the themes of biology
2. Scientific Inquiry
3. The Chemistry of Life
4. Water and Life and Carbon and the Molecular Diversity of Life
5. The Structure and Function of Large Biological Molecules
6. The Cell
7. Membrane structure and function
8. Cell Respiration and Fermentation Photosynthesis
9. Cell Communication
10. The Cell Cycle
11. Meiosis and Sexual Life Styles
12. Mendel and the Gene Idea
13. The Chromosomal Basis of Inheritance
14. Gene Expression
15. Descent with Modification: A Darwinian View of Life
16. The Evolution of Populations
17. An Introduction to Metabolism
18. DNA tools and Biotechnology
19. Invertebrates and Vertebrates
20. Basic Principles of Animal Form and Function
21. Animal Nutrition and Gas Exchange
22. Animal Development
23. Neurons, Synapses and Signaling
24. Nervous System

BSC 1010L - Biology 1 Laboratory

- Course Description:

Students will participate in laboratory experiments designed to reflect the topics presented in BSC 1010.

- Credits: 1 cr
- Lecture: 0 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Melba Horton

- Prerequisite(s):
None.

- Co-requisite(s):

- BSC 1010 - Biology 1

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Investigating Biology Laboratory Manual, Eighth Edition, Judith Giles Morgan and M. Eloise Brown Carter. 2014.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Be able to use a microscope, spectrophotometer, dissection equipment as well as other instruments commonly used in biology.	g
Be able to work in a team environment productively.	g
Learn how biology knowledge can be useful in scientific careers.	g
Learn the workings of an Eukaryotic cell.	g
Gain experience with vertebrate anatomy.	g

- Topics:

1. Scientific Method
2. Microscopes
3. Compound microscope
4. Basic techniques
5. Dissecting (stereoscopic)
6. Electron Microscope (Transmission and scanning)
7. Organization of Eukaryotic Cells
8. Unicellular (single-celled)
9. Aggregate & colony
10. Multicellular
11. Photosynthesis – Cellular Energy
12. Paper chromatography of plant pigments
13. Absorption spectrum of plant pigments
14. Genetics of Populations: Hardy-Weinberg Formula, Natural Selection, and Adaptation
15. Mendelian Genetics with Drosophila Fruit Flies
16. Vertebrate Anatomy

CHM 2045 - Chemistry 1

- Course Description:

This course covers stoichiometry, atomic and molecular structure, and the states of matter, reaction rates and equilibria.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Jaspreet Dhau
- Dr. Robert Green

- Prerequisite(s):

- MAC 1147 or the equivalent or passing grade in CHM 1025.

- Co-requisite(s):

- CHM 2045L- Chemistry 1 Laboratory

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. General Chemistry: Atoms First, MacMurray and Fay, 2nd edition, e-text (ISBN: 9780321813282).

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Relate the quantum and electron configurations of atoms to the periodicity in chemical and physical properties of elements as represented in the periodic table	g
Use stoichiometric methods to convert between mass, moles, and concentration	g
Predict the bonding and resulting geometry of atoms in molecules	g
Determine enthalpy change in chemical reactions	g
Employ the kinetic theory of gases and the ideal gas laws to determine pressure, volume, temperature, and/or amount of a gas	g

- Topics:

1. Measurement, units, dimensional analysis
2. The elements, periodic table, conservation of mass, laws of definite & multiple proportions
3. Atomic theory and structure
4. Light and matter
5. Quantum mechanical model of the atom, orbitals
6. Ionization and ionic bonds
7. Covalent bonds, Lewis structures, resonance
8. VESPR theory, hybrid orbitals, MO theory
9. Stoichiometry
10. Electrolytes, aqueous reactions, acid-base reactions, redox reactions
11. Calorimetry and Hess' Law
12. Gas laws, partial pressure, kinetic-molecular theory of gases
13. Liquids, solids, and phase changes
14. Kinetics, rate laws, first-order reactions, half-life
15. Equilibria and kinetics, equilibrium constants, Le Châtelier's principle, final exam

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CHM 2045L - Chemistry 1 Laboratory

- Course Description:

Students will participate in laboratory experiments designed to reflect the topics presented in CHM 2045.

- Credits: 1 cr
- Lecture: 0 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Jaspreet Dhau
- Dr. Robert Green

- Prerequisite(s):
None.

- Co-requisite(s):

- CHM 2045- Chemistry 1

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Chemistry Laboratory Manual, Cengage Publishing, ISBN: 9781305285286

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate safe laboratory skills	g
Apply problem solving skills to laboratory exercises	g
Effectively communicate in written laboratory reports	g
Utilize scientific methodology including quantitative data analysis and interpretation	g

- Topics:

1. Observations
2. Safety Practices in the Chemistry Lab
3. Identification of a Solid Density
4. Line Spectra
5. Determination of an Empirical Formula
6. Identifying Ionic Solutions
7. Molecular Modeling
8. Standardization of a Titrant
9. Titration of an Unknown
10. Enthalpy of Reactions
11. Molar Volume of Carbon Dioxide

SLS 1106 - First Year Experience

- Course Description:

This course is a weekly seminar designed to support freshman students in their transition to college. Meetings are held in and out of class for students to bring up any personal, academic or administrative concerns they have during their first semester in college. For the more advanced students, this course offers mentorship for those who wish to work on complex problems and projects early in their academic careers.

- Credits: 1 cr
- Lecture: 1 cr
- Lab: 0 cr

- Instructor(s):

-

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify university resources and the procedures for accessing those resources.	g
Develop a plan that utilizes the student's learning style to make their classroom and study experiences more effective.	g
Communicate examples of academic dishonesty and techniques to avoid academic dishonesty.	e
Summarize the best practices for effective communication with other students and university faculty and staff.	f

- Topics:

1. Introduction to the University
2. Virtual Library and Tech Support
3. Diversity, environment, and communication
4. Understanding Your Learning Style
5. Listening and Note Taking
6. Reading and Information Intake
7. Developing/Improving strong study habits and retention
8. Test Taking
9. Self-Management
10. Time Management
11. Know Your Voice

Freshman, Spring Semester

COP 2271C - Introduction to Computation and Programming

- Course Description:

This course is an introduction to computational thinking and the art of computer programming using the C programming language. Students will learn fundamental programming concepts and systematic design techniques. They will use them to write programs that computationally solve and reduce problems. At the end of the course, students will be able to use a programming language without focusing on the language specifics. No prior programming background is required and a working knowledge of high school level algebra is expected.

- Credits: 3 cr
- Lecture: 2 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]
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- Dr. Ashokkumar Patel [apatel@floridapoly.edu]
- Dr. Ricardo Rangel [rrangel@floridapoly.edu]
- Dr. Mohammad Samarah [msamarah@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]
- Dr. Feng-Jen Yang [fyang@floridapoly.edu]

- Prerequisite(s):

- MAC 2311 - Analytic Geometry and Calculus 1 **OR**
  MAC 1281 - Calculus 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. ”Engineering Problem Solving with C”, 4th Ed., Delores M. Etter, ISBN: 978-0136085317, Pearson/Prentice-Hall, 2013.

- Reference(s):

1. ”C How to Program”, 8th Ed., Paul J. Deitel, Harvey Deitel, Pearson, 2016.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	**ABET student outcomes**
Identify and describe basic programming concepts.	a, b, c
Write small programs employing basic programming constructs, such as primitive data types and literals, operations, expressions and statements, logical decisions, and loops.	a, b, c, i
Solve computational problems by reducing them into multiple algorithms using fundamental design techniques, such as abstraction and program decomposition.	a, b, c
Compare computational efficiency of different algorithms that solve the same problem.	a, b, c
Develop a systematic approach to organize, write, and test a computer program.	a, b, c, i

- Topics:

1. Introduction to Programming
2. Program Structure, Constants and Variables, Assignment Statements, and Standard Input and Output
3. Algorithm Development, Conditional, Expressions, and Selection Statements
4. Loop Structures
5. Functions: programmer-defined functions, macro functions, recursive functions.
6. Array: 1-Dimensional and 2-Dimensional
7. Pointers: to variables, pointers to arrays, pointers in function references
8. Structures: in the main function, structures in functions, and arrays of structures

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ENC 2210 - Technical Writing

- Course Description:

This course focuses on the forms, formats, and genres of business, government, professional, and technical communication. Students are given opportunities to practice creating proposals, reports, applications, and resumes.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. C. Wylie Lenz

- Prerequisite(s):

- ENC 1101 - English Composition 1: Expository and Argumentative Writing

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Gurak and John M. Lannon, Strategies for Technical Communication, 3rd ed. [ISBN 13: 978-0-321-99589-6]

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate the ability to write and design clear, usable, and accurate professional and technical documents	f
Find, evaluate, and integrate credible source materials using library databases and other sources	
Design and write technical documents appropriate in terms of purpose and occasion	f
Develop presentations on a topic in an audience-appropriate electronic format (e.g., PowerPoint of Presi).	f

- Topics:

1. Audience-centered writing
2. Discourse communities
3. Email and memos
4. Letters
5. Employment materials
6. Descriptions and Expanded definitions
7. Research
8. Document design
9. Proposals
10. Reports
11. Presentations
12. Instruction Manual

MAC 2312 - Analytic Geometry and Calculus 2

- Course Description:

Techniques of integration; applications of integration; differentiation and integration of inverse trigonometric, exponential, and logarithmic functions; sequences and series are presented in this class.

- Credits: 4 cr
- Lecture: 4 cr
- Lab: 0 cr

- Instructor(s):

-

- Prerequisite(s):

- MAC 2311 - Analytic Geometry and Calculus 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Thomas' Calculus: Early Transcendentals; by George Thomas, Maurice D. Weir, and Joel Hass; 14th edition, Pearson. ISBN: 978-0-13-443902-0. The textbook is required for the course.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Calculate an integral using integration by parts.	a
Calculate an integral using trigonometric substitution.	a
Calculate the volume of a solid of revolution.	a
Deduce whether a given series converges or diverges.	a
Calculate the Taylor series for a given differentiable function.	a

- Topics:

1. Review of Basic Integration
2. Volumes, Arc Length
3. Surface Area, Work, Fluid Forces
4. Center of Mass
5. Integration of Logarithms, Integration by Parts
6. Trigonometric Integrals, Trigonometric Substitution
7. Partial Fractions, Computer Techniques
8. Improper Integrals
9. Sequences and Series
10. Integral Test, Comparison Tests
11. Comparison Tests, Absolute Convergence
12. Ratio and Root Tests, Alternating Series
13. Power Series, Thanksgiving
14. Taylor Polynomials and Taylor Series

PHY 2048 - Physics 1

- Course Description:

This is the first of a two-semester sequence of physics for technology and engineering. The course covers Newtonian mechanics and includes motion, vectors, Newton's laws, work and conservation of energy, systems of particles, collisions, equilibrium, oscillations, thermodynamics and waves.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

-

- Prerequisite(s):

- High-school Physics, PHY 2020 or the equivalent, and MAC 2311- Analytic Geometry and Calculus 1

- Co-requisite(s):

- PHY 2048L- Physics 1 Laboratory

- Co-requisite(s) or Prerequisite(s):

- MAC 2312- Analytic Geometry and Calculus 2

- Textbook(s):

1. Physics for Scientists and Engineers: a strategic approach by Randall D. Knight, 4th Edition, Pearson Publisher.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate an understanding of the principles of scientific inquiry.	a
Demonstrate the quantitative skills needed to succeed in Introductory Physics.	a
Read and interpret graphs and data.	g

- Topics:

1. Concepts of Motion
2. Kinematics in 1D
3. Vectors and Coordinate Systems
4. Kinematics in 2D
5. Force and Motion
6. Dynamics I: Motion Along a Line
7. Newton's Third Law
8. Dynamics II: Motion in a Plane
9. Impulse and Momentum
10. Energy
11. Work
12. Rotation of a Rigid Body
13. Newton's Theory of Gravity
14. Oscillations and Waves
15. Thermodynamics

PHY 2048L - Physics 1 Laboratory

- Course Description:

This laboratory experience for PHY 2048 Physics with Analytic Geometry and Calculus 1 provides practical applications of Newtonian mechanics.

- Credits: 1 cr
- Lecture: 0 cr
- Lab: 1 cr

- Instructor(s):

-

- Prerequisite(s):
None.

- Co-requisite(s):
None.
- Co-requisite(s):

- PHY 2048- Physics 1

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate the skills in performing laboratory experiments	
Read and Interpret graphs and data	g
Calculate the Error Analysis from experimental results with theoretical known values	g

- Topics:

1. Lab 1: Introduction to Measurement-Simple Pendulum
2. Lab 2: Relative Motion in One Dimension
3. Lab 3: Force Table
4. Lab 4: Newton's 2nd Law: Force and Acceleration
5. Lab 5: Coefficients of Friction
6. Lab 6: Atwoods Machine
7. Lab 7: Ballistic Pendulum
8. Lab 8: Spring and Mass Oscillations
9. Lab 9: Standing Waves
10. Lab 10: Heat and Temperature
11. Lab 11: Specific Heat
12. Lab 12: Rotational Inertia

EGN 1007C - Concepts and Methods for Engineering and Computer Science

- Course Description:

This foundation course provides a first hands on experience for the knowledge learned in IDS 1380: Introduction to STEM and it focuses on creativity, teamwork, communication, leadership, and work across the Computer Science discipline and the Engineering disciplines. Students will participate in a design-build-test project. Teams are required to give verbal and written technical and managerial reports.

- Credits: 1 cr
- Lecture: 0 cr
- Lab: 1 cr

- Instructor(s):

-

- Prerequisite(s):

- IDS 1380: Introduction to STEM

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Apply basic mechanical, electrical, and/or software principles to a system component in an appropriate manner.	c
Work in a team to apply methodologies in system engineering to develop a simple system	d, k
Develop a design based on a requirements document	c,h

- Topics:

1. What is engineering design?
2. Requirements specification
3. Design propoals
4. Design review
5. Design process
6. Project Plan
7. Implementing a prototype
8. Debugging and troubleshooting
9. Assessing performance relative to specification requirements.

Sophomore, Fall Semester

PHY 2049 - Physics 2

- Course Description:

The second of a two-semester sequence of physics for scientists and engineers. Content includes Coulomb's law, electric fields and potentials, capacitance, currents and circuits, Ampere's law, Faraday's law, inductance, Maxwell's equations, electromagnetic waves, ray optics, interference and diffraction.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

-

- Prerequisite(s):

- PHY 2048 - Physics 1
- MAC 2312 - Analytic Geometry and Calculus 2

- Co-requisite(s):

- PHY 2049L - Physics 2 Laboratory

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Physics for Scientists and Engineers: a strategic approach by Randall D. Knight, 4th Edition, Pearson Publisher.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate an understanding of the principles of scientific inquiry.	a
Demonstrate the quantitative skills needed to succeed in Introductory Physics.	a
Read and interpret graphs and data.	g

- Topics:

1. Electric Charges and Forces
2. The Electric Field
3. Gauss's Law
4. The Electric Potential
5. Potential and Field
6. Current and Resistance
7. Fundamentals of Circuits
8. The Magnetic Field
9. Electromagnetic Induction
10. Electromagnetic Fields and Waves
11. AC Circuits
12. Superposition
13. Wave Optics
14. Ray Optics
15. Optical Instruments

PHY 2049L - Physics 2 Laboratory

- Course Description:

This laboratory experience for PHY 2049 Physics with Analytic Geometry and Calculus 2 illustrates the practical applications of Coulomb's law, electric fields and potentials, capacitance, currents and circuits, Ampere's law, Faraday's law, inductance, Maxwell's equations, electromagnetic waves, ray optics, interference and diffraction.

- Credits: 1 cr
- Lecture: 0 cr
- Lab: 1 cr

- Instructor(s):

-

- Prerequisite(s):
None.

- Co-requisite(s):

- PHY 2049- Physics 2

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate the skills in performing laboratory experiments	
Read and Interpret graphs and data	g
Calculate the Error Analysis from experimental results with theoretical known values	g

- Topics:

1. Lab 1: Electrostatic Charges
2. Lab 2: Electric Field Mapping
3. Lab 3: Ohm's Law
4. Lab 4: Kirchoff's Law
5. Lab 5: RC Circuit
6. Lab 6: Magnetic Field Mapping
7. Lab 7: Induction – The Magnet Through a Coil
8. Lab 8: Reflection and Refraction
9. Lab 9: Focal Length of a Concave Mirror; Brewer's Angle
10. Lab 10:Interference and Diffraction
11. Lab 11: Resonant Modes of Sound in a Tube

MAD 2104 - Discrete Mathematics

- Course Description:

This course discusses logic, sets, functions, integers, mathematical reasoning and induction, counting principles, permutations and combinations, discrete probability, advanced counting techniques and inclusion-exclusion.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Jared Bunn

- Prerequisite(s):

- MAC 2312 - Analytic Geometry and Calculus 2

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Discrete Mathematics with Applications, Susanna S. Epp, 4^{th} Edition, Cengage, ISBN: 978-0495391326

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Produce the negation of a given conditional statement.	a
Prove a given statement using mathematical induction.	a
Decrypt a message using RSA Cryptography.	a
Calculate a probability using counting techniques	a
Design an algorithm and compute its efficiency	a, c

- Topics:

1. Variables, Basic Logic
2. Conditional Statements and Negations
3. Valid and Invalid Arguments
4. Language of Sets
5. Predicates
6. Quantified Statements
7. Direct Proof
8. Rational Numbers
9. Direct Proof
10. Rational Numbers
11. Divisibility, Q-R Theorem
12. Floor and Ceiling
13. Indirect Arguments
14. Sequences
15. Induction
16. Well-Ordering Principle
17. Language of Functions
18. Relations
19. Equivalence Relations
20. Cryptography
21. Counting Techniques
22. Pigeonhole Principle
23. Probability Axioms
24. Multiplication Rule
25. Inclusion/Exclusion
26. Permutations and Combinations
27. Expected Value

COP 2272C - Computer Programming 1

- Course Description:

This is an intermediate programming course designed for students with prior programming experience in any language. It revises the fundamental programming concepts focusing on best practices in designing and writing efficient code. It also covers basic user-defined data types and the use of essential built-in data structures. After completing the course, students will have a solid command of computer programming and will be able to write medium-sized computer code.

- Credits: 3 cr
- Lecture: 2 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]
- Dr. Kanwalinderjit Gagneja [kgagneja@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]
- Dr. Navid Khoshavi Najafabadi [nkhoshavinajafabadi@floridapoly.edu]
- Mr. Christian Navarro [cnavarro@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]
- Dr. Ricardo Rangel [rrangel@floridapoly.edu]
- Dr. Mohammad Samarah [msamarah@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]
- Dr. Feng-Jen Yang [fyang@floridapoly.edu]

- Prerequisite(s):

- COP 2271C - Introduction to Computation and Programming

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. ”Programming and Problem Solving with C++: Brief Edition”, 6th edition, by Dale and Weems. ISBN: 978-1284028645

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Use primitive data types and control structures to write simple computer programs in a high-level programming language.	c, e
Apply Object-Oriented programming skills and simple data structures to solve given problems	a, e
Apply standard template library to solve given problems	a, e

- Topics:

1. C++ syntax and semantics
2. Numeric types, expressions and output
3. Program inputs and output
4. Control Structures
5. Looping
6. Additional control structures
7. Functions
8. Scope, lifetime, and more on functions
9. User-defined data types
10. Arrays
11. Classes and abstraction
12. Recursion

MAS 3114 - Computational Linear Algebra

- Course Description:

Linear equations, matrices, and determinants; vector spaces and linear transformations; inner products and eigenvalues. This course emphasizes computational aspects of Linear Algebra.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Ala' J. Alnaser

- Prerequisite(s):

- MAC 2312 - Analytic Geometry and Calculus 2 with a grade of C or higher

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Introduction to Computational Linear Algebra", Nabil Nassif , Jocelyne Erhel, and Bernard Philippe, Chapman and Hall/CRC, 1st Edition, 2015

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Use the matrix associated to a system of linear equations to solve the system.	a
Compute the determinant matrices.	a
Verify if a subset is a subspace	a
Construct a basis of a vector space	a
Calculate the eigenvalues and construct a basis for the eigenspaces of a matrix	a

- Topics:

1. Basic Linear Algebra Subprograms
2. Basic Concepts for Matrix Computations
3. Gauss Elimination and LU Decomposition of Matrices
4. Orthogonal Factorization and Linear Least Square Problems
5. Algorithms for Eigenvalue problem
6. Iterative Methods for Systems of Linear Equations

COP 3353C - Introduction to Unix

- Course Description:

This is an introductory course to Linux and Unix operating systems. The course will cover topics including: commands, utilities, text editors, shell programming, programming tools, and regular expressions.

- Credits: 2 cr
- Lecture: 1 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]
- Mr. Christian Navarro [cnavarro@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]

- Prerequisite(s):

- COP 2271C - Introduction to Computation and Programming

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):

- COP 2272C - Computer Programming 1

- Textbook(s):

1. A Practical Guide to Linux Commands, Editors, and Shell Programming, 3rd Edition, by Mark G. Sobell, 2012, ISBN-13: 978-0133085044

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Use Linux/Unix Bash shell and commands	k
Write and execute simple C++ program make files	k
Operate with Linux/Unix file system	k
Write and execute shell scripts	k
Infer the history of Unix/Linux and GNU	f
Design system requirements of a Linux server	c
Identify and solve an engineering problem in a Linux environment	e

- Topics:

1. Introduction and History
2. What is an OS? - A touch of OS theory
3. Setting up Linux/Unix
4. Special Characters, basic utilities, and less is more.
5. VIM
6. Files
7. Programming C++ in Linux/Unix and making a makefile
8. Shells
9. REGEX
10. Bash
11. Programming Bash
12. Managing a server and users in Unix/Linux

Sophomore, Spring Semester

STA 2023 - Statistics 1

- Course Description:

This course covers probability, random variables, hypothesis testing, confidence interval estimation, small sample methods, correlation, simple linear regression, and nonparametric statistics.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Ala' J. Alnaser

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Diez, Barr, Çetinkaya-Rundel; OpenIntro Statistics

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify the merits of alternative sampling techniques.	a
Interpret descriptive statistics and plots.	g
Apply the principles of probability to quantify the likelihood of alternative outcomes.	a
Apply & interpret inferential statistics, including confidence intervals and hypothesis tests.	a

- Topics:

1. Getting, Describing, and Exploring Data
2. Probability and Frequency
3. Distributions
4. Inference Foundations
5. Inference Details—Numerical Data
6. Inference Details—Categorical Data & Intro to Correlation and Regression

DIG 2520 - Digital Media Production

- Course Description:

This course focuses on multimedia technologies and software, it introduces basic image enhancement techniques like in Photoshop or gimp, video editing software like Final Cut Studio, music editing software like GarageBand, and 3D modeling and animation like Blender or MAYA.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Mr. Christian Navarro [cnavarro@floridapoly.edu]

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Adobe Audition CC Classroom in a Book Author(s) : Adobe", Creative Team Publisher : Adobe Press PTG, Copyright year : © 2013, Edition : 1st, Pages : 304, Print ISBN : 9780321929532
2. "Adobe Photoshop CC Classroom in a Book (2017 release)", Author(s) : Andrew Faulkner, Publisher : Adobe Press PTG, Copyright year : © 2017, Edition : 1st, Print ISBN : 9780134663456
3. "Adobe Premiere Pro CC Classroom in a Book (2015 release)", Author(s) : Maxim Jago, Publisher : Adobe Press PTG, Copyright year : © 2016, Edition : 1st, Print ISBN : 9780134309989

- Course Designation as Required, Elective, or Selected Elective: Required
- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Use audio, graphic, and video techniques to edit and produce digital media content	k
Describe fundamental concepts and knowledge of applications.	a
Tell a story to draw the viewer in.	c
Demonstrate ability to edit and create digital media content using Audition, Photoshop, and Premiere.	k
Apply mathematics when setting sample rates.	a

Design a storyboard for video preparation	c
Operate in a production team.	d
Identify and solve an audio engineering problems using Audition.	c
Review the history of digital audio.	g

- Topics:

1. Digital Audio and interface
2. Tools to edit Audition Environment
3. Signal Processing in Audition
4. Mastering and Sound Design
5. Recording voices and foley, multitrack editing
6. Creating music beds and mixing audio
7. Getting to know Photoshop, work area and selections
8. Layer basics, masks, and channels
9. Vector drawing & compositing
10. Telling a story, contrast, lights, setting up projects in Premier Pro
11. Lines and space – video editing basics
12. Transitions & coloring
13. Movement, motion, tone, multi-camera footage
14. Multi-camera editin
15. Video Effects, color correction and grading
16. Compositing, green screen, creating titles & overview

COP 3330C - Computer Programming 2

- Course Description:

This course is an intermediate level computer programming course. It introduces intermediate programming concepts: Object-Oriented design principals, data abstraction, classes, polymorphism, inheritance, and basic algorithms. Students will acquire skills to solve larger projects and algorithmic problems with more efficient code.

- Credits: 3 cr
- Lecture: 2 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]
- Dr. Kanwalinderjit Gagneja [kgagneja@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]
- Mrs.Mouna Kettani [mkettani@floridapoly.edu]
- Dr. Navid Khoshavi Najafabadi [nkhoshavinajafabadi@floridapoly.edu]
- Mr. Christian Navarro [cnavarro@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]
- Dr. Ricardo Rangel [rrangel@floridapoly.edu]
- Dr. Mohammad Samarah [msamarah@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]
- Dr. Feng-Jen Yang [fyang@floridapoly.edu]

- Prerequisite(s):

- COP 2272C - Computer Programming 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Paul Deitel and Harvey Deitel, "Java How To Program, Early Objects.", Pearson, 2017, Eleventh Edition, ISBN-13: 9780133807806.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes

Use subclassing to design simple class hierarchies that allow code to be reused for distinct subclasses.	a, b, c
Explain the relationship between object-oriented inheritance (code-sharing and overriding) and subtyping (the idea of a subtype being usable in a context that expects the supertype).	a, b, c
Write programs that use each of the following data structures: arrays, records/structs, strings, linked lists, stacks, queues, sets, and maps.	a, b, c, i
Identify common coding errors that lead to insecure programs (e.g., buffer overflows, memory leaks, malicious code) and apply strategies for avoiding such errors.	a, b, c
Apply consistent documentation and program style standards that contribute to the readability and maintainability of software.	a, b, c, i

- Topics:

1. Introducing Java
2. Methods and Selection Statements
3. Methods, Arrays, and Array Lists
4. Array Lists and Lists
5. File I/O - GUI Components
6. Inheritance and Sub-classes
7. Inheritance & Sub-classes
8. Polymorphism & Interfaces
9. Polymorphism & Exception Handling
10. GUI Components
11. Graphics & Java 2D
12. Collections
13. Generic Classes and Methods
14. Concurrency
15. Networking in Java

COP 3710 - Database 1

- Course Description:

The use of Structured Query Language (SQL) and broad knowledge of database design, implementation, and systems development are presented in this course. Emphasis is places upon data modeling concepts, approaches and techniques, and stages in database development processes (conceptual, logical and physical design).

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]
- Dr. Mohammad Samarah [msamarah@floridapoly.edu]
- Dr. Feng-Jen Yang [fyang@floridapoly.edu]

- Prerequisite(s):

- COP 2271C - Introduction to Computation and Programming

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Database Systems: Design, Implementation, and Management", 11th Edition Carlos Coronel, Steven Morris
2. "Sam's Teach Yourself SQL in 10 Minutes", 4th Edition, Ben Forta

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Tell the purpose of a database, how it works, what is does, and how it relates to applications of information technology.	a, b, c
Infer the fundamentals and concepts for data modeling methods and techniques.	a, b, c, j
Apply database concepts to design and build a database for an IT project.	a, b, c, g, i, j, k
Operate effectively in a team to produce an IT plan or artifact.	d, e, f
Develop an appreciation for the need for continuing professional and educational learning and development.	h

- Topics:

1. Introduction & Database Systems
2. Data Models
3. Relational Database Model
4. Entity Relationship Modeling
5. Advanced Data Modeling
6. Normalization
7. Introduction to Structured Query Language (SQL)
8. Advanced SQL

CDA 2108 - Introduction to Computer Systems

- Course Description:

This course provides an introduction to logic design and the basic building blocks of digital computers. The course will cover logic gates, some minimization techniques, arithmetic circuits, flip-flops, synthesis of sequential circuits, finite state machines, counters, registers, Random Access Memory (RAM), and Arithmetic Logic Unit (ALU).

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Navid Khoshavi Najafabadi [nkhoshavinajafabadi@floridapoly.edu]

- Prerequisite(s):

- COP 2272C - Computer Programming 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. M. Morris Mano, Charles R. Kime, and Tom Martin,"Logic & Computer Design Fundamentals", Fifth Edition, Pearson, 2015, ISBN-13: 978-0133760637

- Reference(s):

1. Stephen Brown and Zvonko Vranesic,"Fundamentals of Digital Logic with Verilog Design", McGraw-Hill Education; 3rd edition, 2013, ISBN: 978-0073380544
2. David Harris and Sarah Harris,"Digital Design and Computer Architecture", Morgan Kaufmann, 2nd edition, 2012, ISBN: 978-0123944245

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Apply binary numbering systems and conversions	a
Apply boolean algebra to manipulate and minimize logic expressions.	a, i
Use K-maps to minimize functions.	i
Design arithmetic circuits.	j
Develop functions using decoders and multiplexers.	j

Design sequential logic circuits using flip-flops.	j
Recognize the concepts of datapaths, control units, micro-operations, and building blocks of digital computer.	c

- Topics:

1. Digital Systems and Binary Numbers
2. Boolean Algebra and Logic Gates
3. Gate-Level Minimization
4. Combinational Logic
5. Synchronous Sequential Logic
6. Registers and Counters
7. Memory and Programmable Logic
8. ALU
9. Introduction to FPGA & Verilog

EEL 3702C - Digital Logic Design

- Course Description:

The analysis and design of sequential logic circuits, combinational logic circuits, and feedback circuits are covered in this course. Additional topics include Boolean algebra, Boolean functions, number systems, minimizations, binary arithmetic, k-maps, combinational circuit synthesis, combinational medium scale integrated (MSI) logic circuits, sequential logic, sequential MSI logic circuits and synchronous state machine design.

- Credits: 3 cr
- Lecture: 2 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Youssif Al-Nashif
- Dr. David Foster
- Dr. Muhammad Sana Ullah

- Prerequisite(s):

- COP 2271C – Introduction to Computation and Programming

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. M. Morris R. Mano and Michael D. Ciletti .Digital Design: With an Introduction to the Verilog HDL. Fifth Edition, ISBN: 0132774208

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Define basic memory elements, digital logic, Boolean algebra, k-maps, combinational circuits, feedback, medium scale integrated (MSI) logic circuits, sequential logic, small- and medium-scale logic functions, synchronous and asynchronous machines	a
Analyze functional building blocks and control and timing concepts; small- and medium-scale logic functions; combinational logic networks; basic memory elements; synchronous and asynchronous machines	a, c
Distinguish small- and medium-scale logic functions; synchronous and asynchronous machines	a
Design functional building blocks and control and timing concepts; combinational logic networks; basic memory elements	a, c

- Topics:

1. Digital Systems and Binary Numbers
2. Boolean Algebra and Logic Gates
3. Gate Level Minimization
4. Combinational Logic
5. Synchronous Sequential Logic
6. Registers and Counters

Junior, Fall Semester

CNT 3004C - Introduction to Computer Networks

- Course Description:

This course provides an introduction to fundamental concepts in computer networks, including their design and implementation. Topics covered include all seven layers of OSI Reference Model, network protocols (providing reliability and congestion control), routing, and link access. Special attention is also paid to wireless networks and security.

- Credits: 3 cr
- Lecture: 2 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Kanwalinderjit Gagneja [kgagneja@floridapoly.edu]
- Mrs.Mouna Kettani [mkettani@floridapoly.edu]

- Prerequisite(s):

- COP 2272C - Computer Programming 1
- STA 2023 - Statistics 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Computer Networking: A Top-Down Approach", 7th edition, by James Kurose and Keith Ross. ISBN-13: 978-0-13-359414-0

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
List and define basic computer networking terminology.	a, b
Explain the different network communication layers (OSI reference model and TCP/IP)	a, b, c, e
Give examples of reliable delivery protocols.	b, c
Describe the organization of a wireless network.	b, c
Distinguish the different categories of network threats and attacks.	b, c, e, i

- Topics:

1. Introduction
2. Computer Networks and the Internet
3. Application Layer
4. Transport Layer
5. Network Layer: Data Plane
6. Link Layer and LANs
7. Wireless & Mobile Networks
8. Security in Computer Networks

COP 4415 - Data Structures

- Course Description:

This course examines the essential properties of algorithms and data structures. The data structures will be used as tools to aid in algorithm design and application.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Navid Khoshavi Najafabadi [nkhoshavinajafabadi@floridapoly.edu]

- Prerequisite(s):

- COP 2271C - Introduction to Computation and Programming

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "C++ Plus Data Structures", 6th Edition, by Nell Dale, Jones & Bartlett Learning, 9781284089189.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Develop and apply solutions using the basic data structures	a, b, c,e
Analyze and compare the efficiency of different data structures.	a, b,i
Demonstrate understanding in applying data structures manipulating techniques.	a, b, i
Infer, write, and debug C programs using different data structures.	a,b,c
Recognize with fundamental concepts in data structures.	a,b,i

- Topics:

1. Review of Dynamic Allocation, Structures
2. Runtime Analysis
3. Recursion
4. Array-Based Implementations
5. Linked List Implementations
6. Sorting Algorithms and Their Efficiency
7. Sorting Algorithms and Their Implementations
8. Stacks, Stack Implementations
9. Queues and Priority Queues
10. Trees, Tree Implementations
11. Binary Search Tree, AVL
12. AVL, Heaps
13. Dictionaries and Their Implementations
14. Hash
15. Graphs

COP 4531 - Algorithm Design & Analysis

- Course Description:

The course studies a variety of useful algorithms and analyzes their complexity. Students will gain an understanding of principles and data structures that are useful in algorithm design.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]

- Prerequisite(s):

- COP 3530 - Data Structures & Algorithms
- COP 2272C - Computer Programming 1
- MAD 2104 - Discrete Mathematics

- Co-requisite(s):

- COP 4415 - Data Structures

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Levitin, A.V. (2012). Introduction to the Design and Analysis of Algorithms (3rd ed.). Boston, MA: Addison Wesley. ISBN 9780132316811.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Show the worst, best and average efficiency of a given recursive or non-recursive algorithm	a, b, c, j
Design, apply, and analyze Brute Force Algorithms for a specific problem	a, b, c, j
Design, apply, and analyze Decrease and Conquer Algorithms for a specific problem	a, b, c, j
Design, apply, and analyze Divide and Conquer Algorithms for a specific problem.	a, b, c, j
Design, apply, and analyze Transform and Conquer Algorithms for a specific problem	a, b, c, j
Navigate space and time trade-offs.	a, b, c, j
Design, apply, and analyze dynamic programming and greedy technique algorithms for a specific problem.	a, b, c, j

- Topics:

1. Introduction.
2. Fundamentals of the analysis of algorithm efficiency.
3. Brute force and exhaustive search.
4. Decrease and Conquer
5. Divide and Conquer
6. Transform and Conquer
7. Space and Time Trade-Offs
8. Dynamic Programming

IDS 4941 - Professional Experience Internship

- Course Description:

This course is a co-curricular requirement that provides students with the opportunity to experience working in a professional environment or community-based organization where they can apply the knowledge and skills they have gained from their program.
This requirement may be satisfied through a traditional internship provided by an employer; a community service experience; or some other form of professional/entrepreneurial experience; pending approval by the Provost or designee.

- Credits: 0 cr
- Lecture: 0 cr
- Lab: 0 cr

- Instructor(s):

- N/A

- Prerequisite(s):

- Completion of at least 72 Credit hours, or permission of APC, Provost or designee.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Develop practical skills and judgment	g
Demonstrate ability to communicate effectively	f, h
Discover own interests within the field of study	
Develop resume credentials to help them compete for full time positions upon graduation	

- Topics:

1. N/A

MAP 2302 - Differential Equations

- Course Description:

The relationship between differential equations and initial conditions to physical problems in engineering, physics, technology and other applied areas is discussed. Students will be able to formulate, solve, and analyze the results of mathematical models of elementary physical problems and apply them. Topics include: first-order ordinary differential equations, theory of linear ordinary differential equations, solution of linear ordinary differential equations with constant coefficients, the Laplace transform and its application to solving linear ordinary differential equations.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Jared Bunn

- Prerequisite(s):

- MAC 2312 - Analytic Geometry and Calculus 2 (with a minimum grade of C)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Differential Equations for Engineers, Jiri Lebl

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Solve a first order ODE by the linear method.	a
Solve a first order ODE by separation of variables	a
Solve an application problem involving a first order ODE	a
Solve a nonhomogeneous higher order linear ODE with constant coefficients.	a
Solve a differential equation using Laplace Transforms.	a

- Topics:

1. First Order ODE, Solving with Integration, Slope Fields, Existence and Uniqueness
2. First Order ODE, Separable Equations, Linear Equations, Integrating Factors
3. Bernoulli Equations, Homogeneous Equations, Autonomous Equations, Euler's Method
4. Second Order Linear ODE's, Higher Order Linear ODE, Mechanical Vibrations
5. Nonhomogeneous equations, Undetermined Coefficients, Variation of Parameters
6. Variation of Parameters, Forced Oscillations and resonance
7. The Laplace Transform, Solving ODE with LT
8. ODE's with Convolution, Dirac delta and impulse response
9. Systems of Equations, Matrices and Linear Systems, Laplace Transforms and Systems
10. Eigenvalues
11. Runge-Kutta Method
12. Computer Methods
13. Power Series to solve ODE

MAD 3401 - Numerical Analysis

- Course Description:

This course introduces students to the development, application, and examination of basic numerical algorithms.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

-

- Prerequisite(s):
None.

- Prerequisite(s):

- MAS 3105 - Linear Algebra **OR**
  MAS 3114 - Computational Linear Algebra

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Numerical Methods for Engineers and Scientists: An Introduction with Applications using MATLAB", Amos Gilat and Vish Subramaniam, Wiley, 3rd Edition, 2013

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Solve scientific and engineering problems using numerical methods	a
Conduct numerical accuracy in calculation	a
Identify the best numerical method for solving a certain problem by evaluating the performance and efficiency of the different methods	c

- Topics:

1. Mathematical Background
2. Solving Nonlinear Equations
3. Solving a System of Linear Equations
4. Eigenvalues and Eigenvectors
5. Curve Fitting and Interpolation
6. Fourier Methods
7. Numerical Differentiation
8. Numerical Integration
9. ODE - Initial Value
10. ODE - Boundary-Value

Junior, Spring Semester

CEN 4010 - Software Engineering

- Course Description:

The course covers object-oriented software engineering, the software development life cycle, system specification, software design patterns, and the methods of software measurement and estimation.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Mrs.Mouna Kettani [mkettani@floridapoly.edu]

- Prerequisite(s):

- COP 2272C - Computer Programming 1
- COP 3530 - Data Structures & Algorithms **OR**
  (COP 4415 Data Structures **AND**
  COP 4531 Algorithm Design & Analysis)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Software Engineering: Theory and Practice", 4th Edition, by Shari Pfleeger and Joanne Atlee, Prentice Hall, ISBN: 9780136061694.

- Reference(s):

1. "Object-Oriented Software Engineering: Practical Software Development Using Uml and Java". 2nd Edition, by Timothy Christian Lethbridge and Robert Laganier. McGraw-Hill, 2005, ISBN:0077109082
2. "UML 2 Toolkit." By Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, et al., 2003, ISBN: 0471463612
3. "Designing Software Product Lines with UML: From Use Cases to Pattern-Based Software Architectures" by Hassan Gomaa, 2004, ISBN: 0201775956
4. "Software Engineering", 10th Edition, by Ian Sommerville, Pearson, ISBN: 9780133943030.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate understanding of SDLC and S-DIP and apply it to software development.	a, i, j
Design and create a software development and implementation plan based on user requirements.	a, b, c, i, j, k
Demonstrate knowledge of standards such as MIL STD and IEEE and apply them to software development.	a, i, j
Explain and use object-oriented software development.	a, i, j
Operate in a team to create a system development and implementation plan based on requirements and user needs.	d, e, f, g, h

- Topics:

1. Why Software Engineering
2. Modeling the Process and Life Cycle
3. Planning and Managing the Project
4. Capturing the Requirements
5. Designing the Architecture
6. Designing the Modules
7. Writing the Programs
8. Programming Standards and Procedures
9. Testing the Programs
10. Testing the System
11. Delivering the System
12. Maintaining the System

CAP 4630 - Artificial Intelligence

- Course Description:

This course covers fundamental concepts such as search and knowledge representation and applied work in areas such as planning, game playing, and vision. Topics included: logical reasoning, constraint satisfaction problems, graph search algorithms, Bayes rule, Bayesian networks, multi-agent system, neural networks, decision trees, and natural language processing. ”Understand fundamental concepts of Artificial Intelligence, including logical reasoning, constraint satisfaction problems, graph search algorithms, Bayes rule, Bayesian networks, multi-agent system, neural networks, decision trees, and natural language processing.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Feng-Jen Yang [fyang@floridapoly.edu]

- Prerequisite(s):

- STA 2023 - Statistics 1
- COP 3530 - Data Structures & Algorithms **OR**
  (COP 4415 - Data Structures **AND**
  COP 4531 - Algorithm Design & Analysis)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.
- Textbook(s):

1. Artificial Intelligence Illuminated by Ben Coppin. ISBN: 978-0763732301.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Infer concepts and applications of Searches.	a
Infer concepts and applications of Game Playing.	k
Infer concepts and applications of Inferences.	c

- Topics:

1. A Brief History of Artificial Intelligence
2. Uses and Limitations
3. Knowledge Representations
4. Knowledge Representations
5. Search Methodologies
6. Search Methodologies
7. Advanced Search
8. Game Playing
9. Rule Based System
10. CLIPS Programming
11. CLIPS Programming
12. Neural Networks
13. Probabilistic Reasoning
14. Genetic Algorithm

EEL 4768C - Computer Architecture and Organization

- Course Description:

This course covers a top-down approach to computer design. Topics include Computer architecture, introduction to assembly language programming and machine language set design. Computer organization, logical modules, CPU, memory and I/O units, instruction cycles, the data path and control unit, hardwiring and microprogramming are also covered.

- Credits: 3 cr
- Lecture: 2 cr
- Lab: 1 cr

- Instructor(s):

- Dr. David Foster

- Prerequisite(s):

- COP 2272C – Computer Programming 1
- EEL 3702C - Digital Logic Design

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Design the basic building blocks of a computer: arithmetic-logic unit (gate-level), registers (gate-level), central processing unit (register transfer-level), memory (register transfer-level).	a, b, c
Explain the organization of the classical von Neumann machine and its major functional units.	a, b, c
Explain the basic concepts of interrupts and I/O operations.	a, b, c
Write simple assembly language program segments.	a, b, c, i
Discuss the concept of control points and the generation of control signals using hardwired or microprogrammed implementations.	a, b, c

- Topics:

1. Overview and history of computer architecture
2. Basic organization of the von Neumann machine
3. Control unit; instruction fetch, decode, and execution
4. Instruction sets and types (data manipulation, control, I/O)
5. Assembly/machine language programming
6. Addressing modes
7. I/O and interrupts
8. I/O fundamentals: handshaking, buffering, programmed I/O, interrupt-driven I/O
9. Main memory organization and operations
10. Latency, cycle time, bandwidth, and interleaving
11. Cache memories (address mapping, block size, replacement and store policy)
12. Implementation of simple data paths
13. Control unit: hardwired realization vs. microprogrammed realization
14. Instruction pipelining

Senior, Fall Semester

COP 4610 - Operating Systems Concepts

- Course Description:

This course covers the concepts of the design and implementation of operating systems. Topics included: memory and storage management, virtual memory, processes/threads, system calls, interfaces, I/O, file system, and introduction to virtualization.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]

- Prerequisite(s):

- EEL 4768C - Computer Architecture and Organization **OR**
  CDA 3100 - Computer Architecture

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Operating Systems: Three Easy Pieces", by R. Arpaci- Dusseau & A. Arpaci-Dusseau

- Reference(s):

1. Operating System Concepts", 9th edition, by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne. ISBN:978-1- 118-06333-0
2. Operating Systems: Principles and Practice (Second Edition) by Thomas Anderson and Michael Dahlin, ISBN: 978-0- 9856735-2-9

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Describe the basic components of an operating system and their role in implementations for general purpose, real-time, and embedded applications.	
Define the concepts of processes, threads, asynchronous signals and competitive system resource allocation.	c
Explain what multi-tasking is and outline standard scheduling algorithms for multi-tasking.	c

Discuss mutual exclusion principles and their use in concurrent programming, including semaphore construction and resource allocation	
Infer the mechanism of system memory management in Operating Systems	
Use system calls as mechanism to switch between user mode and kernel mode	
Operate on multidisciplinary team for engineering and compliance	d
Infer the history of Unix/Linux and GNU	f
Infer the role of the persistence in the form of hard disk drives and its logic though file system organization	

- Topics:

1. Introduction and History
2. Processes, Process API
3. Processes, direct execution
4. CPU Scheduling, Multi-level feedback
5. Scheduling Loitering – Multi-CPU Scheduling
6. Memory management Address space, translation,
7. Memory management: segmentation, paging
8. Memory management:, Swapping
9. Concurrency and Threads
10. Condition variables, and Locks
11. Semaphores
12. Persistence, Disks, Disk scheduling, RAID
13. File System and Directories
14. Locality and The Fast File System
15. File system implementation

COP 4934C - Senior Design 1

- Course Description:

This is the first course in a sequence of two courses that are based on supervised team projects. In this course students will learn and demonstrate teams work, efficient communication, reading standards, software design methodology, performing project feasibility study, and writing proposals. In addition, the course will touch on aspects of intellectual property, professional ethics, and social impact.

- Credits: 3 cr
- Lecture: 2 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]

- Prerequisite(s):

- CEN 4010 - Software Engineering
- COP 3710 - Database 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Required
- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline.	a
Analyze a problem, and identify and define the computing requirements appropriate to its solution.	b
Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	c
Operate effectively in teams to accomplish a common goal.	d
Demonstrate understanding of professional, ethical, legal, security and social issues and responsibilities.	e
Practice effective communication with a range of audiences.	f
Analyze the local and global impact of computing on individuals, organizations, and society.	g

Recognize of the need for and an ability to engage in continuing professional development.	h
Use current techniques, skills, and tools necessary for computing practice.	i
Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.	j
Apply design and development principles in the construction of software systems of varying complexity.	k

- Topics:

1. Introduction
2. Goals, Objectives, Specifications and Requirements
3. Planning and Managing the Project Documentation
4. Standards
5. Modeling the Process
6. Design Constraints
7. Design Process
8. Designing the Architecture
9. Designing the Modules
10. Intellectual Property
11. Budget
12. Ethics

Senior, Spring Semester

IDS 2144 - Legal, Ethical, and Management Issues in Technology

- Course Description:

This is an intermediate level course intended to prepare students for legal and ethical issues they will encounter in their professional careers and student internships. The course focuses on management oriented technology issues in the legal and business environment, professionalism, and the impact of technology on society. The course also covers service-based learning.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Ms. Emily Grime

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Define the legal environment of business, and explain how it relates to applications of information technology using examples and issue spotting.	e, g
Demonstrate knowledge of, and be able to apply, the analysis techniques of SWOT, SEEC, and PEST to legal and regulatory issues in technology.	g
Analyze management and ethical issues as applied to information technology.	e, g
Operate effectively in a team to produce a risk assessment and management plan, considering legal and regulatory issues for an organization.	d, e, g
Develop an appreciation for the need for continuing professional and educational learning and development.	h

- Topics:

1. Legal Environment of Business
2. Technology and the law
3. Patents, Trademark, Copyright
4. Methods of organizational analysis for legal and regulatory issues
5. HIPPA and records laws
6. Data lock, data management plan, data security, personal information
7. Federal regulations
8. HR issues
9. Management issues
10. Ethics

COP 4020 - Programming Languages

- Course Description:

The course covers programming models underlying different languages. The course will help students make informed design choices in languages supporting multiple complementary approaches. Students will be introduced to the principles of how programming language features are defined, composed, and implemented. In addition, the effective use of programming languages, and appreciation of their limitations, is emphasized by introducing main constructs on programming languages as well as lexical and syntax analysis.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]
- Mrs.Mouna Kettani [mkettani@floridapoly.edu]

- Prerequisite(s):

- MAD 2104 - Discrete Mathematics
- COP 3530 - Data Structures & Algorithms **OR**
  (COP 4415 - Data Structures **AND**
  COP 4531 Algorithm Design & Analysis)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Introduction to Computer Theory", 2th edition, by Daniel I. A. Cohen. ISBN: 978-0-471-13772-6

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Compare and contrast the procedural/functional approach and the object-oriented approach.	a, b, c
Interpret variables and lexical scope in a program using function closures.	a, b, c
Use formal grammars to specify the syntax of languages.	a, b, c
Identify key issues in syntax definitions: ambiguity, associativity, and precedence	a, b, c

- Topics:

1. Languages, Recursive Definitions
2. Regular Expressions
3. Finite Automata (FA)
4. Transition Graphs (TG)
5. Kleene's Theorem
6. Nondeterminism
7. Finite Automata with Output
8. Regular Languages
9. Nonregular Languages
10. Context-free Grammar (CFG)
11. Pushdown Automata, CFG= PDA
12. Non-Context Free Languages
13. Context-free Languages

COP 4935C - Senior Design 2

- Course Description:

This is the second course in a sequence of two courses that are based on supervised team projects. This is a continuation to the project in Senior Design 1. In this course students will learn and demonstrate project implement, debugging, documentation, and testing. The students are expected to: 1) write a final report describing the activity performed during the course; and 2) present the project.

- Credits: 3 cr
- Lecture: 2 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]

- Prerequisite(s):

- COP 4934C - Senior Design 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Required
- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline.	a
Analyze a problem, and identify and define the computing requirements appropriate to its solution.	b
Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	c
Operate effectively in teams to accomplish a common goal.	d
Demonstrate understanding of professional, ethical, legal, security and social issues and responsibilities.	e
Practice effective communication with a range of audiences.	f
Analyze the local and global impact of computing on individuals, organizations, and society.	g

Recognize of the need for and an ability to engage in continuing professional development.	h
Use current techniques, skills, and tools necessary for computing practice.	i
Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.	j
Apply design and development principles in the construction of software systems of varying complexity.	k

- Topics:

1. Revisit Design Constraints
2. Implementation
3. Evaluation
4. Debugging and Testing
5. Prototype Demonstration
6. Documentation (User Manual and Errata)
7. Technical presentation
8. Final written technical report

Cyber Gaming Concentration

CAP 4034 - Computer Animation

- Course Description:

The course builds a foundation of 3D computer animation algorithms which includes: geometric modeling, motion design, lighting and surface properties, keyframing, inverse kinematics, physical simulation, optimization, still systems, rigid body motion, collision detection and modeling.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Mr. Christian Navarro [cnavarro@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Parent, Rick. "Computer Animation: Algorithms and Techniques". 3rd ed. 2012. ISBN: 0124158420.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Recall the traditional and classical animation principles and techniques	a,c
Manipulate 3D objects, as well as identify animation and object relationship hierarchies, by rendering animation using software	a,c
Manipulate animation curve data in order to achieve believable and naturalistic motion	a,c
Apply the basic concepts of rigging, kinematics, and working with skeleton objects.	a,c
Employ expressions, MEL scripts, and Python object coding to automate workflows	i

Apply basic procedural animation concepts such as motion capture, dynamics, particles, fluids and visual fx, in the context working on game and movie pipelines	a, c
Identify some of the state of the art topics in computer animation and present them	f, g

- Topics:

1. Introduction to Computer Animation
2. Introduction to Maya
3. Hand Keyed Animation
4. Motion path animation
5. Scripting in Maya
6. Introduction to Rigging
7. Introduction to Rigging 2
8. Working with Animation in Game Engine
9. Technical Art
10. Motion Capture
11. Intro to Dynamics/ Simulation/Visual FX animation

CAP 4052 - Game Design and Development 1

- Course Description:

This is a technical course introducing the major tools used in game development and programming. Topics include: stages of game development, development methodologies, scripting, game engines, game loading, programming input devices, multi-player design, mobile games, distribution and publishing.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]

- Prerequisite(s):

- CAP 4730 - Computer Graphics

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Tristen, Ben, Mike Geig. Sams Teach Yourself Unity Game Development second edition. Indianapolis: SAMS, 2016. Print. ISBN-13: 978-0-672-33751-2

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Design a game for implementation	c
Operate in teams	d
Practice presenting games to diverse set of audience	g
Apply the necessary tools to make single player games	k

- Topics:

1. Introduction to Unity
2. History of Gaming/Why people play games
3. Unity basic objects
4. Unity terrain generation
5. Rigid bodies, physics and user inputs
6. Prefabs and project organization
7. Collisions and Triggers
8. UI System
9. Animation, Animators
10. Nav meshes and sound systems
11. Brainstorming Design
12. Gathering art assets
13. Level Design
14. Prototyping
15. Software Engineering (the final step of the design)

CAP 4056 - Game Design and Development 2

- Course Description:

This course builds upon CAP 4052 (Game Design and Development I). It is a hands-on, group- and project-based course. Students will use several game design aspects, different game engines, and a variety of software development kits. The focus of this course will be mainly on the technical aspects of game development with non-trivial programming projects employing different computer interaction technologies and digital media sources.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]

- Prerequisite(s):

- CAP 4052 - Game Design and Development 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Tristen, Ben, Mike Geig. Sams Teach Yourself Unity Game Development second edition. Indianapolis: SAMS, 2016. Print. ISBN-13: 978-0-672-33751-2

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate mastery of relevant skills in their disciplines	a
Demonstrate creative design and problem-solving skills in an iterative design process	b
Develop a complete game	c
Demonstrate ability to collaborate in interdisciplinary teams, students will develop their skills in communication, team-based production, and project management	d
Assess both project outcomes and processes.	h

- Topics:

1. Review of Unity
2. Networking
3. Networking the Lobby
4. Network Spawning and animation
5. Network Player Object as non-game object
6. Networking and Internet Services
7. WAN Network
8. Augmented Reality – Basics (and design considerations)
9. Augmented Reality – advanced

CAP 4730 - Computer Graphics

- Course Description:

The objective of this course is to establish a foundation in two- and three- dimensional computer rendering algorithms and display devices. Topics included: Geometric transformations, homogeneous coordinates, anti-aliasing, color vision, ray tracing, surface modeling, texture mapping, polyhedral representations, and reflectance models.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]

- Prerequisite(s):

- COP 3530 - Data Structures & Algorithms **OR**
  (COP 4415 Data Structures **AND**
  COP 4531- Algorithm Design & Analysis)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner, and Kurt Akeley,"Computer Graphics: Principles and Practice", Third Edition, Pearson, 2014, ISBN-13: 978-0321399526

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Design an interactive graphics scene in standard graphics software and on standard graphics hardware.	b, c
Breakdown the graphics setup and infer the functionality of similar graphics environments.	b
Identify and recognize the limitations of current graphics environments, both hardware and software.	b,c
Demonstrate understanding of the mathematical foundations of graphics environments.	a

Demonstrate understanding of the data structures for efficient modeling and rendering of complex scenes of graphics environments.	c
Recognize the visual and artistic aspects of the graphics design process.	g

- Topics:

1. Introduction to Computer Graphics 2. 2D graphics using WPF
2. Rendering
3. Human Visual Perception
4. 3D Graphics
5. Essential Mathematics and Geometry 7. Describing shape
6. Functions on Meshes
7. Transformations in 2D and 3D
8. Camera Specifications and Transformations 11. Approximation and Representation
9. Ray Casting and Rasterization
10. Real-time 3D graphics platforms

Information Assurance & Cyber-Security Concentration

CIS 4203 - Digital Forensics

- Course Description:

This course introduces computer investigative techniques that can be used for legal purposes. It covers evidence collection procedures that extend beyond personal computers to mobile devices, networks and the cloud. Topics covered are: disk and file system analysis, Windows registry analysis, Linux system artifacts, memory analysis, network devices and server analysis, packet analysis, and internet and email analysis.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Kanwalinderjit Gagneja [kgagneja@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]

- Prerequisite(s):

- CNT 3004 - Introduction to Computer Networks
- CIS 4367 - Computer Security

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. The Basics of Digital Forensics: The Primer of Digital Forensics, by John Sammons, ISBN 978- 1-59749-661-2

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Describe what a digital investigation is, the sources of digital evidence, and the limitations of forensics.	b, c
Describe the legal requirements for use of seized data.	e, g
Describe the process of evidence seizure from the time when the requirement was identified to the disposition of the data.	e, g
Describe how data collection is accomplished and the proper storage of the original and forensics copy.	e, g
Identify anti-forensic methods.	i

- Topics:

1. Introduction to fundamental concepts in digital forensics Digital evidence, eDiscovery, Locard's Exchange Principle, expert witnesses
2. Standard Operating Procedures, File Extensions, file signatures, Memory –Formatting, Garbage, allocated, unallocated memory Labs & tools
3. Collecting Evidence
4. Principles and Practices
5. Password Cracking Windows System Artifacts
6. Antiforensics
7. Legal Principles for Digital Forensics
8. Internet and Email Forensics, Network Forensics

CIS 4204 - Ethical Hacking

- Course Description:

This course augments the CIS 4367 - Computer Security and CNT 4409 - Network Security courses by exploring the topic from the hacker's perspective. Latest hacking tools are explored and countermeasures are proposed. Topics covered: penetration testing, reconnaissance, scanning, exploitation, backdoors, rootkits, viruses, worms, packet sniffers, social engineering, phishing, Denial of Service.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]

- Prerequisite(s):

- CNT 3004 - Introduction to Computer Networks
- CIS 4367 - Computer Security

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "CEHv9 Certified Ethical Hacker Version 9 Study Guide", by Sean-Philip Oriyano, from WILEY. ISBN: 978-1119252245

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Recognize computer systems vulnerabilities.	b, c, e, g, i
Identify the various vectors of attacks on different computing platforms.	b, c, e, g, i
Practice penetration testing to isolated test networks and computer systems.	e, g, i

- Topics:

1. Ethical Hacking:Overview
2. System Fundamentals and Cryptography
3. Footprinting
4. Scanning
5. Enumeration
6. System Hacking
7. Malware and Sniffers
8. Denial of Services
9. Session Hijacking
10. Social Engineering and SQL Injections
11. Hacking WiFi and Bluetooth
12. Cloud Technology and Security
13. Physical Security

CIS 4362 - Applied Cryptography

- Course Description:

This course introduces cryptographic primitives and how they are implemented in applications. Topics covered include: symmetric-key encryption algorithms, public key encryption, digital signatures, and message integrity.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Navid Khoshavi Najafabadi [nkhoshavinajafabadi@floridapoly.edu]

- Prerequisite(s):

- STA 2023 - Statistics 1
- COP 3530 - Data Structures & Algorithms **OR**
  (COP 4415 - Data Structures **AND**
  COP 4531 - Algorithm Design & Analysis)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Stallings, W. (2017). Cryptography and Network Security: Principles and Practice (7th Ed.). Pearson Education. ISBN 9780134444282.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Describe the purpose of cryptography and list ways it is used in data communications.	a, i
Define the following terms: cipher, cryptanalysis, cryptographic algorithm, and cryptology, and describe the two basic methods (ciphers) for transforming plain text in cipher text.	a, b, c
Explain how public key infrastructure supports digital signing and encryption.	a, b, i
Describe real-world applications of cryptographic primitives and protocols.	a, b, i
Summarize security definitions related to attacks on cryptographic primitives, including attacker capabilities and goals.	a, b, i

- Topics:

1. Introduction to Cryptography and Data Security, Overview on the field of cryptography,
2. Symmetric cryptography, Cryptanalysis, historical ciphers.
3. Stream Ciphers. Introduction, Random numbers and unbreakable stream cipher, Shift register-based stream ciphers
4. Introduction to Data Encryption Standard (DES)
5. Overview of the DES algorithm, Encryption/decryption system using DES
6. Introduction to Advanced Encryption Standard (AES), Overview of AES algorithm, Encryption/decryption system using AES
7. Message Authentication Codes (MACs)
8. HMAC: a MAC from a hash function
9. Authenticated Encryption, Attacking Non-Atomic Decryption, disk encryption and credit card encryption
10. Public-Key Encryption, Symmetric vs. asymmetric cryptography, Computational number theory, The Diffie-Hellman Protocol, Fermat and Euler
11. Public Key Encryption from Trapdoor Permutations: RSA, Encryption and decryption, Key generation and proof of correctness
12. Public Key Encryption From Diffie-Hellman: ElGamal, The ElGamal Public-key System
13. The discrete logarithm problem

CIS 4367 - Computer Security

- Course Description:

This course covers security issues in different aspect of computing. Topics covered are: access control mechanisms, authentication models, and vulnerability detection. Attacks and mitigation methods at the OS level. Database and operating system security issues, mobile code, security kernels. Malicious code, Trojan horses and computer viruses. Security policy formation and enforcement.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]

- Prerequisite(s):
None.

- Co-requisite(s):

- CIS 4362 - Applied Cryptography
- COP 4610 - Operating Systems Concepts

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. William Stallings, and Lawrie Brown,"Computer Security: Principles and Practice", Third Edition, 2015, Pearson Education, ISBN-13: 978-0133773927

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify the basic concepts of computer security.	a, b, c, e, g
Analyze the tradeoffs of balancing key security properties (Confidentiality, Integrity, and Availability).	a, b, c, e, g
Describe the concepts of risk, threats, vulnerabilities and attack vectors (including the fact that there is no such thing as perfect security).	a, b, c, e, g, i
Explain the concepts of authentication, authorization, and access control.	a, b, c, e, g, i

- Topics:

1. Cryptographic Tools
2. User Authentication
3. Access Control
4. Database and Cloud Security
5. Malicious Software
6. Denial-of-Service Attacks
7. Intrusion Detection
8. Firewalls and Intrusion Prevention Systems

Software Engineering

CEN 4073 - Software Requirements Engineering

- Course Description:

This course covers software specification and requirements as well as software project management and how to effectively allocate resources. The course will provide the students with concepts of software requirement modeling, software requirements specification, prototyping requirements, testing and validating requirements, and requirements management. The students will practice managing a software project based on requirements and allocate resources.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]

- Prerequisite(s):
None.

- Co-requisite(s):

- CEN 4010 – Software Engineering

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Software and Systems Requirements Engineering In Practice", by Brian Berenbach, Daniel J. Paulish, Juergen Kazmeier, and Arnold Rudorfer, McGraw Hill, ISBN: 9780071605472.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Differentiate between types of software requirements	a, i, j
Design and create a software development and implementation plan based on user requirements.	a, b, c, i, j, k
Formulate strategies to elicit requirements from various stakeholders	a, f, g, i
Model software requirements using standard modeling languages	f, g, h, i, j, k
Develop software requirements specification	f, g, h, i, j, k
Assemble a team to construct a system development and implementation plan based on requirements and user needs.	d, e, f, g, h
Organize and manage requirements	f, i
Construct prototypes to capture and test requirements	a, b, c, d, f, j, k

- Topics:

1. Types of Requirements
2. Eliciting Requirements
3. Characteristics of Software Requirements
4. Modeling the Requirements
5. Requirements Specification
6. Quality Requirements (fit criteria)
7. Managing Requirements
8. Prototyping Requirements
9. Testing and validating requirements
10. Tracking a software engineering project
11. Estimating cost and size
12. Software Engineering Project personnel
13. Risk Management

CEN 4065 - Software Design and Architecture

- Course Description:

This course covers the engineering processes of building the software architecture and designing the software product according to design criteria. Software design is the process to define the characteristics of a software system. The course begins with design fundamentals, including concepts, context and processes. Then the software structure and architecture; user interface design and design quality analysis and evaluation are covered within the context of real-world challenges.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]

- Prerequisite(s):

- CEN 4073 - Software Requirements Engineering

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "P. Clements et al., Documenting Software Architectures: Views and Beyond", 2nd ed. Addison- Wesley Professional, 2010.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Understand general principles of software product design.	a, e
Understand elementary software design patterns.	e
Use specific software design notations.	a, k
Distinguish between different design methodologies.	e, j
Compose software design documents.	a, d, f, k

- Topics:

1. Software Design Fundamentals
2. Modeling Software Architectures
3. Architectural Design
4. Methodologies
5. Architectural Design Strategies
6. Architectural Views
7. Domain Modeling Techniques
8. Documenting Software Design
9. Design Quality Analysis and Evaluation
10. Design Tools

CEN 4070 - Software Verification and Quality Assurance

- Course Description:

This course introduces software verification and validation techniques with a particular focus on software testing. The course also provides students a comprehensive understanding of the software quality assurance and techniques used to assess software quality.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]

- Prerequisite(s):

- CEN 4073 - Software Requirements Engineering

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Mauro Pezze, Michael Young: Software Testing and Analysis: Process, Principles and Techniques, Wiley, ISBN 0471455938.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Build a basic foundation in software testing methods.	e
Understand quality assurance as a fundamental component of software life cycle	a, e
Explain differing approaches to performing V&V planning.	a, e, j
Identify the tasks necessary to accomplish different types of testing for a software system.	a, d, k
Specify an appropriate testing strategy for given software development activity.	a, d, f, k

- Topics:

1. Introduction to Software Verification and Validation
2. Software Quality Fundamentals
3. Software Quality Management Processes
4. Software Reliability
5. Software Testing Principles and Concepts
6. Software Testing Levels
7. Test Case Selection and Adequacy
8. Functional Testing
9. Combinatorial Testing
10. Structural Testing
11. Test-Driven Development

CEN 4724 - User Interface and User Experience

- Course Description:

This course covers software design rational, evaluation of User Interfaces, usability engineering, interaction styles, task analysis, user-centered design and prototyping, and measuring the software user experience.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]

- Prerequisite(s):

- CEN 4010 - Software Engineering

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Interaction Design: Beyond Human-Computer Interaction", 4th edition, by Rogers, Sharp, Preece, Wiley, ISBN: 978-1119020752

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Examine the psychological principles underlying effective user interfaces.	e, f, g
Judge and assess user interfaces using questionnaires, experiments, usability engineering and walkthroughs	a, b, c, j
Design effective conceptual models to help the user understand the system by employing task analysis	b, g, i
Practice user-centered design as part of the software engineering process	f, g, h, i, j
Compose User interfaces following scientific guidelines	d, e, f, g, h, k
Estimate the user experience of human computer interfaces	c, i, j, k

- Topics:

1. Introduction to HCI and human-centered design
2. User Interface Evaluation
3. Heuristic Evaluation
4. Interaction Design Process
5. Mental Models
6. Interaction Styles
7. Prototypes
8. Task Analysis
9. Measuring user experience

Computer Science Electives

CAP 4122 - Virtual Reality

- Course Description:

This course is to introduce students to the fundamentals of Virtual Reality (VR). The course topics include bird's eye view, VR geometry, lights and optics, psychology of human vision, visual perception, visual rendering, motion, tracking, interaction, audio, and evaluation and experience.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]

- Prerequisite(s):

- EEL 4768C - Computer Architecture and Organization
- CAP 4730 - Computer Graphics
- CEN 4721 - Human Computer Interaction

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR", Steve Aukstakalnis, Addison-Wesley Professional, 1 edition, 2017. ISBN-13: 978-0134094236

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Apply VR interaction techniques.	j
Develop VR environments.	k
Develop VR applications.	k

- Topics:

1. Introduction to VR and AR
2. Bird's Eye View
3. Geometric modeling, transforming rigid bodies, yaw, pitch, roll, axis-angle representation, quaternions, 3D rotation inverses and conversions, homogeneous transforms, transforms to displays, look-at and eye transforms, canonical view and perspective transforms, viewport transforms.
4. Light and Optics
5. The Physiology of Human Vision
6. Visual Perception
7. Visual Rendering
8. Motion in Real and Virtual Worlds
9. Tracking
10. Interaction
11. Audio

CAP 4410 - Computer Vision

- Course Description:

The course introduces how computers see and interpret the visual world and how this interpretation can be used to enhance game play experience. Topics covered: projections and coordinate systems, camera modeling, stereo vision, edge detection, filtering, segmentation, optical flow, motion vision, color vision, object representation, face recognition, object recognition.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]

- Prerequisite(s):

- MAS 3114 - Computational Linear Algebra **OR**
  MAS 3105 - Linear Algebra
- COP 3330C - Computer Programming 2
- COP 3530 - Data Structures & Algorithms **OR**
  (COP 4415 - Data Structures **AND** COP 4531 - Algorithm Design & Analysis)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Concise Computer Vision: An Introduction into theory and Algorithms", 2014 edition, by Reinhard Klette. ISBN: 978- 1447163190

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify basics concepts in image data.	a
Identify basics concepts in image processing and analysis	a
Apply image segmentation techniques.	i
Apply feature detection and tracking techniques.	i
Apply object detection techniques	i

- Topics:

1. Images and Fourier
2. Color
3. Tutorial Open CV
4. Smoothing, Sharpening, Edges (Basic) and Corners and Edges
5. Image Segmentation
6. Area, Length, Curvature
7. Pixel Labeling: Stereo Vision, Optic Flow, Photometric Stereo
8. Image Features
9. Feature Tracking
10. Kalman Filter

CAP 4612 - Machine Learning

- Course Description:

An overview of machine learning algorithms and their applications. Topics covered include: supervised and unsupervised learning, clustering and classification, linear and logistic regression, dimensionality reduction, support vector machines, anomaly detection.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]
- Dr. Feng-Jen Yang [fyang@floridapoly.edu]

- Prerequisite(s):

- STA 2023 Statistics 1
- MAS 3114 Computational Linear Algebra
- COP 3530 - Data Structures & Algorithms **OR**
  (COP 4415 Data Structures **AND**
  COP 4531- Algorithm Design & Analysis)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Introduction to Machine Learning", 3rd Edition, by Ethem Alpaydin. ISBN: 9780262028189.

- Reference(s):

1. "Machine Learning: Hands-On for Developers and Technical Professionals", 1st edition, by Jason Bell. ISBN: 9781118889060.
2. "Data Mining: Concepts, Models, Methods, and Algorithms", 2nd edition, by Mehmed Kantardzic. ISBN: 9781118029138.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
List the differences among the three main styles of learning: supervised, reinforcement, and unsupervised.	a,c

Contrast simple algorithms for supervised learning, reinforcement learning, and unsupervised learning.	b, c
Identify examples of classification tasks, including the available input features and output to be predicted.	a, k
Describe over-fitting in the context of a problem.	e
Evaluate the performance of a simple learning system on a real-world dataset.	a, k

- Topics:

1. Supervised Learning
2. Bayesian Decision Theory
3. Parametric Methods
4. Dimensionality Reduction
5. Clustering
6. Nonparametric Methods
7. Decision Trees
8. Multilayer Perceptrons
9. Kernel Machines
10. Hidden Markov Models
11. Reinforcement Learning

CAP 4830 - Modeling and Simulation

- Course Description:

The course will introduce the concepts of continuous and discrete event system simulation. The focus of the course will be discrete event simulation. In this course, the students will learn the basic definitions, Modeling and Simulation paradigms, design techniques, and applications.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]

- Prerequisite(s):

- COP 3330C - Computer Programming 2
- STA 2023 - Statistics 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Simulation Modeling and Analysis, Fifth Edition, Averill M. Law, McGraw-Hill, 2015

- Reference(s):

1. Discrete-Event System Simulation, 5th Edition, Jerry Banks, John S. Carson, II, Barry L. Nelson, David M. Nicol, Pearson, 2010.
2. AnyLogic in Three Days: a Quick Course in Simulation Modeling, Ilya Grigoryev, 2014.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate the understanding of M&S concepts, applications and development process life-cycle	a, c
Demonstrate the understanding of discrete event simulation	a, c
Demonstrate the understanding of continuous simulation	a, c
Construct a discrete event simulation for a given problem	j

- Topics:

1. Why M&S?
2. Modeling and Simulation
3. M&S Systems, Applications, Three methods in simulation
4. Discrete Event Simulation
5. Agent Based Modeling
6. Network Applications of ABM Review
7. Designing State-Based Behavior
8. Input Modeling
9. Randomness
10. Queueing
11. Output Analysis.
12. Verification & validation.

CEN 4088 - Software Security Testing

- Course Description:

This course introduces software testing with a focus on testing security flaws. Topics covered: secure software development lifecycle, web application testing, risk assessment, developing security policies for applications, threat analysis and application development vulnerabilities, exploitation testing, black-box testing.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]

- Prerequisite(s):

- CEN 4010 - Software Engineering

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Secure Software Development: A Security Programmer's Guide", by Jason Grembi. ISBN: 978-1-4180-6547-8.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Describe the requirements for integrating security into the software development lifecycle.	a, b, c, e
Apply the concepts of the Design Principles for Protection Mechanisms, the Principles for Software Security, and the Principles for Secure Design on a software development project.	a, b, c, i
Describe software development best practices for minimizing vulnerabilities in programming code.	i, k
Employ security verification and assessment of a software application.	i

- Topics:

1. Why You Need to Learn Secure Programming
2. Coding in SDLC
3. Principles of Security and Quality
4. Getting Organized: What to Do on Day One
5. Software Requirements
6. Designing for Quality
7. Designing for Security
8. Developments Tools
9. Developing Good Habits
10. Testing for Quality and Security
11. Maintain Your Software

CEN 4213 - Embedded Systems Programming

- Course Description:

The course focuses on the programming of embedded systems in diverse set of applications, environments, and settings. Topics include: Reading technical specifications for embedded systems, Embedded systems architectures, Low-level programming, Embedded systems development environments, communication protocols, and real-time operating systems.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]

- Prerequisite(s):

- COP 4415 - Data Structures
- EEL 4768C - Computer Architecture and Organization

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Introduction to Embedded Systems: Using ANSI C and the Arduino Development Environment," David Russell, Morgan & Claypool, 2010.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Differentiate between microprocessor and microcontroller	b
Formulate knowledge in embedded systems concepts	b, i
Describe the programming environment for embedded systems	a,i
Demonstrate the ability to build and debug specific applications for an embedded system.	c, i, j, k

- Topics:

1. Sensors and Actuators
2. Memory Architectures
3. Interfacing to Sensors and Actuators
4. Interrupts
5. Multitasking
6. Scheduling
7. Model-Based Design
8. Dynamic modeling
9. State Machines

CEN 4721 - Human Computer Interaction

- Course Description:

This course surveys the many techniques humans interact with computers and mobile devices i.e. physical buttons, touch screens, speech, eye gaze, gestures, and game controllers. Topics included: creating and improving user-centric interfaces, interactive design processes, and sensing and recognizing activities of people by a computer.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]

- Prerequisite(s):

- COP 2271C - Introduction to Computation and Programming
- COP 3530 - Data Structures & Algorithms **OR**
  (COP 4415 - Data Structures **AND**
  COP 4531 - Algorithm Design & Analysis)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Interaction Design: Beyond Human-Computer Interaction", Fourth Edition by Jennifer Preece, Helen Sharp, Yvonne Rogers, ISBN: 978-1119020752

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	**ABET student outcomes**
Describe the nature of human-computer interaction (HCI).	a, b
Identify the key elements of HCI design.	b, i
Develop criteria to test and analyze the effectiveness of HCI design.	j
Apply principles of software engineering to HCI design and development.	j, k
Develop HCI computer models and prototypes; develop an HCI project from requirements through implementation; conduct an HCI project evaluation and prepare a project report.	j, k

- Topics:

1. HCI Intro, Interaction Design
2. Understanding and Conceptualizing Interaction
3. Cognitive Aspects
4. Social Interaction
5. Emotional Interaction
6. Interfaces
7. Data Gathering
8. Data Analysis, Interpretation, And Presentation
9. The process of Interaction Design
10. Establishing Requirements
11. Design, Prototyping, And Construction
12. Interaction Design in Practice
13. Introduction Evaluation
14. Evaluation Studies
15. Evaluation: Inspections, Analytics, And Models

CIS 4369 - Web Application Security

- Course Description:

This course's main focus is on securing web-based communications and applications. The security vulnerabilities involved in applications such as e-commerce that are based on communicating sensitive data over the Internet is covered. Securing the web client, the communication channel, and the web servers such as Apache and IIS is reviewed in detail. In addition, the inner working of SSL is discussed and its set up is practiced.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]

- Prerequisite(s):

- CIS 4362 - Applied Cryptography

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Internet Security: How to Defend Against Attackers on the Web, Second Edition", 2nd ed, by Mike Harwood. ISBN: 9781284090550.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Describe the browser security model.	a,c,e
Discuss the concept of web sessions, secure communication channels such as TLS and importance of secure certificates, authentication including single sign-on such as OAuth and SAML.	a,b, c,e, i
Describe common types of vulnerabilities and attacks in web applications, and defenses against them.	a, b, c, e, g, i
Use client-side security capabilities in an application.	j, k

- Topics:

1. Mainframe to Client / Server to World Wide Web
2. Security Considerations for Small Businesses
3. Security Considerations for Home and Personal Online Use
4. Mitigating Risk When Connecting to the Internet
5. Mitigating Web Site Risks, Threats, and Vulnerabilities
6. Introducing the Web Application Security Consortium (WASC)
7. Securing Web Application
8. Mitigating Web Application Vulnerabilities
9. Maintaining PCI DSS Compliance for E- commerce Web Sites
10. Testing and Quality Assurance for Production Web Sites
11. Performing a Web Site Vulnerability and Security Assessment

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CNT 4409 - Network Security

- Course Description:

The course introduces networks security tools and techniques. Topics covered are: hardware and software network security tools, firewalls, attacks and mitigation at the network level, authentication, intrusion detection, network vulnerability analysis, threat and risk assessment.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]

- Prerequisite(s):

- CIS 4362 - Applied Cryptography
- CNT 3004 - Introduction to Computer Networks

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Network Security Essentials Applications and Standards", 5th edition, by Williams Stallings. ISBN: 978-0133370430.

- Reference(s):

1. J. F. Kurose and K. W. Ross, "Computer Networking: A Top-Down Approach", Addison Wesley, 6th Edition, ISBN: 978-0132856201.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Describe the different categories of network threats and attacks.	a, b, c, e
Describe virtues and limitations of security technologies at each layer of the network stack.	a, b, c, e
Identify the appropriate defense mechanism and its limitations given a network threat.	a, b, c, e, i

- Topics:

1. The OSI Security Architecture
2. Security Attacks
3. A Model for Network Security
4. Key Distribution and User Authentication
5. Network Access Control and Cloud Security
6. Transport-Level Security
7. Wireless Network Security
8. Electronic Mail Security
9. IP Security
10. Malicious Software
11. Intruders
12. Firewalls

CNT 4526 - Wireless and Mobile Networking

- Course Description:

This course will introduce students to wireless and mobile network architecture, protocols, and technologies. The course will cover topics including cellular networks, Wi-Fi, Bluetooth, ZigBee, etc

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]

- Prerequisite(s):

- COP 4531 - Algorithm Design & Analysis
- CNT 3004 - Introduction to Computer Networks

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Wireless Networking Complete", Pei Zheng , Larry L. Peterson, Bruce S. Davie, Adrian Farrel, Morgan Kaufmann Series in Networking, 1st Edition, 2009

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify the architecture for some of the cutting- edge wireless technologies.	a, b
Demonstrate understanding of mobile IP	a, b, c
Analyze the performance of wireless networks	a, b, c, i
Apply distributed algorithms and protocols.	a, b, c

- Topics:

1. Multiple Access
2. Mobile IP
3. Wireless WANs
4. Wireless LANs
5. Ad Hoc and Sensor Network
6. Wireless MANs
7. Wireless PANs

COP 2034C - Introduction to Programming Using Python

- Course Description:

This course is an introduction to computational thinking and the art of computer programming using Python. Students will learn fundamental programming concepts and systematic design techniques. They will use them to write programs that computationally solve and reduce problems. At the end of the course, students will be able to use a programming language without focusing on the language specifics. No prior programming background is required and a working knowledge of high school level algebra is expected.

- Credits: 3 cr
- Lecture: 2 cr
- Lab: 1 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]
- Dr. Kanwalinderjit Gagneja [kgagneja@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]
- Mrs.Mouna Kettani [mkettani@floridapoly.edu]
- Dr. Navid Khoshavi Najafabadi [nkhoshavinajafabadi@floridapoly.edu]
- Mr. Christian Navarro [cnavarro@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]
- Dr. Ricardo Rangel [rrangel@floridapoly.edu]
- Dr. Mohammad Samarah [msamarah@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]
- Dr. Feng-Jen Yang [fyang@floridapoly.edu]

- Prerequisite(s):

- MAC 2311 - Analytic Geometry and Calculus 1

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Cay S. Horstmann and Rance D. Necaise,"Python for Everyone", Wiley, 2016, 2nd edition, ISBN-13: 978-1119056553

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify and describe basic programming concepts.	a, b, c
Write small programs employing basic programming constructs, such as primitive data types and literals, operations, expressions and statements, logical decisions, and loops.	a, b, c, i
Solve computational problems by reducing them into multiple algorithms using fundamental design techniques, such as abstraction and program decomposition.	a, b, c
Compare computational efficiency of different algorithms that solve the same problem.	a, b, c
Develop a systematic approach to organize, write, and test a computer program	a, b, c, i

- Topics:

1. Introduction
2. Programming with Numbers and Strings
3. Decisions
4. Loops
5. Functions
6. Lists
7. Files and Exceptions
8. Recursion
9. Sorting and Searching

COP 3530 - Data Structures & Algorithms

- Course Description:

The course introduces program run-time analysis and algorithm design and analysis. Topics include: data abstraction principals, serial and parallel data structures, linked lists, graphs, trees, divide and conquer algorithms, greedy algorithms, and linear programming.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]
- Dr. Navid Khoshavi Najafabadi [nkhoshavinajafabadi@floridapoly.edu]

- Prerequisite(s):

- COP 2272C - Computer Programming 1
- MAD 2104 - Discrete Mathematics

- Co-requisite(s):

None.

- Co-requisite(s) or Prerequisite(s):

None.

- Textbook(s):

1. "Data Structures and Algorithms in C++", 4th Edition, by Adam Drozdek, Cengage Learning, ISBN: 9781133608424.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Explain what is meant by "best", "expected", and "worst" case behavior of an algorithm.	a, b, c
Calculate informally the time and space complexity of simple algorithms.	a, b, c
Identify a practical example for each of the strategies (brute-force, greedy, divide-and-conquer, recursive backtracking, and dynamic programming).	a, b, c
Discuss the runtime and memory efficiency of principal algorithms for sorting, searching, and hashing.	a, b, c
Demonstrate the ability to evaluate algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in a particular context.	a, b, c, i

- Topics:

1. Review of Object-Oriented Programming Using C++
2. Complexity Analysis
3. Recursion
4. Linked Lists
5. Sorting
6. Stacks and Queues
7. Trees
8. Hashing
9. Graphs

COP 3834C - Web Application Development

- Course Description:

Topics include: Client-side programming, distributed transactions, remote procedure calls, component objects, server side programming and network load balancing. Methods such as HTML5, CSS, JavaScript, XML, PHP, Python, and Ruby Rails are introduced.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]

- Prerequisite(s):

- COP 2271C - Introduction to Computation and Programming

- Co-requisite(s):

None.

- Co-requisite(s) or Prerequisite(s):

None.

- Textbook(s):

1. Fundamentals of Web Development, 1st Edition, © 2015 by Randy Connolly & Ricardo Hoar, published by Pearson, 1024 pages Print ISBN: 9780133407150

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Design layout and create web pages using HTML.	a, b, c, f, i, k
Create cascading style sheets to control display of content.	a, b, c, f, i, k
Create and process forms to transfer information to and from a web server.	a, b, c, f, i, k
Design and create XML documents and code simple document type definitions and schemas.	a, b, c, f, i, k
Practice the implementation of PHP, JavaScript and RubyRails for client and server-side programming.	a, c, c, f, i, k
Choose and implement appropriate tools for a given web development task based on requirements.	b, i
Design, plan and create a web application working in teams.	d
Recognize the need for continued professional and educational development.	h
Demonstrate an ability to analyze local and global impacts of web based technology on individuals, organizations, and society.	g

- Topics:

1. Introduction to the course
2. Introduction to HTML
3. Introduction to CSS
4. Advanced CSS: Layout
5. JavaScript
6. XML Processing and Web Service
7. PHP

COP 4520 - Introduction to Parallel and Distributed Computing

- Course Description:

The course introduces concepts of parallel algorithms analysis and implementation. Topics covered: shared memory model, distributed memory model, concurrency, synchronization, message passing interface (MPI), heterogeneous parallel programming, GPU programming.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]
- Dr. Mohammad Samarah [msamarah@floridapoly.edu]

- Prerequisite(s):

- (EEL 4768C - Computer Architecture and Organization **OR**
  CDA 3100 - Computer Architecture
- COP 3530 - Data Structures & Algorithms **OR**
  (COP 4415 - Data Structures **AND**
  COP 4531 - Algorithm Design & Analysis)

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things 1st Edition, by K. Hwang, J. Dongarra, G. C. Fox
2. Parallel and Distributed Computing: Architectures and Algorithms, by Basu, S. K. January 2, 2016 Phi Learning Pvt. Ltd.
3. MPI: A Message-Passing Interface Standard Version 3.0, September 21, 2012, Message Passing Interface Forum, University of Tennessee, Knoxville, Tennessee, published by High-Performance Computing Center Stuttgart, Germany
4. A User's Guide to MPI, Peter S. Pacheco, University of San Francisco, March 30, 1998

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Distinguish between sequential and parallel execution and the performance implications.	a, b, c
Explain the differences between shared and distributed memory.	a, b, c, i

Define the differences between the concepts of Instruction Parallelism, Data Parallelism, Thread Parallelism/Multitasking, Task/Request Parallelism.	a, b, c, i
Write more than one parallel program (e.g., one simple parallel program in more than one parallel programming paradigm; a simple parallel program that manages shared resources through synchronization primitives; a simple parallel program that performs simultaneous operation on partitioned data through task parallel (e.g., parallel search terms; a simple parallel program that performs step-by-step pipeline processing through message passing)	a, b, c
Write a correct and scalable parallel algorithm.	a, b, c

- Topics:

1. Systems Modeling, Clustering, and Virtualization
2. MPI and parallel programming algorithms
3. Computing Clouds, Service-Oriented Architecture, and Programming
4. Grids, P2P, and the Future Internet

COP 4620 - Compilers and Interpreters

- Course Description:

This course introduces students to the theory of programming language processors. The topics will cover: organization of translators, grammars and languages, symbol tables, lexical analysis, syntax analysis, error handling, code generation, optimization, and interpretation.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]

- Prerequisite(s):

- COP 4415 - Data Structures

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Compilers: Principles, Techniques, and Tools", S. Aho, M. Lam, J. Ullman, and R. Sethi, 2nd edition, 2011.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective
- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate an understanding of the theory and application of compiler design.	a, b, c
Construct a compiler for a specific programming language.	a, b, c, i, k
Write the grammar for a new programming language.	a, b, c
Demonstrate understanding of compiler construction tools	a, b, c, i

- Topics:

1. A Simple Syntax-Directed Translator
2. Lexical Analysis
3. Syntax Analysis
4. Syntax-Directed Translation
5. Intermediate-Code Generation
6. Run-Time Environments
7. Code Generation
8. Machine-Independent Optimizations
9. Instruction-Level Parallelism
10. Optimizing for Parallelism and Localit
11. Interprocedural Analysis

COP 4656 - Mobile Device Applications

- Course Description:

This course covers the evaluation, design, and creation of mobile device software. Mobile application genres and the various development tools, languages, and environments are also covered.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]

- Prerequisite(s):

- COP 3330C - Computer Programming 2

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. "Android Programming Concepts, Includes Navigate 2 Advantage Access", by Trish Cornez and Richard Cornez. ISBN-13: 9781284070705.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective
- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Define mobile device hardware, mobile application development, native code concepts	a, b, c
Differentiate rapid application development, native code and managed code development concepts for mobile devices	a, b, c, i
Analyze impact of mobile device applications on the environment, industry or society.	a, b, c, g

- Topics:

1. Java Programming Concepts
2. Introduction to Android
3. Building User Interfaces and Basic Applications
4. Activities and Intents
5. Fragments, Action Bar, and Menus
6. Graphics, Drawing, Audio
7. Threads, Handlers, and Programmatic Movement
8. Touch Gestures
9. Sensors and Camera
10. File Storage, Shared Preferences, SQLite

COP 4930 - Special Topics

- Course Description:

A comprehensive study on selected advanced topics in Computer Science.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Muhammad Rizwan Abid [mabid@floridapoly.edu]
- Dr. Mustafa Ilhan Akbas [makbas@floridapoly.edu]
- Dr. Youssif Al-Nashif [yalnashif@floridapoly.edu]
- Dr. Dean Bushey [dbushey@floridapoly.edu]
- Dr. Wei Ding [wding@floridapoly.edu]
- Dr. Karim Elish [kelish@floridapoly.edu]
- Dr. Kanwalinderjit Gagneja [kgagneja@floridapoly.edu]
- Dr. Abdelwahab Hamam [ahamam@floridapoly.edu]
- Dr. Luis Jaimes [ljaimes@floridapoly.edu]
- Mrs.Mouna Kettani [mkettani@floridapoly.edu]
- Dr. Navid Khoshavi Najafabadi [nkhoshavinajafabadi@floridapoly.edu]
- Dr. Ashokkumar Patel [apatel@floridapoly.edu]
- Dr. Ricardo Rangel [rrangel@floridapoly.edu]
- Dr. Mohammad Samarah [msamarah@floridapoly.edu]
- Dr. Bradford Towle Jr. [btowle@floridapoly.edu]
- Dr. Feng-Jen Yang [fyang@floridapoly.edu]

- Prerequisite(s):

- CEN 4010 - Software Engineering

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Demonstrate proficiency in the selected topic	

EEL 4664 - Autonomous Systems and Robotics

- Course Description:

This course is a project-based intensive semester program, with an integrated introduction to robotics, autonomy, real-time operating systems, and systems engineering. Students specify and design a small-scale yet complex robot capable of real-time interaction with the natural world. Topics covered include embedded systems control, computer vision, localization and planning, mapping algorithms, and sensor integration into real-time operating systems. Students design, assemble, and program a scale-model autonomous, self-driving vehicle. They learn to integrate and program radar sensors, visual sensors, inertial sensors, and GPS mapping, in a series of project challenges: Obstacle detection and wall following, visual servoing, mapping and localization, and motion planning. The final exam is a capstone demonstration of all accomplishments and is a Grand Prix time trial, race, and presentation by the students. Students engage in extensive written and oral communication exercises. Enrollment limited.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Dean Bushey [dbushey@floridapoly.edu]

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. N/A

- Course Designation as Required, Elective, or Selected Elective: Select Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Design and conduct experiments as part of an engineering team to solve problems	a, d
Practice effective communication.	g
Design a complex system	c
Use modern engineering tools and techniques	k

- Topics:

1. Introduction
2. Build integrated Systems
3. Embedded Systems Control
4. Perception 1: Computer Vision
5. Perception II: Localization
6. Perception III: Mapping and SLAM
7. Planning I: Complete Algorithms
8. Planning II: Practical Algorithms
9. Advanced Topic: Machine Learning
10. Advanced Topic: Advanced Perception
11. Advanced Topics

Arts and Humanities

ARH 2000 - Art Appreciation

- Course Description:

Introduction to the artistic experience through the examination of different ideas, approaches and purposes of art.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Vicki Lowe

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Perceiving the Arts: An Introduction to the Humanities, 11/E, Dennis J. Sporre, Elon University, ISBN-10: 020599511X, ISBN-13: 9780205995110, 2015, Pearson

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify formal elements of art styles, art functions, and content of art works.	g
Identify and define the principles of design organization and application.	g
Explain the influence of philosophy, religion, socio-political organization on different art forms.	g
Describe and analyze art works using theoretical knowledge and practical experience.	g

- Topics:

1. Introduction to the Arts
2. Two Dimensional Arts
3. Three Dimensional Arts
4. Architecture
5. Art History Video Production includes options: Writing, Narration, Acting, Music, Dance, Filming, Set Design, Historical, Cultural, & Religious Research.

PHI 2010 - Introduction to Philosophy

- Course Description:

This course is an introduction to the nature of philosophy, philosophical thinking, major intellectual movements in the history of philosophy, and specific problems in philosophy.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

-

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Adler, Mortimer. (1978). Aristotle for Everybody. Macmillan: Touchstone. 9780684838236.
2. Collins, J. and H. Selina. (1999). Introducing Heidegger. Icon Books. 2nd Edition. 9781840460889.
3. Kreeft, Peter. (2014). Philosophy 101 by Socrates. St. Augustine Press. 9781840460889.

- Course Designation as Required, Elective, or Selected Elective: Required

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Learn a brief history of philosophy.	g
Sharpen your critical thinking skills by studying some of the best arguments of the best philosophical thinkers in the west.	g
Comment on and critique this material.	g
Learn to question the priority of different values.	g

- Topics:

1. What is Philosophy? Job, Solomon, Homer, Socrates
2. Human Nature; Groups
3. Nature of Reality
4. Plato's Cave; History of Philosophy
5. God
6. Problems: Time;Freedom; Religious Experience
7. Knowledge
8. Truth
9. Logic
10. Personal Ethics
11. Social Ethics
12. The Meaning of Life
13. 20th Century

Social Sciences

AMH 2010 - American History to 1877

- Course Description:

This course will survey American history from just prior to the initial exploration and settlement of the Americas to the period of Reconstruction. The course will discuss the English colonies in North America; the American Revolution; the United States Constitution; Antebellum America; the American Civil War; and Reconstruction.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Amanda Bruce

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Foner, Eric. Give Me Liberty! An American History. Seagull Fifth Edition, Volume 1: From 1865. W.W. Norton and Company, 2017.
2. Foner, Eric. Voices of Freedom: A Documentary History. Volume 1, Fifth Edition. W.W. Norton and Company, 2017

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify, understand, and analyze the central ideas of primary and secondary sources.	g
Synthesize information gleaned from a variety of primary and secondary sources to develop original arguments in formal writing assignments.	g
Work individually and collaborate with other students to produce original work that articulates historical understanding of key course concepts.	d
Describe and analyze historical patterns within American history and construct a coherent argument that explains the social, economic, political, and/or cultural reasons for historical change.	g

- Topics:

1. America before Columbus
2. God, Gold and Glory: European Exploration and Colonization of the Americas Textbook
3. England's Failed Conquistadors: Jamestown and Virginia
4. The City on a Hill: The Puritans and New England
5. Many Origins: The Expansion of English America
6. The Colonies Mature: The Anglicization and "Normalization" of America
7. The Forced Founders: The Rise of African Slavery
8. The Colonies Mature II: Politics and Thought in Colonial America
9. The Roots of Discontent: Empire and Protest
10. Deposing a King: From Protest to Revolution
11. The Radicalism of the American Revolution: Politics in an Age of Revolution
12. The Limits of Freedom: Loyalists, Natives Americans, Women, and Slaves
13. Original Meanings: Federalism, Anti-Federalism, and the Constitution
14. The Age of Federalism: The Founding Fathers Fight over the Meaning of America
15. The "Revolution" of 1800: The Triumph of Jeffersonian Republicanism
16. What Hath God Wrought: The Market Revolution of the 1800s
17. Jacksonian Democracy: (White) Americans Learn to Play Politics
18. The Antebellum South I: Life in a Slave Society
19. The Antebellum South II: Slave Life
20. Reforming Americans I: From Mormons to Temperance
21. Reforming Americans II: Abolitionists and Feminists
22. "Like a Fire Bell in the Night:" The Origins of Sectional Tension
23. The Union Fails: The Rise of the Republican Party and Secession
24. The Civil War I: The Second American Revolution?
25. The Civil War II: The Battle Cry of Freedom

AMH 2020 - The United States Since 1877

- Course Description:

This course presents a survey of the emergence of modern America as an industrial world power. The Progressive Era, WWI, the Great Depression and the New Deal, WWII, and the Cold War era will be discussed.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Amanda Bruce

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Foner, Eric. Give Me Liberty! An American History. Seagull Fifth Edition, Volume 2: From 1865. W.W. Norton and Company, 2017.
2. Foner, Eric. Voices of Freedom: A Documentary History. Volume 2, Fifth Edition. W.W. Norton and Company, 2017.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify, understand, and analyze the central ideas of primary and secondary sources.	g
Synthesize information gleaned from a variety of primary and secondary sources to develop original arguments in formal writing assignments.	g
Work individually and collaborate with other students to produce original work that articulates historical understanding of key course concepts.	d
Describe and analyze historical patterns within American history and construct a coherent argument that explains the social, economic, political, and/or cultural reasons for historical change.	g

- Topics:

1. Reconstruction
2. African-Americans and the New South
3. Industrialization and workers in the Gilded Age
4. Building an American Empire
5. Conquering and incorporating the West
6. The impact of immigration, urbanization and industrialization
7. Progressive reform
8. Race and Progressive Reform
9. Woman suffrage and women's rights
10. World War I
11. Debating the U.S. character
12. The Depression and the New Deal
13. Evaluating the New Deal
14. America and the world: WWII
15. WWII's impact at home
16. Early Cold War strategy
17. The Second Red Scare/Domestic containment
18. Cold War policies and challenges
19. The Civil Rights Movement
20. The Great Society
21. Vietnam
22. 2nd wave feminism
23. Social justice movements
24. America's crisis of confidence
25. The new conservative movement
26. The Reagan Revolution: domestic policies
27. The Reagan Revolution: foreign policy

AMH 2930 - American Popular Culture

- Course Description:

This course examines the history of American popular culture, from the nineteenth century to the early twenty-first century. Studying popular culture provides a fascinating window into larger developments in American History, including urbanization and immigration, racial segregation and challenges to it, and the growth of monopolies. This course sheds light on a history of conflict associated with race, class, gender and ethnic differences while also examining how popular culture contributes to a common American culture.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Amanda Bruce

- Prerequisite(s):

None.

- Co-requisite(s):

None.

- Co-requisite(s) or Prerequisite(s):

None.

- Textbook(s):

1. Major Problems in American Popular Culture, edited by Kathleen Franz and Susan Smulyan. Published by Wadsworth Cengage Learning, 2012.
2. Additional articles accessed through university databases and additional primary sources through on-line sites.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Identify, understand, and analyze the central ideas of primary and secondary sources.	g
Synthesize information gleaned from a variety of primary and secondary sources to develop original arguments in formal writing assignments.	g
Work individually and collaborate with other students to produce original work that articulates historical understanding of key course concepts.	d
Describe and analyze historical patterns within American history and construct a coherent argument that explains the social, economic, political, and/or cultural reasons for historical change.	g

- Topics:

1. What is popular culture?
2. P.T. Barnum and the Rise of Urban Amusements
3. Creating and Separating Nineteenth-Century Audiences
4. Minstrelsy and Making Whiteness
5. Working-class Women and Urban Amusements
6. U.S. Imperialism in Popular Culture
7. Coney Island and the Growth of Mass Culture
8. Sports and the Color Line
9. Film and Working-Class Audiences
10. Reforming the Movies
11. Jazz and its Audiences
12. The Commercial Development of Radio
13. Radio and its Audiences
14. Consolidating Popular Culture
15. World War II's Impact on Popular Culture
16. Early Television and Conformity
17. The Juvenile Delinquency Panic
18. Youth and Popular Culture
19. Movies and the End of the Production Code
20. The Politics of 1960s Gay Consumer Culture
21. Pressure Groups Reform Television
22. Hip-Hop and American Popular Culture
23. Women and Popular Music
24. Constructing Masculinity through Popular Culture
25. Regulating Video Games for Children
26. New Media and Popular Culture

PSY 2012 - General Psychology

- Course Description:

An introduction to the basic principles, theories, and methods of psychology surveying the various areas of psychology.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

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- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Psychology: From Inquiry to Understanding (3rd edition) by Lilienfeld, Lynn, Namy, and Woolf (2013)

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Articulate the definition of psychology and distinguish it from other disciplines	g
Describe the steps of the scientific method, including its means for scientific thinking	g
Explain empirical research methods and understand how to read psychological research literature	g
Recognize and assess the importance of major concepts associated with the content areas of biology, brain functioning, learning, memory, lifespan development, intelligence, language/thinking, emotion, motivation, health/wellness, personality theories, and social phenomenon	g
Identify common mental disorders and approaches to clinical treatment	g

- Topics:

1. Psychology and Scientific Thinking
2. Research Methods
3. Biological Psychology
4. Sensation and Perception
5. Consciousness
6. Learning
7. Memory
8. Thinking, Reasoning, and Language
9. Intelligence and IQ Testing
10. Human Development
11. Emotion and Motivation
12. Stress, Coping, and Health
13. Social Psychology
14. Personality
15. Psychological Disorders
16. Psychological and Biological Treatments

ECO 2013 - Principles of Macroeconomics

- Course Description:

This course presents the nature of economic aggregates such as investment, employment, and price levels. The interrelationship of business and government policies; applicability of economic theory to the problems of business forecasting cyclical fluctuations and long-term economic trends are also examined.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Jim Dewey

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Paul Krugman and Robin Wells. 2012. Macroeconomics, 3e. ISBN: 9781429283434.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Apply supply and demand analysis to the determination of key macroeconomic variables.	g
Define real and nominal key macroeconomic variables and understand their calculation.	g
Understand the major determinants of long run economic growth.	g
Determine how changes in key variables impact the economy in the short-run using aggregate demand and aggregate supply.	g
Analyze how changes in fiscal and monetary policy can affect the economy.	g

- Topics:

1. First Principles
2. Economic Models: Trade-offs and Trade
3. Graphs in Economics
4. Supply and Demand
5. Price Controls and Quotas: Meddling with Markets
6. International Trade
7. Consumer and Producer Surplus
8. Introduction to Macroeconomics
9. Macroeconomics: The Big Picture
10. Tracking the Macroeconomy
11. Unemployment and Inflation
12. Long-Run Economic Growth
13. Savings, Investment Spending, and the Financial System
14. Income and Expenditure
15. Deriving the Multiplier Algebraically
16. Aggregate Demand and Aggregate Supply
17. Fiscal Policy
18. Taxes and the Multiplier
19. Money, Banking, and the Federal Reserve System
20. Monetary Policy
21. Reconciling Two Models of the Interest Rate

ECO 2023 - Principles of Microeconomics

- Course Description:

Theories of production, determination of prices and distribution of income in regulated and unregulated industries are discussed. Attention is also given to industrial relations, monopolies and comparative economic systems.

- Credits: 3 cr
- Lecture: 3 cr
- Lab: 0 cr

- Instructor(s):

- Dr. Jim Dewey

- Prerequisite(s):
None.

- Co-requisite(s):
None.

- Co-requisite(s) or Prerequisite(s):
None.

- Textbook(s):

1. Timothy Taylor et al. Principles of Microeconomics. OpenStax College, Rice University. ISBN: 9781938168246.

- Course Designation as Required, Elective, or Selected Elective: Selected Elective

- Learning Outcomes:

Course Learning Outcomes	ABET student outcomes
Use supply and demand analysis to analyze the impact of key economic variables on market outcomes.	g
Analyze resource allocation in highly competitive markets.	g
Identify and analyze the impact of increased producer market power on market outcomes.	g
Analyze cases where competitive markets fail to allocate resources efficiently, including externalities and public goods.	g

- Topics:

1. Introduction and Scarcity
2. Demand and Supply
3. Elasticity
4. Consumer Behavior
5. Cost Structure
6. Highly Competitive Markets
7. Monopoly
8. Imperfect Competition
9. Antitrust Policy
10. Externalities and Public Goods
