# UCSC EXTENSION - FALL 2026 COURSE CATALOG

This catalog was generated on September 19, 2025 and the information contained in it is deemed accurate as of that date. We recommend referring to our website for the most up to date information.

# CERTIFICATES

# BIOINFORMATICS

Cost: Starting at $5,480.
Required Credits: 6–7 courses (minimum 18 quarter units). Take 4 required courses (12 quarter units) and 2–3 elective courses (minimum 6 quarter units). End with certificate of completion review.
Duration: A full-time student can complete the certificate in 12 months.

## Certificate Description

Build your computational and scientific foundation

Big data is everywhere and its presence across multiple industries will continue to stimulate job growth in pharma, biotech, and software industries. This certificate program is designed in consultation with industry leaders to meet the need for biologists and computer scientists to analyze and interpret today's deluge of biological information. Tailor your studies to your particular needs and interests while learning the tools and methods of bioinformatics. Life scientists delve into data tech and computer scientists gain a background in molecular biology.

Bioinformatics certificate program objectives

Use public domain bioinformatics tools, including Genbank and the Protein Data Bank (PDB).

Employ statistical design of experiment (SDOE) to analyze experimental data and factors affecting outputs.

Distinguish key molecular biology techniques—gene cloning, manipulation and sequencing; PCR; RNA interference; and gene expression analysis.

Complete a computational biology project using Java.

Recognize sequence analysis techniques such as Hidden Markov Models and RNA analysis.

Query and read DNA sequences from Fasta files.

**Accompanying lecture slides**

## Courses

### *1. Required Courses(s): Four Total & Equal to 12 Units*

Bioinformatics Tools, Databases and Methods | BINF.X400, 3.0 Units
Experimental Methods in Molecular Biology | BINF.X401, 3.0 Units
Next-Gen Sequence Analysis Tools - A Hands-On Approach | BINF.X405, 3.0 Units
Python for Data Analysis | DBDA.X420, 3.0 Units

### *2. Electives: Total of Six Units*

Data Analysis, Introduction | DBDA.X404, 3.0 Units
Data and Workflow Management for Bioinformatics | BINF.X410
Gene Therapy: Hacking the Genome | BINF.X409, 1.5 Units
Genomics and Next Generation DNA Sequencing: Methods and Applications | BINF.X408, 3.0 Units

Machine Learning and AI in Bioinformatics | BINF.X411, 3.0 Units
Principles of Drug Discovery and Development | CTDM.X417
Relational Database Design and SQL Programming | DBDA.X415, 3.0 Units
Statistics | BUSM.X406, 3.0 Units

### *3. Completion Review:*

Bioinformatics Certificate Completion Fee | O-CE0060

### *4. Related Course(s) (Not Part of Certificate Program)*

Personal Development Seminar: Concepts in Next-Gen Sequence Analysis | BINF.800, 0.5 CEU's

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken the necessary prerequisites or meet the requirements through job experience or previous education. You can learn more about each course in **the Syllabus Library** . Molecular biology knowledge Familiarity with the principles of modern molecular biology is required to begin the Bioinformatics certificate. You can satisfy this requirement with an introductory course in molecular biology (taken within the last five years) or by demonstrating equivalent work experience. Statistics knowledge UCSC Extension offers Statistics . Programming knowledge Basic familiarity with the Python programming language is required to begin the Bioinformatics certificate. You can satisfy this requirement with an introductory course in Python (taken within the last five years) or by demonstrating equivalent work experience. UCSC Extension offers Python Programming for Beginners . Genomics and next Generation DNA sequencing knowledge Basic familiarity with genomics and next generation DNA sequencing is required for **Next-Gen Sequence Analysis Tools—a Hands-On Approach** . You can satisfy this requirement with a similar course or by demonstrating equivalent work experience. UCSC Extension offers **Genomics and Next Generation DNA Sequencing: Methods and Applications** .

## Recommend Course Sequence

After completing the prerequisites, it is recommended that you start with **Next-Gen Sequence Analysis Tools—a Hands-On Approach** and **Experimental Methods in Molecular Biology .** Courses may then be taken in any sequence, unless otherwise specified in the individual course description.

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence you may request your Bioinformatics Certificate Completion Review .

# BUSINESS ADMINISTRATION

Cost: $5,125–$6,500 + Estimated Books & Materials: $750
Required Credits: 7–10 courses (minimum 19 quarter units). Take 5 required courses (13 quarter units) and 2–5 elective courses (6 quarter units). End with certificate of completion review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Build the foundation of successful leadership

Our program builds on the huge body of science underlying the latest best practices for management. You will gain practical skills to handle the day-to-day aspects of running a business and study evidence-based methods to maximize company performance. Network with industry professionals who teach facilitation, negotiation, coaching, and how to help employees carry out a unified vision. Choose elective courses from the following areas:

**Business Essentials**

**Financial Analysis/Accounting**

**Management Development**

**Marketing Business Development**.

Business Administration certificate program objectives

Explain how the American legal process can impact business

Apply supply chain operation principles and techniques to cost effectively create products or services that can be competitively sold in the global marketplace

Apply marketing principles and techniques to sell innovative and competitive products or services

Employ the fundamentals of business finance to provide insights and guidance to the business in a dynamic and changing business environment

## Courses

### *1. Required Course(s):*

Finance I, Fundamentals | BUSM.X405, 3.0 Units
Organizational Development and Change | HRMT.X401, 2.0 Units
Principles of Marketing | MKTG.X400, 2.0 Units
Supply Chain Operations Management | BUSM.X419, 3.0 Units

### *2. Core Course(s): (Choose 1)*

Business Law and Its Environment | BUSM.X409, 3.0 Units
International Business and the Global Economy | BUSM.X402, 3.0 Units

### *3. Electives: Business Essentials*

Effective Negotiations: Principles, Strategies, and Techniques | BUSM.X416, 1.5 Units
Facilitation Skills | HRMT.X406, 2.0 Units
International Business and the Global Economy | BUSM.X402, 3.0 Units
Logistics and Transportation Management | BUSM.X420, 3.0 Units
Managing Global Supply Chains | BUSM.X421, 1.5 Units
Principles of Business Analysis | BUSM.X400, 3.0 Units

### *4. Electives: Financial Analysis/Accounting*

Finance for the Business Professional | BUSM.X403, 1.0 Units
Statistics | BUSM.X406, 3.0 Units

### *5. Electives: Management Development*

Business Communications | BUSM.X404, 2.0 Units
Human Resource Management | HRMT.X400, 1.5 Units
Principle Based Leadership for Project Managers | PPMT.X422, 1.5 Units

### *6. Electives: Marketing Business Development*

Power of Market Research | MKTG.X401, 2.0 Units
Product Marketing and Management | MKTG.X406, 2.0 Units

### *7. Completion Review:*

Business Administration Certificate Completion Fee | O-CE0405

### *8: Also of Interest: Provided in partnership with Ziplines. It does not apply towards the Business Administration Certificate.*

Business Analytics Science Certificate Course | APBS.804, 8.0 CEU's

## Recommend Course Sequence

Flexible course sequence

Courses may be taken in any order provided the prerequisites are met. You can learn more about each course in **the Syllabus Library** .

Substitutions

You may take one elective outside the certificate curriculum if you receive prior approval from the Academic Services Department.

Substitutions for undeclared students

If you have not yet declared your candidacy in the Business Administration certificate program, please follow the current curriculum requirements.

To receive your certificate

Upon completion of the course sequence, you may request your **Business Administration Certificate**

**Completion Review .**

# CLINICAL TRIALS DESIGN AND MANAGEMENT

Cost: $4,680–$6,500 + Est. Course Materials: $1,000
Required Credits: 6–7 courses (minimum 16 quarter units). Take 5 courses (11.5 quarter core units) and 2–4 elective courses (minimum 4.5 quarter units). End with certificate of completion review.
Duration: A full-time student can complete this certificate in 9–12 months.

## Certificate Description

Learn the entire clinical trial process

Phase I to III clinical trials

As you study with leaders in the global biopharmaceutical and medical device industries, many of whom are discovering new treatments and health products every day, you'll gain a practical understanding of the scientific principles, current regulations, and ethical issues underlying clinical research.

You will gain an understanding of how to bring a new drug to market approval—from the discovery of a potential drug molecule and evaluation in the laboratory to clinical trials with human volunteers and FDA oversight processes, including the principles of Good Clinical Practice.

The impact of drug patents on pharmaceutical pricing for new drugs

The underlying science that drives clinical trial design

Statistical considerations and the kind of information obtained from trials

FDA regulations that govern clinical trials

Bioethics related to the treatment of human subjects participating in clinical trials

Basic concepts related to drug safety

Clinical Trials Design and Management certificate learning outcomes

Demonstrate an understanding of the mechanics and key regulatory requirements of conducting a clinical trial to evaluate the safety and efficacy of an investigational drug in human volunteers.

Have an awareness and rudimentary understanding of the technologies that biopharmaceutical companies employ to discover and evaluate the pharmacological activities of potential new drug molecules.

Know the key players involved in drug discovery and development: Biopharmaceutical companies;

Contract research organizations; and

Clinical sites conducting Phase I through Phase III studies.

Understand the role of key oversight organizations U.S. Food and Drug Administration in the context of

Good Clinical Practice;

Relevant Title 21 Code of Federal Regulations; and

International Conference of Harmonization Guidelines in the conduct of clinical studies.

Assess how clinical trials are designed specific to different therapeutic areas.

Identify the role biostatistics plays in designing the clinical protocol and evaluating the resulting safety and efficacy data.

## Courses

### *1. Required Course(s): Five Total & Equal to 11.5 Units*

Clinical Statistics for Non-Statisticians | CTDM.X403, 2.0 Units
Drug Development Process | CTDM.X418, 3.0 Units
Drug Discovery, Survey | CTDM.X419, 1.0 Units
Good Clinical Practices | CTDM.X411, 3.0 Units
Science of Clinical Trials Design | CTDM.X415, 2.5 Units

### *2. Electives: At Least 4.5 Units*

Clinical Data Management | CTDM.X400, 2.0 Units
Clinical Project Management | CTDM.X401, 2.0 Units
Document Preparation: Protocols, Reports, Summaries | CTDM.X408, 1.5 Units
Drug Safety and Adverse Events Reporting | CTDM.X409, 1.5 Units
Medical Writing | CTDM.X413, 2.0 Units
Preparing for FDA Inspections and Conducting Sponsor Audits-GxP | CTDM.X414, 1.5 Units

### *3. Completion Review:*

Clinical Trials Design and Management Certificate Completion Fee | O-CE0113

### *4. Related Course(s): These Courses Are Not Part of The Certificate Program*

Biology of Cancer | BTEC.X402, 2.0 Units
Viruses, Vaccines and Antiviral Therapy | BTEC.X413, 2.0 Units

## Requisite Knowledge

Familiarity with medical terminology is required.

## Recommend Course Sequence

Please begin with **Drug Development Process .** After that, courses may be taken in any order provided the prerequisites for those courses are satisfied. You can learn more about each course in You can learn more about each course in the Syllabus Library .

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence you may request your Clinical Trials Design and Management Certificate Completion Review .

# COMPUTER PROGRAMMING

Cost: $4,530–$5,500 + Estimated Course Materials: $250
Required Credits: 5–7 courses (minimum 14 quarter units). Take 2 required courses (6 quarter units) and 3–5 electives (minimum 8 quarter units). End with certificate of completion review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Know your code—the foundation of innovation

Understanding how to write and test code has become a foundational criteria for tech jobs across most industries. In the UCSC Silicon Valley Extension Computer Programming certificate program you learn front end and back end web development technologies, gaining a strong foundation in software development. You learn to apply coding skills across platforms—from computers and mobile devices, to web development and the cloud.

**Computer Programming certificate program objectives**

Demonstrate the ability to develop logically structured software solutions through the use of a high-level programming language

Design object-oriented systems

Implement optimal solutions for software systems using advanced concepts of algorithms and computer science theory

Our Computer Programming students

Entry-level programmers or people changing careers

Software developers who want to enhance their programming knowledge

Non-technical professionals who want programming training to expand their career options

Hobbyists who need to learn programming to build their own applications

Project managers who want to communicate more effectively with programmers and better manage software projects

## Courses

### *1. Required Course(s):*

Object-Oriented Analysis and Design | SEQA.X401, 3.0 Units

### *2. Core Course(s): (Choose 1)*

C++ Programming | CMPR.X404, 3.0 Units
Java Programming II | CMPR.X413, 3.0 Units
Python for Programmers | CMPR.X416, 3.0 Units

### *3. Electives: Programming Languages*

C++ Programming | CMPR.X404, 3.0 Units
C Programming I | CMPR.X400, 2.0 Units
C Programming II | CMPR.X401, 3.0 Units
Java Programming I | CMPR.X412, 2.0 Units
Java Programming II | CMPR.X413, 3.0 Units

### *4. Electives: Scripting Languages*

Data Structures and Algorithms Using Python | CMPR.X425, 3.0 Units
Python for Programmers | CMPR.X416, 3.0 Units
Python: Object-Oriented Programming | CMPR.X420, 2.0 Units
Python Programming for Beginners | CMPR.X415, 1.5 Units

### *5. Electives: Mobile Device Programming*

Mobile Application Development - Android and iOS, Advanced | CMPR.X422, 3.0 Units
Mobile Application Development - Android and iOS, Introduction | CMPR.X421, 3.0 Units

### *6. Electives: Adv. Programming and Concepts*

Hands-On Data Engineering | DBDA.X424, 3.0 Units
Introduction to Machine Learning | AISV.X400, 3.0 Units
Rust Programming Fundamentals | CMPR.X426, 3.0 Units

### *Completion Review:*

Computer Programming Certificate Completion Fee | O-CE0114

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education.

## Recommend Course Sequence

Get started

Courses are best taken in order of complexity—I, II, III; Beginners, Comprehensive, Advanced. Other courses may be taken in any order. You can learn more about each course in **the Syllabus Library** .

Shared credits

Some Engineering and Technology courses may be listed in more than one program. However, only one course may be shared between two E&T certificate programs unless otherwise noted.

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence you may request your Computer Programming Certificate Completion Review .

# DATA SCIENCE AND DATA ANALYTICS

Cost: $5,230–$6,000 + Estimated Course Materials: $500
Required Credits: 6 courses (16 quarter units). Take 2 required courses (6 quarter units) and 4 elective courses (minimum 10 quarter units). End with certificate of completion review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Learn the language of data

The industry of business intelligence and analytics has undergone major shifts in fundamental technologies. The UCSC Extension certificate program in Data Science and Data Analytics offers training for data scientists, analysts, administrators, and managers who want to apply analytics to business decision-making.

## Courses

### *1. Required Course(s): Track 1 - Data Science*

Big Data, Introduction | DBDA.X401, 3.0 Units
Data Analysis, Introduction | DBDA.X404, 3.0 Units

### *2. Electives: Track 1 - Data Science*

Business Intelligence Solutions | DBDA.X402, 3.0 Units
Dashboards and Data Visualization | DBDA.X419, 3.0 Units
Data Modeling, Introduction | DBDA.X421, 2.0 Units
Deep Learning and Artificial Intelligence | AISV.X401, 3.0 Units
Introduction to Machine Learning | AISV.X400, 3.0 Units
Python for Data Analysis | DBDA.X420, 3.0 Units
Python for Machine Learning | DBDA.X427, 3.0 Units
Relational Database Design and SQL Programming | DBDA.X415, 3.0 Units

### *3. Required Course(s): Track 2 - Data Engineering*

Big Data, Introduction | DBDA.X401, 3.0 Units
Relational Database Design and SQL Programming | DBDA.X415, 3.0 Units

### *4. Electives: Track 2 - Data Engineering*

Data Analysis, Introduction | DBDA.X404, 3.0 Units
Hands-On Data Engineering | DBDA.X424, 3.0 Units
MySQL and Oracle Database for Developers and Designers | DBDA.X409, 2.0 Units
NoSQL Databases, Introduction | DBDA.X410, 3.0 Units
Python for Data Analysis | DBDA.X420, 3.0 Units
The Internet of Things: Big Data Processing and Analytics | EMBD.X412, 3.0 Units

### *5. Completion Review:*

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education. You can learn more about each course in **the Syllabus Library** .

## Recommend Course Sequence

The sequence may vary based on student background and professional interest. Choose one of the two specialized tracks—**Track 1: Data Science** or **Track 2: Data Engineering**

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

Shared credits

Some Engineering and Technology courses may be listed in more than one program. However, only one course may be shared between two E&T certificate programs unless otherwise noted.

To receive your certificate

Upon completion of the course sequence, you may request your Certificate Completion Review.

**Data Science and Data Analytics Certificate Completion Review**

# EARLY CHILDHOOD EDUCATION: ASSOCIATE TEACHER

Cost: Starts at $2,880.
Required Credits: 5 courses (20 quarter units).
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Teach our youngest to love learning.

Preschool teachers and child care center operators in the Early Childhood Education Associate Teacher program gain the academic preparation and field experience needed to work in preschools, day care facilities, infant and toddler centers and other programs serving young children. You will study the latest instructional techniques that promote intellectual, social, emotional, physical, and creative growth in children.

Key focus areas

Child growth and development

Strategies for effective classroom teaching

Developmentally based curriculum

Current research and trends in this field

ECE Associate Teacher Learning Outcomes

Develop daily schedules and implement age-appropriate curriculum for a center or classroom.

Identify social, intellectual, emotional, physical, and cognitive development of infants through middle childhood.

Distinguish differences in major learning theories and curriculum models relating to early childhood education center philosophies.

Communicate effectively with families, staff, and communities about the physical, cognitive, social, and emotional needs of children.

Decode healthcare policies and procedures that relate to child care setting licensure.

Develop positive guidance strategies to work with diverse groups of children including those with special needs.

## Courses

### *1. Required Course(s):*

ECE 1: Development in Early Childhood | ECED.X301, 4.0 Units

ECE 2: Introduction to Teaching Young Children | ECED.X302, 4.0 Units
ECE 3: Curriculum Development in Early Childhood Programs | ECED.X303, 4.0 Units
ECE 4: The Young Child in the Family and Community | ECED.X304, 4.0 Units
ECE 8: Child Health, Safety and Nutrition | ECED.X308, 5.0 Units

### *2. Completion Review:*

Early Childhood Education Associate Teacher Certificate Completion Fee | O-CE0411

### *3. Related Course(s): These Courses Are Not Part of The Certificate Program*

Attention Deficit Hyperactivity Disorder (ADHD) in the Classroom | ECED.X318, 3.0 Units
ECE: Brain Development in Early Childhood | ECED.X310, 3.0 Units
ECE: Creative Arts for the Young Child (Preschool Through Grade 3) | ECED.X312, 3.0 Units
ECE: Infant/Toddler Growth and Development | ECED.X313, 3.0 Units
ECE: Principles of Infant/Toddler Caregiving | ECED.X314, 3.0 Units
Math Development in Young Children | ECED.X316, 2.0 Units
Science Play: Inquiry-Based Learning Made Easy | ECED.X317, 1.0 Units

## Requisite Knowledge

There are no requirements to join the program.

## Recommend Course Sequence

Flexible course sequence

Courses may be taken in any order provided the prerequisites are met.

Substitutions

You may take one elective outside the certificate curriculum if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence, you may request your Early Childhood Education Associate Teacher Certificate Completion Review .

# EARLY CHILDHOOD EDUCATION: SUPERVISION AND ADMINISTRATION

Cost: Starting at $2,760.
Required Credits: 4 courses (20 quarter units). End with certificate of completion review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Head up your own ECE center

Running your own child care center or serving as a site supervisor for our youngest learners requires the vision of an entrepreneur, the skills of a manager, and the heart of a teacher.

In the **Early Childhood Education: Supervision and Administration** program, you'll learn best practices for recruiting, teacher training, and staff management while working toward your state child development site supervisor or program director permit.

You will learn to instill positive guidance and discipline into your curriculum for infants, toddlers, and young children.

The program is designed for students looking to complete requirements for the Child Development Site Supervisor Permit through the California Commission on Teacher Credentialing , and for site directors seeking professional development to renew permits for licensed facilities.

Classroom curriculum

Child growth and development

Classroom teaching strategies

Center management

Creating a developmentally based curriculum

Current industry research and trends

Leadership curriculum

The curriculum delivers targeted instruction to prepare you to become a successful child care owner and build your qualifications as a director. Gain the confidence to manage and run any child care center.

Budget administration

Facilities management

Personnel recruitment—best practices

Supervisory skills

**Early Childhood Education: Supervision and Administration** learning objectives

Create optimal learning environments through efficient staff interactions with children and their families

Identify the differences in major learning theories and curriculum models as they pertain to early childhood education center philosophies and use them to enhance and develop appropriate care and education at child care centers

Apply effective communication with families, staff, and communities about the physical, cognitive, social, and emotional needs of children as a leader and director

Identify high-quality settings for children using quality indicators such as the National Association for the Education of Young Children guidelines and standards and know what they are looking for as it pertains to getting child care centers licensing, permits, and regulations for the state of California

Develop positive guidance and mentorship strategies to use when working with diverse groups of children including those with special needs

## Courses

### *1. Required Course(s):*

ECE 10: Supervision and Administration: Parents as Partners in Education | ECEA.X320, 5.0 Units
ECE 11: Supervision and Administration of Early Childhood Centers, Part A | ECEA.X321, 5.0 Units
ECE 12: Supervision and Administration of Early Childhood Centers, Part B | ECEA.X322, 5.0 Units
ECE 13: Adult Supervision and Mentoring | ECEA.X323, 5.0 Units

### *2. Completion Review:*

Early Childhood Education: Supervision and Administration Certificate Completion Fee | O-CE0095

## Requisite Knowledge

Required coursework for this professional certificate While anyone may take courses in this program, to qualify for a certificate in **Early Childhood Education: Supervision and Administration** individuals must meet the following criteria: Completion of the ECE: Associate Teacher certificate (20 units) Completion of the ECE: Advanced Teacher certificate (17 units) Hold an associate degree or have completed 90 quarter units (60 semester units) in General Education. Completion of 350 days of experience in an instructional capacity in a child care and development program, working at least three hours per day within the last four years. **NOTE**: Students who have a bachelor's degree or a Multiple Subject Teaching Credential may request a waiver of some required coursework and experience. Contact extension@ucsc.edu for more information . Students who do not meet the overall prerequisites are welcome to enroll in individual courses, provided they meet the specific prerequisites for those courses.

## Recommend Course Sequence

Flexible course sequence

Courses may be taken in any order provided the prerequisites are met.

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence you may request your Early Childhood Education Site Supervisor Certificate Completion Review .

# EDUCATIONAL THERAPY

Cost: $6,090–$6,300 + est. course materials: $500 + possible practicum/internship cost
Required Credits: 10–11 courses (minimum 30 quarter units). Take 7 required courses (21 quarter units), 2–3 elective (minimum 4 quarter units), and capstone course (5 units). End with certificate review.
Duration: A full-time student can complete the certificate in about two years.

## Certificate Description

The impact of inspired learning

Learn how individualized interventions can make a tremendous impact in the classroom, in private practice, and in the home. In one of the few **Association of Educational Therapists-approved** training programs, you will learn to assess the different challenges students have so you can effectively collaborate with an educational team and understand the underlying theory and the latest research to implement practical strategies for learning.

Teachers, tutors, resource specialists, and aspiring educational therapists will learn to empower and inspire their students.

Suitability for practice

The UCSC Silicon Valley Extension Educational Therapy program is committed to candidates' development of ethical practice, establishment of professional boundaries, client confidentiality, and awareness of internship competence and personal limitations.

Our curriculum guides you to combine educational and therapeutic strategies—for evaluation, remediation, advocacy, and case management—on behalf of individuals with learning differences.

Educational therapists work one-on-one through using socio-emotional, psycho-educational, and neuropsychological paradigms to develop individualized learning and treatment plans. They alleviate learning difficulties by using individuals' strengths to overcome challenges.

This program is designed for all educators, psychologists, marriage and family therapists, and other allied professionals at all levels as well as individuals interested in learning enrichment.

Educational Therapy certificate program objectives

Understand challenges faced by students with dyslexia, dyscalculia, ADHD, autism spectrum, and other learning differences.

Comprehend the theories, issues, strategies, and materials related to the assessment and instruction of students with reading difficulties.

Learn how dyscalculia impacts learning and apply strategies for helping students understand computation and problem-solving in mathematics.

Employ ethical principles in the field, and develop a business plan for managing a clinical practice.

Use and understand assessment tools and procedures frequently used in educational therapy settings.

Gain a deeper understanding of the priorities of learners, their needs, and the process of building a remediation plan.

The UCSC Silicon Valley Professional Educational Therapy certificate program is approved by the Association of Educational Therapists. Founded in 1979, AET defines and sets standards for the professional practice of educational therapy. Educational therapists provide a broad range of individualized educational interventions for children and adults with learning disabilities and other learning challenges.

## Courses

### *1. Required Course(s): Seven Total & Equal to 21 Units*

Educational Assessments I | EDTH.X303, 3.0 Units
Educational Assessments II | EDTH.X304, 3.0 Units
Educational Therapy: Structured Literacy I | EDTH.X301, 3.0 Units
Educational Therapy: Structured Literacy II | EDTH.X313, 3.0 Units
Principles of Educational Therapy | EDTH.X300, 3.0 Units
Strategies for Learning Differences in Mathematics | EDTH.X302, 3.0 Units
Techniques of Educational Therapy: Affective, Cognitive and Perceptual Elements | EDTH.X305, 3.0 Units

### *2. Electives:*

Assistive Technology for Learning Differences | EDTH.X310, 3.0 Units
Attention Deficit Hyperactivity Disorder (ADHD) in the Classroom | ECED.X318, 3.0 Units
ECE: Brain Development in Early Childhood | ECED.X310, 3.0 Units
Management of Clinical Practice | EDTH.X306, 3.0 Units
Neurodivergent Learners | EDTH.X312, 1.0 Units
Psychology of Human Learning | EDTH.X308, 3.0 Units
Understanding Learning Differences | EDTH.X309, 3.0 Units

### *3. Capstone Course:*

Educational Therapy Practicum | EDTH.X390, 5.0 Units

### *4. Completion Review:*

Educational Therapy Certificate Completion Fee | O-CE0412

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education. Note: We require a bachelor's degree and preferably some experience working with children to complete this certificate program. If you do not have an educational background, we strongly recommend that you enroll in the following courses. **Psychology of Human Learning Understanding Learning Differences**

## Recommend Course Sequence

Flexible course sequence

Courses may be taken in any order provided the prerequisites are met and your final course is Educational Therapy Practicum .

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence you may request your Educational Therapy Certificate Completion Review.

# EMBEDDED SYSTEMS

Cost: $3,810–$5,500 + Est course materials: $500
Required Credits: 5–6 courses (14 quarter units). Take 3 required courses (8 quarter units) and 2–3 elective credit courses (6 quarter units). End with Certificate Review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Build your knowledge of universal connectivity

The UCSC Silicon Valley Extension Embedded Systems professional certificate program prepares students with the core design skills needed to work at some of the top companies in the Valley.

Our hardware professional students learn to design function-specific computer and communication systems, including:

mobile devices,

the Internet of Things,

networking equipment,

industrial controllers, and

consumer and automotive electronics.

Learn on industry-standard hardware

Students get invaluable hands-on experience with quick prototyping using FGPAs from Xilinx. Learn to design and test hardware and software innovations of the future as you prepare for high-paying jobs in the industry.

Embedded Systems certificate program objectives

Design, debug, and synthesize digital logic for ASICs, PGAs, and IP cores

Understand the basics of embedded software and hardware design

Decode IO technologies, including PCI Express, Ethernet, and Fibre Channel

Design and implement prototypes using FPGA

## Courses

### *1. Required Course(s):*

Embedded Firmware Essentials | EMBD.X403, 2.0 Units
Embedded Linux Design and Programming | EMBD.X423, 3.0 Units
Embedded System Hardware Architectures, Introduction | EMBD.X415, 3.0 Units

### *2. Electives: Embedded Software*

AI-Driven Embedded Systems | EMBD.X424, 2.0 Units
Linux Kernel and Drivers, Advanced | EMBD.X422, 3.0 Units
Linux Kernel & Drivers | EMBD.X421, 3.0 Units
Linux Systems Programming | EMBD.X420, 3.0 Units
Real-Time Embedded Systems Programming, Introduction | EMBD.X410, 3.0 Units
The Internet of Things: Big Data Processing and Analytics | EMBD.X412, 3.0 Units

### *3. Electives: Embedded Hardware*

Comprehensive Signal and Power Integrity for High-Speed Digital Systems | EMBD.X400, 3.0 Units
High Efficiency Switch-mode Power Supply, Design Overview | EMBD.X405, 3.0 Units
IO Concepts and Protocols: PCI Express and Ethernet | EMBD.X406, 3.0 Units
Practical Design with Xilinx FPGAs | EMBD.X408, 3.0 Units
Printed Circuit Board Design for Signal Integrity and EMC Compliance | EMBD.X409, 1.5 Units
Wireless Infrastructure: from Antenna Design to 5G, Fundamentals | EMBD.X419, 3.0 Units

### *4. Also of Interest - Do not count towards the Certificate*

Basic Printed Circuit Board Design | EMBD.800, 3.0 CEU's

### *5. Completion Review:*

Embedded Systems Certificate Completion Fee | O-CE0071

## Requisite Knowledge

Technical aptitude You need a degree in a technical field or equivalent knowledge acquired through training and experience in system design and development. We recommended you have experience in C programming. Please review course descriptions Make sure you have taken the necessary prerequisites or meet the requirements through job experience or previous education before registering for a course.

## Recommend Course Sequence

We suggest students begin with **Embedded System Hardware Architectures, Introduction .**

The remaining courses may be taken in any order provided prerequisites are met.

Electives are offered in two areas of study.

Embedded Hardware

Embedded Software

**Substitutions**

You may take one elective outside the certificate curriculum if you receive prior approval from the Academic Services Department.

**Shared credits**

Some Engineering and Technology courses may be listed in more than one program. However, only one course may be shared between two E&T certificate programs unless otherwise noted.

**To receive your certificate**

Upon completion of the course sequence, you may request your Embedded Systems Certificate Completion Review.

# HUMAN RESOURCE MANAGEMENT

Cost: $6,285–$7,500 + est. course materials: $800
Required Credits: Take 6 required courses (10.5 quarter units) and 3-5 elective courses (minimum 4.5 quarter units). End with the certificate review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Source, develop, and lead a diverse workforce

Impact your organization's overall success

In today’s ultra-competitive economy, you need to know how to recruit and retain top employees, particularly those from underrepresented groups. You need to communicate powerfully, maximize the impact of total rewards programs, and understand how technology and people analytics are changing human resources management.

In each UCSC Silicon Valley Extension course, you will update your skills to effectively source, onboard, engage, develop, and support employees in any field. Learn systems and processes to align with business objectives, develop effective leaders, and create work environments that enhance productivity.

Talent Acquisition and Workforce Planning

Leadership Development

Employee Relations

HR Business Partners/Generalist

Human Resource Management certificate program objectives

Design, assess, and evaluate employee benefits programs

Recruit talent and plan a strategic workforce

Train, facilitate, and design instruction for employees

Evaluate performance management approaches and techniques

Navigate organizational development, design, and change management to assure high employee engagement and productivity

This program has been pre-approved for recertification credit hours toward aPHR®, aPHRi™, PHR®, PHRca®, SPHR®, GPHR®, PHRi™ and SPHRi™ recertification through HR Certification Institute® (HRCI®).

The official seal of the HR Certification Institute ® confirms that the following UCSC Silicon Valley Extension courses meet the criteria for pre-approved recertification credits for HRCI’s eight credentials, including SPHR® and PHR®.*

**Business Communications** (19.25 HRCI credit hours)

**Finance for the Business Professional** (13 HRCI credit hours)

These courses have been pre-approved for business recertification credit hours toward aPHR®, aPHRi™, PHR®, PHRca®, SPHR®, GPHR®, PHRi™ and SPHRi™recertification through HR Certification Institute® (HRCI®).

UCSC Silicon Valley Extension is recognized by the Society for Human Resource Management (SHRM) to offer professional development credits (PDCs) for the SHRM-CP® or SHRM-SCP®.

## Courses

### *1. Required Course(s):*

Benefits Management: A Comprehensive Study of Employee Benefit Programs | HRMT.X407, 2.0 Units
Compensation Management | HRMT.X404, 2.0 Units
Effective Employee Relations | HRMT.X414, 1.5 Units
Human Resource Management | HRMT.X400, 1.5 Units
Managing the HR Staffing Function | HRMT.X409, 1.5 Units
Organizational Development and Change | HRMT.X401, 2.0 Units

### *2. Electives: Recruiting and Staffing*

Effective Performance Management | HRMT.X402, 2.0 Units

### *3. Electives: Leadership Development*

Business Communications | BUSM.X404, 2.0 Units
Facilitation Skills | HRMT.X406, 2.0 Units
Finance for the Business Professional | BUSM.X403, 1.0 Units
Leading People Through Change | HRMT.X412, 1.0 Units
People Analytics - Delivering Measurable Business Impact | HRMT.X418, 1.5 Units

### *4. Electives: Employee Relations*

Law and Human Resource Management | HRMT.X405, 2.0 Units
Workplace Conflict Resolution and Mediation | HRMT.X419, 1.5 Units

### *5. Electives: HR Business Partners/General*

Human Resources Business Partner (HRBP) Excellence | HRMT.X416, 1.0 Units

### *6. Completion Review:*

Human Resource Management Certificate Completion Fee | O-CE0133

### *7: Also of Interest: Provided in partnership with Ziplines. It does not apply towards the Human Resource Management Certificate.*

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education.

## Recommend Course Sequence

Please follow this sequence

It is highly recommended that students new to the field of human resources begin with Human Resource Management . After that, courses may be taken in any order.

Substitutions

You may take one elective outside the certificate curriculum if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence, you may request your Human Resource Management Certificate Completion Review .

# MARKETING MANAGEMENT

Cost: $4,825–$5,500 + est. course materials: $700
Required Credits: 7 courses (15 quarter units): Take 4 required courses (9 quarter units) and 3 elective courses (6 quarter units). End with Certificate of Completion Review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Silicon Valley-style customer-driven marketing

In this hyper-personalized and buyer-centric era, isolated sales and marketing are a thing of the past. Today's marketer needs to master ai tools and strategies to succeed in sales and marketing alignment; the fusion of sales, marketing, and social selling; and programmatic marketing and sales. Discover the transformative power of artificial intelligence in crafting personalized customer experiences.

Focus your studies

Choose elective courses from the following areas:

**Marketing Management**

**Digital Marketing**

Marketing Management certificate program objectives

Create integrated, multi-channel marketing campaigns

Evaluate the success of marketing campaigns based on data

Communicate brand values to diverse audiences

Leverage social media as a selling tool

Align sales and marketing strategies

## Courses

### *1. Required Course(s):*

Implementing Marketing and Sales Strategies | MKTG.X403, 2.0 Units
Integrated Marketing Communication | MKTG.X408, 3.0 Units
Principles of Marketing | MKTG.X400, 2.0 Units

### *2. Electives: Digital Marketing*

Applied Digital Media Planning and Platforms | MKTG.X419, 2.0 Units
CRM: Customer Relationship Management | MKTG.X407, 2.0 Units
Customer Acquisition Strategies | MKTG.X405, 2.0 Units
Search Engine Marketing | MKTG.X410, 2.0 Units
Web and Mobile Analytics | MKTG.X412, 2.0 Units

### *3. Electives: Marketing Management*

Consumer Insights: Data Analysis and Interpretation | MKTG.X413, 2.0 Units
Generative AI for Marketers | MKTG.X420, 2.0 Units
Power of Market Research | MKTG.X401, 2.0 Units
Product Marketing and Management | MKTG.X406, 2.0 Units
Public and Analyst Relations | MKTG.X402, 2.0 Units

### *4. Capstone Course:*

Marketing in Practice | MKTG.X491, 2.0 Units

### *5. Completion Review:*

Marketing Management Certificate Completion Fee | O-CE0406

### *6: Also of Interest: Provided in partnership with Ziplines. It does not apply towards the Marketing Certificate.*

Digital Marketing Science Certificate Course | APBS.802, 8.0 CEU's

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education.

## Recommend Course Sequence

Get started

Please begin with Principles of Marketing . After that, courses may be taken in any order provided the prerequisites are met.

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence you may request your Marketing Management Certificate Completion Review .

***Declared candidacy prior to Dec. 19, 2020?**

We made changes to the requirements for this certificate on Dec. 18, 2020. Students who declared candidacy prior to that date may choose to follow the current requirements above or the former 14-unit credit requirements that were in place when they declared, including:

3 courses (7 units) of required credit.

4–5 courses (7 units) of elective credit.

Certificate of completion review.

# MEDICAL DEVICE QUALITY AND DESIGN

Cost: $4,875–$5,605 + est. course materials: $500
Required Credits: 6–8 courses (14 quarter units)
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

From tongue depressors to Fitbits

Digital health, smart wearable devices, medical device software and in-vitro diagnostics are just a few of the latest strides in the highly regulated healthcare industry.

In the Medical Device Quality and Design certificate program students focus on technological and regulatory advancements in the field. They learn the fundamentals and underlying concepts of regulatory compliance, as well as global harmonization quality compliance initiatives.

You'll study the front end of medical device design and development used to verify that design inputs meet design outputs, including:

User needs,

Risk management,

Human factors, and

Methodologies.

What you will learn

Interpret and develop documentation that complies with: U.S. FDA quality system requirements (21 CFR 820)

European Medical Device Regulations (EU MDRS / IVDRS), ISO 13485

Risk management (ISO 14971)

Write a risk management plan and risk management report

Apply risk management principles to develop verification and validation plans for software and manufacturing processes

Develop a human factors usability plan

Interpret FDA guidelines and regulations and develop quality test plans for digital health and medical device software

Explain and apply risk management principles defined in ISO 14971 throughout the design and development lifecycle, such as product risk, software risk, and cybersecurity risk

UCSC Silicon Valley Professional Education is a Regulatory Affairs Professional Society (RAPS) RAC Recertification Approved Provider.

Please see the Professional Development section below to see courses in this program that meet the RAC recertification requirements to maintain the credential.

## Courses

### *1. Core Course(s): Medical Device Quality & Design - 14 Units*

Design Control for Medical Devices | MEDD.X400, 2.0 Units
European Medical Device Regulation: Clinical Evaluation and Post-Market Surveillance | REGL.X408, 3.0 Units
Human Factors and Usability in Medical Device Development | MEDD.X401, 2.0 Units
Medical Device Process Validation | MEDD.X411, 2.0 Units
Mobile Health, SaMD, and AI/ML Devices | MEDD.X404, 1.0 Units
Quality Management Systems for Medical Devices: ISO 13485 and FDA Requirements | MEDD.X407, 2.5 Units
Regulation of in vitro Diagnostics in Europe and the US | MEDD.X408, 2.5 Units
Risk Management for Regulated Industries | MEDD.X409, 3.0 Units
Validating Software for Medical Devices and Emerging Technologies | MEDD.X410, 2.0 Units
Value-Added Quality Audits | REGL.X407, 1.5 Units

### *2. Completion Review:*

Medical Device Quality and Design Certificate Completion Fee | O-CE0403

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education. **Statistics knowledge**: You will need an understanding of statistics for this program. UCSC Extension offers Statistics .

## Recommend Course Sequence

**Please follow this sequence**.

Students new to the industry should begin with Quality Systems for Medical Devices FDA QSR and ISO 13485 . For those with experience in this field, courses can be taken in any order provided the prerequisites are met.

# PROJECT AND PROGRAM MANAGEMENT

Cost: $5,130–$6,250 + est. course materials: $500
Required Credits: 7 courses (15 quarter units). Take 4 required courses (10.5 quarter units) and 2–3 elective courses (minimum 4.5 quarter units).
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

As practiced by PMI®-certified Silicon Valley leaders

Establish business needs.

Define products.

Estimate costs and schedules.

Manage risk.

Our students, aspiring and seasoned project and program managers, learn from industry leaders who are guiding teams in Silicon Valley's largest companies, most innovative startups, and trend-setting organizations.

Our instructors, certified by the Project Management Institute®, bring their deep professional experience into the classroom. They teach the latest principles, practices, processes, and tools to quickly originate project plans, going beyond the PMI Body of Knowledge (PMBOK®) to solve real work challenges. Students learn current industry practices including agile and lean project leadership methodologies such as Scrum, Kanban, Scrumban, and the Scaled Agile Framework (SAFe).

Project and Program Management certificate program objectives

Plan and execute successful projects

Analyze stakeholders' needs and requirements

Enlist and lead successful teams

Assess and manage project risks

Use both traditional waterfall and lean-agile project models

Make informed and profitable project business decisions

Qualify for the internationally recognized Master Project Manager® credential

Students who complete 35 hours of instruction in this program will satisfy the training requirements for both the PMI® PMP® (Project Management Professional) and CAPM® (Certified Associate in Project Management) exams.

## Courses

### *1. Required Course(s):*

Agile Project Management Fundamentals | PPMT.X426, 1.5 Units
Project Leadership and Communication | PPMT.X415, 3.0 Units
Project Management Fundamentals | PPMT.X425, 3.0 Units

### *2. Electives: Business Acumen*

Decision-Making Tools and Techniques | PPMT.X418, 1.5 Units
Principles of Business Analysis | BUSM.X400, 3.0 Units
Quality Management for Enterprises, Products, and Programs | PPMT.X421, 2.0 Units

### *3. Electives: Power Skills*

Creating the Successful Team | PPMT.X403, 1.5 Units
Managing International Projects | PPMT.X411, 1.5 Units
Principle Based Leadership for Project Managers | PPMT.X422, 1.5 Units

### *4. Electives: Ways of Working*

Achieving Organizational Agility using the Scaled Agile Framework, SAFe© | PPMT.X420, 1.5 Units
Agile Project Management Using Scrum | PPMT.X408, 1.5 Units
Clinical Project Management | CTDM.X401, 2.0 Units
Managing the Triple Constraints | PPMT.X427, 3.0 Units
Project Risk Management | PPMT.X406, 1.5 Units

### *5. Capstone Course:*

Applied Project Management | PPMT.X417, 3.0 Units

### *6. Completion Review:*

Project and Program Management Certificate Completion Fee | O-CE0165

### *7: Also of Interest: Does not apply towards the Project & Program Management Certificate.*

AI Technology Workshop Series: AI Enhanced Project Management | AISV.817_W9, 0.3 CEU's
AI Technology Workshop Series: For Product Managers | AISV.817_W6, 0.3 CEU's

### *8: Also of Interest: Provided in partnership with Ziplines. Does not apply towards the Project & Program Management Certificate.*

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education.

## Recommend Course Sequence

Please follow this sequence

Students may enroll in **Project Management Fundamentals** , **Agile Project Management**

**Fundamentals ,** and **Project Leadership and Communication** simultaneously. Electives may then be taken in any order. **Applied Project Management** , the capstone course, should be taken last.

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence you may request your Project and Program Management Certificate Completion Review .

# REGULATORY AFFAIRS

Cost: $5,515–$6,000 + est. course materials: $750
Required Credits: 7 courses (14 quarter units). End with certificate of completion review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Medical discovery and commercialization

Students in the Regulatory Affairs certificate program learn to navigate the intricate regulatory landscape of medical devices. They embark on a journey of discovery that emphasizes patient safety, ethics, and compliance, gaining a thorough understanding of regulatory intelligence, federal regulations, and global regulatory requirements. Students learn:

Best practices for interacting and negotiating with the FDA.

Regulatory submission writing.

Risk management strategies in the product lifecycle.

A foundation for the Regulatory Affairs Certification (RAC) exam (administered by the Regulatory Affairs Professionals Society).

Join our industry-wide network of instructors and classmates who share your passion for developing regulatory strategies for the global marketplace.

Regulatory Affairs certificate program learning objectives

Develop a global regulatory strategy for medical devices, drugs, and biologics.

Identify how regulatory affairs and quality compliance professionals contribute to an organization’s bottom line by keeping up with global regulatory requirements.

Understand and apply good manufacturing practices (GxPS/cGMPS) and quality system regulation for drugs, biologics, and medical devices to help an organization achieve sustainable compliance.

Apply risk management principles when conducting post-market surveillance activities such as recalls and market corrections.

Communicate in writing and verbally with corporate executives.

Negotiate with regulatory agencies such as the FDA.

Demonstrate knowledge of the design and development life cycle approach for drugs and biologics medical devices and have knowledge on how to compile a design history.

## Courses

### *1. Required Courses: Take seven (7) courses, minimum 14 quarter units.*

Communicating and Negotiating with the FDA | REGL.X402, 1.5 Units
Design Control for Medical Devices | MEDD.X400, 2.0 Units
European Medical Device Regulation: Clinical Evaluation and Post-Market Surveillance | REGL.X408, 3.0 Units
Foundations in Medical Devices: Developing Premarket U.S. Regulatory Strategies and Working in a Regulated Environment | REGL.X410, 2.0 Units
Global Medical Device Submissions and Strategy | REGL.X401, 1.5 Units
Good Manufacturing Practices | REGL.X400, 3.0 Units
Post-Market Regulatory Obligations for Medical Devices | MEDD.X406, 1.5 Units
Quality Management Systems for Medical Devices: ISO 13485 and FDA Requirements | MEDD.X407, 2.5 Units
Regulatory Submissions: Devices and Diagnostics | REGL.X405, 2.5 Units

### *2. Certificate Review:*

Regulatory Affairs Certificate Completion Fee | O-CE0364

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education. Students with a basic understanding of the life sciences and strong written and oral communication skills will gain the most from this program.

## Recommend Course Sequence

Begin with Quality Systems for Medical Devices FDA QSR and ISO 13485 (formerly Medical Device Quality Systems ) or Foundations of Medical Devices: Developing Premarket U.S. Regulatory Strategies and Working in a Regulated Environment , followed by Global Medical Device Submissions and Strategy .

After that, courses may be taken in any order provided the prerequisites are met.

Substitutions

You may take one elective outside the certificate curriculum if you receive prior approval from the Academic Services Department.

To receive your certificate

Complete the course sequence before requesting your Regulatory Affairs Certificate Completion Review .

# SOFTWARE ENGINEERING AND QUALITY

Cost: $4,625–$6,000 + est. course materials: $500
Required Credits: 5–7 courses (minimum 14 quarter units). Take 3 core courses (6.5 units) and 3–4 electives (minimum 7.5–9 quarter units). End with certificate of completion review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Learn QA methodologies. Build a strong SQA team. Save on costs.

Software errors cost companies millions of dollars. The longer it takes to discover bugs, the more costly the corrective action. When you study quality assurance in the UCSC Silicon Valley Extension Software Engineering and Quality certificate program, you learn to methodically and thoroughly test and manage software projects. You learn to minimize defects early in the life cycle and influence product development to improve the customer experience.

Our rigorous approach to quality assurance complements the latest and established practices in software engineering and user experience design with proven techniques in software testing.

Three QA focus areas

We offer three focus areas for your studies to help you prepare for your next software quality assurance job.

**Software Engineering and Quality certificate program objectives**

Demonstrate competence in the software development lifecycle, from requirements to release

Design and model software systems using object orientation

Develop test plans and quality assurance strategies that minimize defects in software systems

Apply accepted software development techniques, such as Agile, in planning a software system’s development

Design clean and consistent user interfaces

**Our Students**

The students in our Software Engineering and Quality certificate program include:

Software developers who want to build a foundation in software engineering, architecture, and developmental process.

Software QA and test professionals seeking adaptive SQA and testing knowledge and skills.

Software project leaders and managers overseeing their team’s on-time delivery of high-quality products.

## Courses

### *1. Required Course(s):*

Managing Software Projects | SEQA.X406, 1.5 Units
Object-Oriented Analysis and Design | SEQA.X401, 3.0 Units
Software Quality Assurance and Testing | SEQA.X403, 2.0 Units

### *2. Electives: Software Engineering*

Advanced DevOps Technologies | SEQA.X409, 3.0 Units
Data Structures and Algorithms Using Python | CMPR.X425, 3.0 Units
Designing, Building and Integrating RESTful API | SEQA.X407, 2.0 Units
DevOps Technologies | SEQA.X408, 3.0 Units

### *3. Electives: Quality and Testing*

Agile Software Development using TDD/BDD and Python | SEQA.X404, 3.0 Units
Quality Management for Enterprises, Products, and Programs | PPMT.X421, 2.0 Units
Web Applications Testing, Comprehensive | SEQA.X405, 3.0 Units

### *4. Electives: User Experience Design*

Mobile Interface Design and Gen AI | UEWD.X412, 3.0 Units
User Experience Design Fundamentals | UEWD.X414, 3.0 Units

### *5. Completion Review:*

Software Engineering and Quality Certificate Completion Fee | O-CE0383

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education. **Required**. Experience with a programming language is required as well as a degree in computer science or engineering or equivalent experience in software development, testing, QA, or project management.

## Recommend Course Sequence

Flexible course sequence

Courses may be taken in any order provided the prerequisites are met.

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

Shared credits

Some Engineering and Technology courses may be listed in more than one program. However, only one course may be shared between two E&T certificate programs unless otherwise noted.

To receive your certificate

Upon completion of the course sequence you may request your Software Engineering and Quality Certificate Completion Review .

# USER EXPERIENCE AND WEB DESIGN

Cost: $4,850-$5,470 + est. course materials: $550
Required Credits: 6 courses (minimum 15 quarter units). Take 5 core courses (12 quarter units) and 1 elective course (minimum 3 quarter units). End with a certificate of completion review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

The User Experience and Web Design professional certificate program equips students with essential skills for designing modern, user-centered digital experiences. The latest industry-aligned curriculum integrates foundational UX principles with emerging trends, including accessibility, inclusivity, ethical design, artificial intelligence integration, and data-driven decision-making.

The UX and web design field continues to evolve rapidly reflecting advancements in technology, new user expectations, and evolving industry demands. We focus on the skills you need to be competitive in this dynamic field.

**AI-powered design solutions**

**Accessibility standards**

**Ethical design practices**

**Hands-on learning**

**Real-world application**

You'll work with the latest design systems and collaboration tools including **Figma, Miro,** and **Jira**.

**Learning Outcomes**

Design user experiences that prioritize accessibility, inclusivity, ethical practices, responsible design, and user privacy.

Conduct user research studies using industry-standard tools and methodologies.

Integrate user-centered design principles.

Employ industry-standard prototyping tools and data-driven design principles to solve real-world problems.

## Courses

### *1. Required Course(s)*

Collaborative Design: Enhancing UX with AI | UEWD.X423, 3.0 Units
Interaction Design and Prototyping | UEWD.X416, 2.0 Units
User Experience Design Fundamentals | UEWD.X414, 3.0 Units
User Research and Analysis | UEWD.X424, 2.0 Units

### *2. Electives: (Choose One)*

Designing with Cascading Style Sheets: Advanced | UEWD.X407, 3.0 Units
Mobile Interface Design and Gen AI | UEWD.X412, 3.0 Units
User Experience Design, Advanced | UEWD.X415, 3.0 Units

### *3. Capstone Course: Required*

Capstone User Experience Project | UEWD.X490, 2.0 Units

### *4. Completion Review:*

User Experience and Web Design Certificate Completion Fee | O-CE0613

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken the prerequisites or meet the requirements through job experience or previous education. It's recommended that you are familiar with Adobe Creative Suite (Illustrator, Photoshop, etc.) through coursework or equivalent knowledge and experience.

# SILICON CHIP DESIGN & SEMICONDUCTOR ENGINEERING

Cost: $4,350–$5,500 + est. course materials: $500
Required Credits: 5 courses (minimum 14 quarter units). Take 3 required courses (9 quarter units) and 2 elective courses (minimum 6 quarter units). End with certificate of completion review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

Learn next-level VLSI design skills for top Silicon Valley companies

UCSC Silicon Valley Extension Silicon Chip Design & Semiconductor Engineering professional certificate program provides students with the core design skills they need to work at top companies in the Valley. Both established and aspiring engineers develop new skills, gain insight into digital and analog design techniques and methodologies, and learn from our expert faculty.

Integrated circuit curriculum

You'll explore ASIC, semiconductor, EDA, device, and integrated circuits. In our VLSI lab, our instructors will give you the opportunity to get hands-on experience with hardware specification, logic design, verification, synthesis, physical implementation, circuit design, integrated circuit product testing, and the latest EDA tools on Linux.

Logic designers, design for test professionals, verification engineers, and project leaders receive next-level training for career growth so they can meet the latest demands of top Silicon Valley employers.

Two tailored elective tracks

**Track 1: Front-end Design**
For professionals pursuing careers in application-specific integrated circuits (ASIC) architectural definitions and logic designs for its implementation.

**Track 2: Back-end Design**
For professionals interested in the physical implementations of ASIC designs from synthesis to silicon.

## Courses

### *1. Core Course(s): (Choose Three)*

Advanced Verification with SystemVerilog OOP Testbench | VLSI.X400, 3.0 Units
AI for Autonomous Driving Systems: Concepts to FPGA | VLSI.X416, 3.0 Units
Practical DFT Concepts for ASICs, SoC and SiP | VLSI.X409, 3.0 Units
System and Functional Verification Using UVM (Universal Verification Methodology) | VLSI.X410, 3.0 Units
SystemVerilog Assertions and Formal Verification | VLSI.X411, 3.0 Units

### *2. Electives: Front-End*

Analog IC Design, Introduction | VLSI.X401, 3.0 Units
Digital Logic Design Using Verilog | VLSI.X404, 3.0 Units
Embedded System Hardware Architectures, Introduction | EMBD.X415, 3.0 Units
High-Performance Computer Architecture | VLSI.X415, 3.0 Units
High Speed Interface Techniques | VLSI.X405, 3.0 Units
IO Concepts and Protocols: PCI Express and Ethernet | EMBD.X406, 3.0 Units
Wireless Infrastructure: from Antenna Design to 5G, Fundamentals | EMBD.X419, 3.0 Units

### *3. Electives: Back-End*

3D IC Packaging and Physical Verification | VLSI.X418, 3.0 Units
ASIC Physical Design, Advanced | VLSI.X402, 3.0 Units
Comprehensive Signal and Power Integrity for High-Speed Digital Systems | EMBD.X400, 3.0 Units
High Speed Interface Techniques | VLSI.X405, 3.0 Units
Introduction to VLSI and ASIC Design | VLSI.X403, 3.0 Units
Physical Design Flow From Netlist to GDSII | VLSI.X408, 3.0 Units
Practical Design and Implementation of VLSI Memory Devices | VLSI.X417, 3.0 Units
Practical Design with Xilinx FPGAs | EMBD.X408, 3.0 Units
Timing Closure in Silicon IC Design | VLSI.X414, 3.0 Units

### *4. Completion Review:*

Silicon Chip Design & Semiconductor Engineering Certificate Completion Fee | O-CE0186

### *5. Related Workshops - not for credit*

Semiconductor Design and Innovation Workshop Series: High-Precision GHz Op Amp Design | VLSI.800_W3, 0.3 CEU's
Semiconductor Design and Innovation Workshop Series: RISC-V: Understanding Computer Architecture | VLSI.800_W2, 0.3 CEU's
Semiconductor Design and Innovation Workshop Series: Timing Constraint Management for Modern System On Chip | VLSI.800_W1, 0.3 CEU's

## Requisite Knowledge

Technical expertise You need a degree in a technical field or equivalent knowledge acquired through training and experience in hardware design and development. Experience with UNIX and/or LINUX is required for lab sessions. Knowledge of a programming language such as C, Perl or Bash Shell is helpful. Please review course descriptions Make sure you have taken necessary prerequisites or meet the requirements through job experience or previous education before registering for a course.

## Recommend Course Sequence

Beginners should take introductory courses before advanced. Other courses can be taken based on your interests and professional levels.

Related Electives

Embedded System Hardware Architectures, Introduction (3.0)

System Design for Low Power Management (1.0)

Substitutions

You may take one elective outside the certificate curriculum if you receive prior approval from the Academic Services Department.

Shared credits

Some Engineering and Technology courses may be listed in more than one program. However, only one course may be shared between two E&T certificate programs unless otherwise noted.

To receive your certificate

Upon completion of the course sequence, you may request your Semiconductor Engineering Certificate Completion Review .

# EARLY CHILDHOOD EDUCATION: ADVANCED TEACHER

Cost: Starting at $2,655.
Required Credits: 5–7 courses (minimum 17 quarter units). Take 4 required courses (14 quarter units) and 1–2 elective courses (minimum of 3 quarter units).
Duration: A student can complete this specialization in 9–12 months.

## Certificate Description

Advance your ECE classroom

The Early Childhood Education Advanced Teacher program at UCSC Silicon Valley Extension prepares preschool teachers and operators to manage the unique challenges they face in our region.

Aspiring ECE lead teachers will gain both a thorough academic preparation and practical field experience to work in child centers, preschools, day care facilities, infant and toddler centers and other programs serving young children. Our students learn instructional techniques that promote intellectual, social, emotional, physical, and creative growth in children.

The foundation for a successful ECE career

Understand child growth and development.

Build strategies for effective classroom teaching.

Identify developmentally-based curriculum.

Know current research and trends in this field.

Be confident to teach in a daycare center.

ECE: Advanced Teacher certificate learning outcomes

Assess teaching styles to inform future experiences with children.

Master techniques in observation and assessment of the social, intellectual, emotional, physical, and cognitive development of children from birth through adolescence.

Develop positive guidance strategies to use when working with diverse groups of children including those with special needs.

Apply differences in major learning theories and curriculum models as it pertains to early childhood education center philosophies.

## Courses

### *1. Required Course(s):*

ECE 5: Positive Guidance and Discipline for the Young Child | ECED.X305, 3.0 Units

ECE 6: Culture and Diversity in the Early Childhood Classroom | ECED.X306, 3.0 Units
ECE 7: Practicum in Early Childhood Education | ECED.X307, 5.0 Units
ECE 9: Language and Literacy for the Young Child | ECED.X309, 3.0 Units

### *2. Electives: At Least 3 Units*

Attention Deficit Hyperactivity Disorder (ADHD) in the Classroom | ECED.X318, 3.0 Units
ECE: Brain Development in Early Childhood | ECED.X310, 3.0 Units
ECE: Creative Arts for the Young Child (Preschool Through Grade 3) | ECED.X312, 3.0 Units
ECE: Infant/Toddler Growth and Development | ECED.X313, 3.0 Units
ECE: Principles of Infant/Toddler Caregiving | ECED.X314, 3.0 Units
Math Development in Young Children | ECED.X316, 2.0 Units
Science Play: Inquiry-Based Learning Made Easy | ECED.X317, 1.0 Units

### *3. Completion Review:*

Early Childhood Education Advanced Teacher Certificate Completion Fee | O-CE0421

## Requisite Knowledge

To complete the ECE 7: Practicum in Early Childhood Education for this advanced program, you need to have taken the following courses: ECE 1: Development in Early Childhood ECE 3: Curriculum Development in Early Childhood Programs ECE 4: The Young Child in the Family and Community Please see our section on Recommended course sequence for more information.

## Recommend Course Sequence

Flexible course sequence

Courses in the Advanced Teacher program may be taken in any order provided the prerequisites are met and your final course is ECE 7: Practicum in Early Childhood Education .

While you may stack or take concurrently your required ECE courses in both the ECE Associate Teacher and ECE Advanced Teacher certificate programs, you must complete the ECE Associate Teacher certificate program **before** applying for the Advanced Teacher certificate.

Please see our section on Requisite knowledge for more information.

Substitutions

You may take one elective outside the certificate curriculum, if you receive prior approval from the Academic Services Department.

To receive your certificate

Upon completion of the course sequence you may request your Early Childhood Education Advanced Teacher Certificate Completion Review .

# ARTIFICIAL INTELLIGENCE APPLICATION DEVELOPMENT

Cost: $4,790 - $6,070 + est. course materials: $500
Required Credits: 14 units. Take 2 required courses (6 quarter units), 2 elective courses (6 quarter units), and the capstone course (2 quarter units). End with certificate of completion review.
Duration: A full-time student can complete the certificate in 9–12 months.

## Certificate Description

## Courses

### *1. Required Course(s):*

Deep Learning and Artificial Intelligence | AISV.X401, 3.0 Units
Introduction to Machine Learning | AISV.X400, 3.0 Units

### *2. Elective Courses: (Choose Two)*

Artificial Intelligence for Robotics | AISV.X405, 3.0 Units
Computer Vision and Image Processing | AISV.X406, 3.0 Units
Deep Reinforcement Learning | AISV.X403, 3.0 Units
GANs for Data Synthesis | AISV.X404, 3.0 Units
Natural Language Processing | AISV.X402, 3.0 Units

### *3. Capstone Course:*

Capstone Building Integrated AI Applications | AISV.X490, 2.0 Units

### *4. Completion Review:*

Artificial Intelligence Application Development Certificate Completion Fee | O-CE0422

## Recommend Course Sequence

It is highly recommended that students begin with **Introduction to Machine Learning** (AISV.X400). After that, courses may be taken in any order provided the prerequisites are met.

# SPECIALIZATIONS

# ADMINISTRATIVE PROFESSIONALS

Cost: $3,000
Required Credits: 4 courses/minimum 6.5 units. Take 2 core courses (3 units) and 2 elective credit courses (3.5–5 units)
Duration: A student can complete this specialization in 6-9 months.

## Specialization Description

Build Your Administrative Professional Skills

Once you have a solid foundation in administrative support, you can build your own career trajectory. This is especially true in the UCSC Extension Specialization for Administrative Professionals where you learn practical skills in three key areas:

Business Finance

Strategic Communications, and

Effective Writing.

Add on an elective such as facilitation, project management, customer relations, or public relations fundamentals and launch your career in business support.

Learning Outcomes in the Administrative Professionals Program

Develop a broad understanding of financial concepts and tools.

Demonstrate effective organizational communication.

Apply proficiency fundamentals of administrative roles including human resources, financial responsibilities, public relations, and project management.

Career Path Versatility

You can continue to grow your career by applying the units from this specialization to the Business Administration , Human Resource Management and Marketing Management certificates. Make yourself an invaluable member of any dynamic team.

## Courses

### *1. Required Course(s): Two Required*

Business Communications | BUSM.X404, 2.0 Units
Finance for the Business Professional | BUSM.X403, 1.0 Units

### *2. Electives: Two Required*

CRM: Customer Relationship Management | MKTG.X407, 2.0 Units
Facilitation Skills | HRMT.X406, 2.0 Units
Project Management Fundamentals | PPMT.X425, 3.0 Units

Public and Analyst Relations | MKTG.X402, 2.0 Units

### *3. Completion Review:*

Specialization for Administrative Professionals Completion Fee | O-CE0507

# DEVOPS AND DATA VIRTUALIZATION

Cost: $2,300–$3,000
Required Credits: 3 required courses (8.5 CEU). End with Specialization completion review.
Duration: A full-time student can complete the specialization in 6–9 months.

## Specialization Description

Learn to manage, connect, and troubleshoot business systems*

The DevOps and Virtualization specialist manages, connects, and troubleshoots business technology like a pro. In this information technology systems program—the only systems-focused credential of its kind in Silicon Valley—you will study the specialized set of communication tech skills that prepare you to tackle diverse business needs. You will learn to be the person that makes office communication, through a myriad of platforms, networks and cloud-based apps, seem easy for coworkers and be the hero who minimizes downtime.

DevOps and Virtualization program objectives

Discuss CPU, storage and network virtualization

Design, code, and deploy a cloud-focused tool or application

Describe service-oriented architecture and the cloud software development toolchain

## Courses

### *1. Required Course(s):*

Advanced DevOps Technologies | SEQA.X409, 3.0 Units
DevOps Technologies | SEQA.X408, 3.0 Units
System Virtualization Fundamentals | LINX.X417, 2.5 Units

### *2. Completion Review:*

Specialization in DevOps and Virtualization Completion Fee | O-CE0518

## Requisite Knowledge

It is strongly suggested that you have: **Basic programming experience** using a high-level programming language like Java, Python, C#, or a scripting environment like Bash.

# LEAN-AGILE PROJECT MANAGEMENT

Cost: $3,000–$4,500 + est. course materials: $500
Required Credits: Total required: 4 courses or 6 units.
Duration: A student can complete this specialization in 6 months.

## Specialization Description

Jumpstart your career for today's rapidly changing organizations with a specialization in Lean-Agile project management methodologies. In this short specialization program, you will learn the current knowledge and practices of Agile product life-cycle management (APLM), including Lean-Agile principles, systems thinking, Scrum and Kanban methodologies, and the Scaled Agile Framework (SAFe©) for Lean Enterprises.

Your new knowledge and skills—including effective customer collaboration, adaptive planning, and leading cross-function teams—will be the essential elements for implementing shorter iterative development cycles with more frequent product releases with higher quality for delighted customers.

Lean-Agile Project Management objectives

Apply Lean-Agile principles and mindful practices within the context of the project team and the larger organization;

Originate and evolve iterative release plans, from concept to cash, based on rapid delivery of business value, using stakeholder collaboration, and empowered cross-functional teams practicing real-time continuous improvement; and

Succeed within the Scaled Agile Framework (SAFe©) for Lean Enterprises to achieve organizational-level agility by leading knowledgeably and effectively with enterprise-wide Lean-Agile teams.

PMBOK® Guide

Our courses are compliant with A Guide to the Project Management Body of Knowledge, PMBOK® Guide , Sixth Edition.

## Courses

### *1. Prerequisite(s): "Project Management Fundamentals" or "Role of the Project Manager" or equivalent work experience.*

Project Management Fundamentals | PPMT.X425, 3.0 Units

### *2. Required Course(s):*

Achieving Organizational Agility using the Scaled Agile Framework, SAFe© | PPMT.X420, 1.5 Units
Agile Project Management Fundamentals | PPMT.X426, 1.5 Units
Agile Project Management Using Scrum | PPMT.X408, 1.5 Units
Principle Based Leadership for Project Managers | PPMT.X422, 1.5 Units

### *3. Completion Review:*

Specialization in Lean-Agile Project Management Completion Fee | O-CE0508

### *3. Elective Course(s):*

Achieving Organizational Agility using the Scaled Agile Framework, SAFe© | PPMT.X420, 1.5 Units
Agile Project Management Using Scrum | PPMT.X408, 1.5 Units
Principle Based Leadership for Project Managers | PPMT.X422, 1.5 Units

# MOBILE APPLICATION DEVELOPMENT

Cost: $2,650–$3,000 + est. course materials up to $200
Required Credits: Total Required: 3 courses/9 units. Take 2 required courses and choose 1 elective.
Duration: A student can complete this specialization in 6–9 months.

## Specialization Description

Push to your creative edge

Our Specialization in Mobile Application Development focuses your development expertise in one of the fastest growing fields in technology. Learn to develop iPad, iPhone, and Android applications, and create an engaging interface design. A professional specialization recognizes your experience in this growing industry.

Mobile Application Development program objectives

Demonstrate proficiency with design concepts, theory, and principles relating to the design process and software tools of mobile application designs.

Apply critical thinking and creative problem-solving skills to a variety of web and mobile app design and production cases.

Create a professional quality mobile application with cloud backend services that is in line with the fundamentals of mobile cybersecurity guidelines.

## Courses

### *1. Required Course(s):*

Mobile Application Development - Android and iOS, Advanced | CMPR.X422, 3.0 Units
Mobile Application Development - Android and iOS, Introduction | CMPR.X421, 3.0 Units
Mobile Interface Design and Gen AI | UEWD.X412, 3.0 Units

### *2. Completion Review:*

Specialization in Mobile Application Development Completion Fee | O-CE0500

### *2. Electives: (Choose One)*

## Requisite Knowledge

**Please review the course descriptions** to ensure that you have taken necessary prerequisites or meet the requirements through job experience or previous education. Prerequisite language courses cannot be counted toward the specialization.

## Recommend Course Sequence

Flexible course sequence

Courses may be taken in any order provided the prerequisites are met.

To receive your certificate

Upon completion of the course sequence you may request your Mobile Application Development Specialization Completion Review.

# PYTHON

Cost: $2,400
Required Credits: 6.5 units
Duration: 4–6 months

## Specialization Description

Meet the Growing Demand for Python Developers

Python, one of the most widely used programming languages in the open source community, is in high demand by employers in just about every industry. It is especially important for people interested in breaking into data science and machine learning.

Fortunately, the elegance and simplicity of Python makes it one of the easiest languages to master. In this 6.5-unit Python Specialization, you can start as a novice and, in just four to six months of hands-on practice, master the fundamentals.

This specialization includes:

**Python Programming for Beginners.** Learn the fundamental principles of programming with Python, a mind-expanding, new way of thinking for novices.

**Python: Object-Oriented Programming.** Gain a strong understanding of this most important programming concept, which provides the structure of most Python applications, and the basis of the language itself.

**Python for Programmers.** Practice the core facilities of Python, as well as the libraries that are most important to professional programmers, and pick up the tools to create your own libraries.

Once you've finished with these three courses, you'll have a competitive edge for the job market.

More details about our 3-course Python specialization program below. Start with a single course! We suggest: **Python Programming for Beginners ,** followed by **Python: Object-Oriented Programming ,** and on to the more advanced **Python for Programmers .**

## Courses

### *1. Required Course(s): You must successfully complete the three courses below.*

Python for Programmers | CMPR.X416, 3.0 Units
Python: Object-Oriented Programming | CMPR.X420, 2.0 Units
Python Programming for Beginners | CMPR.X415, 1.5 Units

### *2. Completion Review:*

Specialization in Python Completion Fee | O-CE0509

# JAVA DEVELOPMENT

Cost: $2,625
Required Credits: 8 units
Duration: 4–6 months

## Specialization Description

Meet the growing demand for Java developers

Java, one of the easiest object-oriented programming languages to learn and use, has been the dominant language for decades. No longer just a web development language, it’s now used in general-purpose programming. Developers use this platform-independent, open-source programming language for web, mobile, and server-side applications development.

The growth of Android OS, wearables, and appliances in the Internet of Everything (IoE) has contributed to the soaring popularity of Java and it's the language of choice for backend development for high-performance concurrent applications. It also has a simplicity; it doesn’t use the complicated concepts of pointers and thereby avoids the challenges of dealing with memory leaks.

In this 8-unit Java Programming specialization, you can start as a novice and, in just four to six months of hands-on practice, master the fundamentals, and start articulating the intricacies of efficient algorithms using Java. Java is ubiquitous. Students of Java find a wide range of community support while they develop this skill.

Giving you a competitive edge

**Java Programming I**
A mind-expanding, new way of thinking for novices

**Java Programmings II**
Gain a strong understanding of object-oriented programming (OOP) concepts that provide the structure for most Java applications and the basis of the language itself.

**Data Structures and Algorithms using Java**
Deeper insights into Java data structures and algorithms. You'll practice the core facilities of Java, Java API, create your own libraries, and gain the ability to analyze algorithms that are most important to professional programmers. Note: 70% of interview questions for developers are focused on this one topic.

## Courses

### *1. Required Course(s): You must successfully complete the three courses below.*

Data Structures and Algorithms Using Java | CMPR.X407, 3.0 Units
Java Programming I | CMPR.X412, 2.0 Units
Java Programming II | CMPR.X413, 3.0 Units

### *2. Completion Review:*

## Recommend Course Sequence

We suggest: **Java Programming I** , followed by **Java Programmings II** , and on to the more advanced **Data Structures and Algorithms using Java .**

# DATA ENGINEERING

Cost: $2,610
Required Credits: 3 courses (8 quarter units)
Duration: 6-9 months to complete

## Specialization Description

## Courses

### *1. Required Course(s): You must successfully complete the three courses below.*

Hands-On Data Engineering | DBDA.X424, 3.0 Units
MySQL and Oracle Database for Developers and Designers | DBDA.X409, 2.0 Units
Relational Database Design and SQL Programming | DBDA.X415, 3.0 Units

### *2. Completion Review*

Specialization in Data Engineering Completion Fee | O-CE0530

# DATA SCIENCE

Cost: $2,920
Required Credits: 3 courses (9 quarter units)
Duration: 6 – 9 months

## Specialization Description

## Courses

### *1. Required Course(s): You must successfully complete the three courses below.*

Dashboards and Data Visualization | DBDA.X419, 3.0 Units
Data Analysis, Introduction | DBDA.X404, 3.0 Units
Python for Data Analysis | DBDA.X420, 3.0 Units

### *2. Completion Review*

Specialization in Data Science Completion Fee | O-CE0529

# LINUX DEVELOPMENT

Cost: $2,300 (includes specialization fee)
Required Credits: 3 courses or 9 units
Duration: A student can complete the program in 6–9 months.

## Specialization Description

Build Linux skills. Expand your job opportunities.

The job boards are full of opportunities for people with the latest Linux skills—the foundation for malware analysts, testing engineers, security administrators, and developers.

In this advanced Linux systems and development program students gain a comprehensive education that quickly prepares them for high-demand jobs in industries such as IoT, telecommunications, automotive systems, and enterprise computing.

Tailor your learning experience

Thanks to a flexible course structure, students can tailor their learning experience to specific interests and career goals within the Linux ecosystem.

**Learning outcomes**

Design and develop embedded Linux systems

Create and manage Linux kernel modules

Implement Linux device drivers

Utilize Linux programming interfaces and tools

Whether you're a software engineer looking to specialize in Linux systems, an embedded systems developer, or an IT professional aiming to enhance your Linux expertise, this specialization will provide you with advanced knowledge and practical skills to excel in Linux development and administration.

## Courses

### *1. Required Courses:*

Embedded Linux Design and Programming | EMBD.X423, 3.0 Units
Linux Kernel & Drivers | EMBD.X421, 3.0 Units
Linux Systems Programming | EMBD.X420, 3.0 Units

### *2. Completion Review:*

Specialization in Linux Development Completion Fee | O-CE0532

### *3. Related Course(s): These courses are not part of the Specialization program*

Linux Kernel and Drivers, Advanced | EMBD.X422, 3.0 Units

# AI BUSINESS PRACTICES

Cost: $2,275
Required Credits: 7.5 CEUs
Duration: A Student can complete the program in 6–9 months.

## Specialization Description

**Beyond the hype: Practical AI for workplace automation**

In this highly practical specialization for the nontechnical professional, students explore the characteristics of generative AI and learn real-world AI applications to improve workplace productivity.

You'll explore AI use cases and learn to streamline your daily tasks, such as document and presentation creation, report generation, and project management—all using readily available, free AI technology and by refining your AI prompts.

**Strategic innovation. Responsible AI integration.**

By implementing the principles of generative AI, students address ethical challenges while deploying new models.

Get hands-on practice with freely available AI-enhanced tools.

Learn efficient natural language prompts for generating content.

Experience robotic process automation (RPA).

Integrate AI intelligence.

Evaluate agent performance.

Explore advancements toward human-level control.

Increase your understanding of the ethical, responsible, and security aspects of AI.

By the end of the program, you'll be empowered to leverage AI effectively for personal and professional growth in diverse settings and have a comprehensive understanding of AI technologies, ethical implications, and practical applications across industries.

Learning Outcomes

Optimize AI technology for specific needs.

Address ethical challenges while deploying effective generative AI models.

Enhance workplace productivity via freely available AI-enhanced tools and prompt engineering.

Set up and evaluate simple agents for task automation.

## Courses

### *1. Required Courses: You must complete the three courses below, plus one from section 2.*

AI Tools for the Office | AISV.815, 2.0 CEU's
Generative AI Fundamentals | AISV.814, 2.0 CEU's
The Business of AI | AISV.800, 1.5 CEU's

### *2. Choose one of the following.*

Generative AI in the Enterprise: RAG and AI Agents | AISV.818, 2.0 CEU's
Intelligent Automation: Enhancing workflows with AI-powered RPA | AISV.816, 2.0 CEU's

### *3. Completion Review:*

Specialization in AI Business Practices Completion Fee | O-CE0531
Specialization in AI Strategies, Productivity and Practices Completion Fee | O-CE0531

## Requisite Knowledge

We recommend that you launch your studies in **AI Business Practices** with **AI Essentials** or have equivalent knowledge.

# MACHINE LEARNING WITH PYTHON

Cost: $1,995
Required Credits: 6 unit | 2 required courses
Duration: A full-time student can complete the certificate in 3-6 months.

## Specialization Description

## Courses

### *1. Required Courses: Complete the two courses below.*

Introduction to Machine Learning | AISV.X400, 3.0 Units
Python for Machine Learning | DBDA.X427, 3.0 Units

### *2. Completion Review:*

Specialization in Machine Learning with Python Completion Fee | O-CE0533

## Requisite Knowledge

We recommend that you: Have reasonably good programming and debugging skills that are beyond the basic or beginner level. Are comfortable with basic knowledge of algebra, calculus, probability, and statistics.

# SERIES

# DIGITAL MARKETING SCIENCE

Cost: $2,450. Save 17% off of regular price of $2,950. + Est. course materials: $500
Required Credits: 8 quarter CEUs
Duration: 10 weeks

## Series Description

Learn the science, strategies, and skills for digital marketing success.

A 10-week online mentored certificate course

A fully online program with optional, but highly recommended, live, weekly, instructor-led classes.

This Digital Marketing Science certificate course will transform you into a complete digital marketer with expertise in the most in-demand marketing domains. Fast-track your career in digital marketing with practical training and technical certifications you can apply on the job. Delivered online, this comprehensive curriculum is taught by industry experts and supplemented with live/online mentor-led classes.

You'll leave the course with proof of your digital marketing skills. For your final project, you will apply your new skills to the website of a real business in the form of a playbook and get feedback from industry experts and peers.

Earn industry-recognized certifications and qualifications.

**Google Ads Search Certification**

**Google Analytics Individual Qualification**

**HubSpot Email Marketing Certification**

Plus several highly marketable certifications offered by Marketo, The Trade Desk, and Facebook as well as tools for:

**Web Analytics**

**Search Engine Optimization**

**Search Engine Marketing**

**Social Media Marketing**

**Email Marketing**

**Reputation Management**

**Digital Marketing Strategy**

Optional online class meetings

During each session, students are invited to join in on optional online weekly meetings. Check out our upcoming start dates . You can enroll up to one week after the start date.

Paying upfront isn’t always realistic. To help put a Digital Marketing Science certificate through UCSC Silicon Valley in your reach, we offer a three-part payment plan. For more information or questions regarding payment options, please contact admissions@ziplines.com .

**Learn more about the Digital Marketing Science certificate course.**

This Digital Marketing Science Certificate Course is provided in partnership with Ziplines Education , a market-driven education company that delivers innovative programs to prepare learners for the demands of today's economy.

**Ziplines Student Testimonials**

## Courses

# EDUCATIONAL CREDENTIALING

Cost: $410
Required Credits: 2 units
Duration: 6 weeks

## Series Description

Stay up to date with your training

UCSC Extension offers the Technology in Schools, Introduction (SB 2042 Standard 11) online course for clearing the preliminary credential required for SB 2042 Multiple Subject and Single Subject. This course complies with the California Commission on Teacher Credentialing (CCTC) standards.

California Commission on Teacher Credentialing

Our courses meet standards for the mandatory CCT credential, but please confirm with the administrator of your credential program that the course you intend to take is acceptable.

Please see our Licensure and Certification Policy to learn more.

## Courses

### *1. Required Courses*

Technology in Schools, Introduction (SB 2042 Standard 11) | EDUC.XSC209, 2.0 Units

# LEGAL STUDIES

Cost: Varies per program—$995–$3,300.
Required Credits: 4.2 – 5 CEUs
Duration: 7-week, self-paced and fully online program

## Series Description

Legal training tailored to your industry

Expand your consulting business

Each industry develops its own unique legal strategies and professional lexicon to grow and navigate the constantly evolving world of law. We're offering legal studies courses in key Silicon Valley industries—engineering, nursing, healthcare, and victim advocacy—to give you a practical understanding of your consulting role in the legal realm.

Whether you are an advocate for crime victims or an entrepreneur exploring a medical professional, this curriculum is tailored to your professional development.

## Courses

# PARALEGAL STUDIES

Cost: Paralegal: $2,095-$2,195. Adv. Paralegal: Starts at $3,300 or $660 a topic.
Required Credits: Paralegal Program: 9 CEUs • Advanced Paralegal Program: Up to 27 CEUs
Duration: Paralegal: Two 7-week sessions • Advanced Paralegal Program: Six 7-week sessions

## Series Description

The job outlook for paralegals and legal assistants is bright, adding jobs at a brisk 10 percent annually and it's especially good if you've you've got strong computer and database management skills. Whether you're interested in supporting a law office, diving into banking or corporate programs, or hanging your own shingle, the diverse paralegal profession needs skilled paralegals.

We offer two levels of paralegal training to help you gain a comprehensive understanding of the American judicial system—the **Paralegal Certificate Course ©** and the **Advanced Paralegal Certificate Course .** While not UCSC-designated certificate programs, the combined courses meet state of California paralegal certification requirements and culminate in a certificate of completion.

Meet California education requirements

Completing both the Core Requirements and the Advanced Requirements of the Paralegal Certificate Program provides comprehensive training and skills to work in the quickly-growing paralegal profession. In combination, the two paralegal programs meet the requirements of the California Business and Professional Code §6450 .

## Courses

## Requisite Knowledge

**Please review course descriptions**. Without any prior degrees or legal experience, you will need to take both courses and receive a certificate of completion to practice in California. Please visit The Center for Legal Studies for more information on California Business & Professions Code §6450.

## Recommend Course Sequence

Begin with Paralegal Core Certificate Course © (Paralegal I & II) Students must successfully complete the core requirements before they take the Advanced Paralegal Certificate Course . Advanced course topics can be taken in any order.

# ARTIFICIAL INTELLIGENCE

Cost: Varies.
Required Credits: Varied CEUs and UC Credit
Duration: Varies

## Series Description

The wave of artificial intelligence data and technology sweeping across industry is transforming how we work, how we develop new products and services, how we measure our success, and how we plan for the future. That is why we are creating the most comprehensive AI curriculum in the UC Extension system.

AI curriculum for today's workforce

Hands-on, practical technical skills

Strategic business acumen

Skills for a skyrocketing demand

Interactive online classroom with industry leaders

AI opens doors—AI for All

In this fast-growing multi-billion dollar market, we are casting a wide net to ensure the future is created by many for many. AI is reshaping our workforce, costing jobs in many sectors, and creating new jobs. We want to make sure everyone is ready for the transition—the technically focused, the business-minded, and the seasoned tech worker—as well as the underrepresented populations that often face high barriers to entry into the well-paying tech workforce.

Industry-aligned curriculum

Cross-industry skills preparation

Active curriculum guidance and classroom mentorship

Tech-focused and business-focused programs

Lowered barriers to entry for people interested in learning

## Courses

### *1. Artificial Intelligence (AI) Courses*

AI-Driven Embedded Systems | EMBD.X424, 2.0 Units
AI, Empathy, and Ethics | AISV.806, 1.0 CEU's
AI Essentials | AISV.813, 0.5 CEU's
AI Tools for the Office | AISV.815, 2.0 CEU's
Generative AI for Marketers | MKTG.X420, 2.0 Units

Generative AI Fundamentals | AISV.814, 2.0 CEU's
Generative AI in the Enterprise: RAG and AI Agents | AISV.818, 2.0 CEU's
Intelligent Automation: Enhancing workflows with AI-powered RPA | AISV.816, 2.0 CEU's
Python for Machine Learning | DBDA.X427, 3.0 Units
The Business of AI | AISV.800, 1.5 CEU's

### *2. AI Development*

Artificial Intelligence for Robotics | AISV.X405, 3.0 Units
Capstone Building Integrated AI Applications | AISV.X490, 2.0 Units
Computer Vision and Image Processing | AISV.X406, 3.0 Units
Deep Learning and Artificial Intelligence | AISV.X401, 3.0 Units
Deep Reinforcement Learning | AISV.X403, 3.0 Units
GANs for Data Synthesis | AISV.X404, 3.0 Units
Introduction to Machine Learning | AISV.X400, 3.0 Units
Natural Language Processing | AISV.X402, 3.0 Units

### *3. AI Workshops*

AI Technology Workshop Series: AI Enhanced Project Management | AISV.817_W9, 0.3 CEU's
AI Technology Workshop Series: AI in the Semiconductor Industry | AISV.817_W4, 0.3 CEU's
AI Technology Workshop Series: AI Model Development Lifecycle | AISV.817_W12, 0.5 CEU's
AI Technology Workshop Series: For Instructors and Educators | AISV.817_W1, 0.3 CEU's
AI Technology Workshop Series: For Product Managers | AISV.817_W6, 0.3 CEU's
AI Technology Workshop Series: For the User Experience Professional | AISV.817_W5, 0.5 CEU's
AI Technology Workshop Series: Github Copilot For Programmers (C/Python) | AISV.817_W2, 0.3 CEU's
AI Technology Workshop Series: Humanoid Robotics | AISV.817_W10, 0.3 CEU's
AI Technology Workshop Series: Large Multimodal Models LMM | AISV.817_W8, 0.5 CEU's
AI Technology Workshop Series: LLMs and Prompt Engineering | AISV.817_W7, 0.4 CEU's
AI Technology Workshop Series: Model Context Protocol | AISV.817_W15, 0.5 CEU's
AI Technology Workshop Series: Open Computer AI Agent by Hugging Face | AISV.817_W13, 0.5 CEU's
AI Technology Workshop Series: Practical uses of DeepSeek/Llama | AISV.817_W11, 0.4 CEU's
AI Technology Workshop Series: Spiking Neural Networks | AISV.817_W14
AI Technology Workshop Series: Unit Testing Tooling and Strategies | AISV.817_W3, 0.3 CEU's

## Recommend Course Sequence

Please be sure you meet the prerequisites for each course. You may choose courses in any order according to your interest.

Other AI-related specializations

**Python Specialization**

**Programming for Data Science with Python**

**Data Scientist**

# BUSINESS ANALYTICS SCIENCE

Cost: $2,450. Save 17% from regular price of $2,950.
Required Credits: 8 CEUs
Duration: 10 weeks

## Series Description

Business analytics fundamentals to drive growth

In a data-driven economy, creating value means leveraging data to identify, strategize, and solve business problems. In this certificate course, you'll learn the fundamentals in gathering, analyzing and presenting strategic data effectively to different audiences.

Data scientists and analytics experts working in some of the most successful global companies—**Looker, Facebook, Novartis,** and **Prudential**—will teach you how to drive growth and influence decision-making using the data in your organization.

Topics of study

**Data Modeling**
Understand application workflows, design tables, determine primary keys and use the right data types effectively.

**SQL, The Language of Data**
Develop SQL queries and learn techniques such as filtering, working with joins and using aggregate functions.

**Data Visualization Tools**
Design research questions and select tools, techniques and visualization types to highlight insights. Get hands-on with Tableau.

**KPIs**
Develop business objectives and articulate their relationship to business performance.

**Optional online class meetings**

Students are invited to join in on optional online meetings each week. You can enroll up to one week after the start date.

Paying upfront isn't always realistic. To help put a **Business Analytics Science** certificate through UCSC Silicon Valley in your reach, we offer a three-part payment plan. For more information regarding payment options, please contact admissions@ziplines.com .

The Business Analytics Science Certificate Course is provided in partnership with Ziplines Education , a market-driven education company that delivers innovative programs to prepare learners for the demands of today's economy.

**Ziplines Student Testimonials**

## Courses

# COASTAL SUSTAINABILITY & RESILIENCE

Cost: $2,500. Some limited needs-based fellowships available. Contact csp@ucsc.edu
Required Credits: 4 CEUs
Duration: 10 weeks. Includes a 9-week virtual program + a 2.5 day in-person workshop

## Series Description

Navigate coastal adaptation and sustainability projects

From policies to practice for a resilient future

The Certificate in Coastal Sustainability and Resilience series aims to increase the number of practitioners in coastal communities who are knowledgeable and prepared to integrate a range of sustainability solutions, including nature-based solutions, in coastal adaptation, sustainability, and resilience projects.

Our multisector network of instructors and classmates share a dedication to implementing practical solutions to coastal resilience projects. Through cohort-based activities grounded in science, students build actionable knowledge and skills, such as.

Climate adaptation and resilience strategies.

Nature-based solutions.

Applying to funding sources.

An overview of the insurance landscape.

A national, regional, and state perspective on nature-based policy solutions.

Equitable engagement of interested parties

Our Participants

The first course in this series— **Coastal Climate Resilience** —is designed for people who are actively working in the field of coastal climate resilience and plan to apply learnings in real time. This includes practitioners across the United States who are working at the interface of climate and coastal adaptation, particularly practitioners and scientists in positions to plan, finance, implement, model, incentivize, and transfer risks associated with coastal adaptation projects. We are particularly interested in supporting:

environmental planners,

municipal, regional, and state leaders,

tribal members,

climate and sustainability managers,

risk modelers,

insurance industry employees,

engineers, and,

community liaisons working at the interface of climate and adaptation.

## Courses

### *1. Coastal Climate Resilience courses*

Coastal Climate Resilience | SRSV.800, 4.0 CEU's

# PRE-HEALTH POSTBACC

Cost: Varies
Required Credits: Varies
Duration: Varies

## Series Description

**Science courses for aspiring health professionals**

**University of California postbaccalaureate-level courses**

Healthcare is one of the fastest growing industries in the country, adding about 1.9 million jobs annually.

This Pre-Health Postbaccalaureate series provides flexible, individualized courses for aspiring healthcare professionals who are ready to take the next step in their career plans.

Whether you are interested in medicine, dentistry, or other health allied fields, this is a cost-effective program to complete your science prerequisites and improve your overall GPA.

**Our students**

This series is perfect for students who have earned an undergraduate degree and wish to complete or strengthen prerequisites for admission to health professional schools.

**UCSC undergraduates should follow the requirements of their major at the main campus.**

Additional Science Courses

Don’t see the class you are looking for below? UCSC is partnering with UCLA to offer additional science courses.

**See UC Science Course page for enrollment details.**

## Courses

### *Biology*

Biochemistry | BIOL.X100, 5.0 Units
Cell and Molecular Biology | BIOL.X001_A, 5.0 Units
Development and Physiology | BIOL.X001_B, 5.0 Units
Ecology and Evolution | BIOL.X001_C, 5.0 Units

### *Chemistry*

General Chemistry I | CHEM.X001_A, 5.0 Units
General Chemistry II | CHEM.X001_B, 5.0 Units
General Chemistry III | CHEM.X001_C, 5.0 Units
General Chemistry III Lab | CHEM.X001_C_L, 2.0 Units
General Chemistry II Lab | CHEM.X001_B_L, 2.0 Units

Organic Chemistry I | CHEM.X002_A, 5.0 Units
Organic Chemistry II | CHEM.X002_B, 5.0 Units
Organic Chemistry II Lab | CHEM.X002_B_L, 2.0 Units
Organic Chemistry I Lab | CHEM.X002_A_L, 2.0 Units

### *Supplemental Instruction (Cohort Program Only)*

Medical School Application Workshop - Central Coast | PBSV.800_CC
Medical School Application Workshop - Silicon Valley | PBSV.800_SV
Postbacc Lecture Series - Central Coast | PBSV.805_CC
Postbacc Lecture Series - Silicon Valley | PBSV.805_SV

# APPLIED BUSINESS SCIENCE

Cost: $2,250 to $2,450 per course.
Required Credits: CEUs available vary per course.
Duration: 10 weeks

## Series Description

**Learn business fundamentals and the latest industry tools**

Enroll in a 10-week online, mentored certificate course taught fully online by Ziplines through UCSC Silicon Valley Extension. Choose among three key industry areas**—Business Analytics, Digital Marketing, Product Management—**or broaden your horizon by taking all three.

## Courses

# Course Descriptions

## *3D IC Packaging and Physical Verification | VLSI.X418*

3.0 Units

This course provides an in-depth exploration of the principles, techniques, and applications of three-dimensional integrated circuit (3D IC) packaging. 3D IC packaging is a cutting-edge technology that enables the stacking of multiple integrated circuits (ICs) within a single package, offering numerous advantages in terms of performance, power efficiency, and form factor. The course begins with an introduction to the fundamentals of IC packaging, including various packaging technologies and their evolution. It then delves into the concepts and challenges associated with 3D IC packaging. Students will gain a comprehensive understanding of the design considerations, fabrication processes, and assembly techniques employed in 3D IC packaging. The course also covers topics like EMIR and has comprehensive physical verification in the areas of chip stacking.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the fundamentals of 3D IC packaging and analyze the benefits and challenges of 3D IC packaging

Identify different 3D IC packaging architectures and understand advanced packaging materials and processes

Discuss emerging trends and future directions in 3D IC packaging

Collaborate effectively in a multidisciplinary team(s)

Apply theoretical knowledge to practical applications

**Skills Needed**

Some familiarity with material science principles and a fundamental knowledge of semiconductor manufacturing processes. Skills You Will Gain

3D IC Packaging Fundamentals – Understand key concepts, benefits, and challenges of 3D IC technology.

Advanced Packaging Techniques – Explore architectures, materials, and fabrication processes.

Physical Verification & EMIR – Learn chip stacking verification and power integrity analysis.

Industry Trends & Innovations – Stay ahead with emerging technologies in 3D IC packaging.

Collaboration & Practical Application – Work in multidisciplinary teams on real-world projects.

## *Achieving Organizational Agility using the Scaled Agile Framework, SAFe© | PPMT.X420*

1.5 Units

Few companies can survive long without releasing to market quality products and services, cost-effectively and ahead of competition. Increasingly high-value work calls for lean-agile teams, often using the SAFe© framework. This Agile class empowers students to understand lean-agile principles and practices, and readily and effectively collaborate with or integrate in SAFe© teams. Since 2016, enterprises have adopted SAFe© as the No. 1 approach for scaling agile, more than Scrum of Scrums and any other approach.

Learning Outcomes

At the conclusion of the course, you should be able to

Demonstrate why organizations need to adopt a framework such as SAFe©

Collaborate productively with/in SAFe teams

Evaluate what it takes for organizations to succeed in adopting SAFe

Access and utilize free resources and references for continuously monitoring and learning advances in lean agile

Topics Include

Overview of Lean Agile Principles and Thinking

Agile and Lean Practices

Introduction to SAFe®

SAFe® Lean-Agile Principles

Starting SAFe®

PI Planning

Skills Needed

Experience working in a team or project, in any role.

Skills You Will Gain

SAFe© Framework Mastery – Understand why organizations adopt SAFe© for scaling Agile.

Lean-Agile Principles – Apply Agile and Lean methodologies to improve productivity.

Effective Team Collaboration – Work efficiently within or alongside SAFe© teams.

SAFe© Adoption Strategies – Evaluate key success factors for enterprise Agile transformation.

Continuous Learning & Improvement – Access resources to stay updated on Agile best practices.

## *Advanced DevOps Technologies | SEQA.X409*

3.0 Units

As more and more industries use DevOps practices and technologies, the demand for skilled DevOp technologists is skyrocketing. This course builds on the DevOps training in our introductory course, expanding on the methodologies and techniques necessary for students to understand real-world DevOps-based deployments. Through examples and hands-on assignments, students explore core DevOps concepts, container orchestration, cloud-based deployments, automated deployment tools, and system monitoring. Students also work with networking, Bash shell and Python scripting, package installation/management, Linux server configuration, and automated source code control mechanisms.
**Topics Include**

Scripting with Bash & Python

Infrastructure as Code (IaC) using Terraform

Git/GitHub

Microservices

Container configuration using Docker

Container deployment/orchestration using Kubernetes

Continuous integration and deployment (CI/CD) using GitHub Actions, GoCD

Continuous deployment using FluxCD & GoCD

Cloud-deployments in Amazon Web Services.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Design and implement complex deployment scenarios

Perform automated server setup using virtual machines and containers

Implement multi-mode cluster setups and cloud-based deployments

**Skills Needed:**

Students must understand the topics covered in "DevOp Technologies" or have professional-level experience deploying systems in a data center or cloud and programming experience or a course in Bash scripting or Python.

## *Advanced Verification with SystemVerilog OOP Testbench | VLSI.X400*

3.0 Units

SystemVerilog is the industry IEEE-1800 standard combining the hardware description language and hardware verification language. This course focuses on the use of advanced verification features in SystemVerilog. Students will learn the step-by-step processes of creating flexible verification components, which form the basis of modern industry-standard methodologies such as UVM (Universal Verification Methodology). They will also gain experience developing an industrial-strength object-oriented programming (OOP) testbench that is layered, configurable, constrained-random, and coverage-driven. The course starts with a brief review of SystemVerilog language semantics and simulation fundamentals such as event ordering, delta cycles and race conditions, which will then feed into closely related entities in program block, clocking block, and interfaces. Students will learn how to develop a complete verification environment by building flexible testbench components via the use of virtual interfaces, classes, mailboxes, dynamic arrays, and queues, etc. Functional coverage in the form of covergroup, coverpoint, and SystemVerilog Assertion (SVA), will round up the development of a complete verification environment. You will become familiar with the flexibility of an OOP-centric technique, the power of constrained random verification and the use of functional coverage tools to ensure the success of a verification project.

Concepts introduced in class are reinforced in the lab. In addition to in-class hands-on labs and weekly take-home assignments, students will work on a required project to build an advanced OOP testbench and verification environment for a selected application (such as a 10G Ethernet MAC design), with transaction-level and layered architecture. Students will form a project team, create a test plan, develop an OOP-centric verification environment, perform functional coverage, and submit a complete project report. This course builds the foundation for the course "System and Functional Verification Using UVM (Universal Verification Methodology)."

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the shortcomings of Verilog-HDL testbench, and the benefits/flexibility of Object Oriented Programming (OOP) Testbench

Explain the building blocks of a well-designed OOP Testbench: program block, clocking block, interface, classes, inheritance, polymorphism, randomization

Demonstrate Functional Coverage, and how to use coverage as an objective and quantitative measurement to achieve coverage closure

Develop industrial-strength OOP testbench that is layered, constrained-random and coverage-driven

**Skills Needed:**

A course in SystemVerilog and knowledge of VHDL, Verilog, C/C++, and some hardware verification experience. Ability to install and configure open-source software on own computers.

## *Agile Project Management Fundamentals | PPMT.X426*

1.5 Units

Agile, typically associated with software development and product development, is quickly becoming the preferred project management paradigm. It enables organizations to deliver value to organizations and customers quickly, to recalibrate scope and priorities frequently, and to reduce project overhead. Agile teams constantly work to improve team performance. With roots in Japanese quality management practices, Agile has also become a model for process, product, and IT management.

In this overview course, students dive into the history, principles and practices of this highly collaborative project management system.

Learning Outcomes

At the conclusion of the course, you should be able to

Understand the origins of Agile.

Compare traditional waterfall project management to three common Agile frameworks—Hybrid, Kanban, and Scrum.

Gain experience with Agile Manifesto

Seven Lean Principles

Kanban and Scrum

User-centered design

Quality management, including user acceptance testing.

Differentiate leadership vs. management. Understand how to scale agile in the enterprise and techniques to address challenges.

Topics Include

Key concepts and best practices related to Hybrid, Kanban, and Scrum as common Agile frameworks.

User-centered design requirements, their articulation as user stories, and the importance of a fast response to user acceptance testing.

Quality management forms in Agile development.

Strategies to scale Agile in the enterprise.

Skills You Will Gain

Agile Frameworks: Compare and apply Agile frameworks like Hybrid, Kanban, and Scrum to manage projects effectively.

Agile Principles & Manifesto: Gain a deep understanding of the Agile Manifesto and the seven Lean principles that drive Agile success.

User-Centered Design: Implement user-centered design principles to create products that meet customer needs and expectations.

Quality & Testing: Master quality management techniques, including user acceptance testing, to ensure project success.

Scaling Agile: Learn strategies to scale Agile practices across teams and organizations, tackling common challenges along the way.

## *Agile Project Management Using Scrum | PPMT.X408*

1.5 Units

This course introduces the principles and practices associated with Agile project management using the popular Scrum framework. We will discuss the project management processes of the full project lifecycle in the context of Scrum. Theory and real life examples will be used to demonstrate the benefits of the Scrum framework in maximizing customer value delivery and promoting open collaboration and flexibility in adapting to changing market requirements. Concepts and techniques will be reinforced as students simulate a Scrum team and execute a real-world project.

Learning Outcomes

Upon successful completion of this course, students will be able to

Articulate and implement the theory and values and principles behind the SCRUM framework

Introduce the SCRUM methodology into their project organization and/or company

Coordinate and lead a SCRUM team, manage the team artifacts and events for implementing the SCRUM framework

Define and elicit the individual responsibilities of the Developers, Product Owner, and Scrum Master

Facilitate the SCRUM events, including the sprint, sprint planning meetings, daily scrum meetings,

sprint review, and sprint retrospective meetings

Implement collaborative techniques for facilitating team decision making

Topics include

Introduction to Agile

History of Scrum

Business benefits from using Scrum

Scrum process – planning and executing Sprints

Scrum roles and their significance

Scrum events

Scrum artifacts

Scrum example scenarios

Scrum culture

How to adopt Scrum in an organization

Skills You Will Gain

Scrum Framework Mastery: Understand and apply Scrum principles, values, and theory to drive successful project delivery.

Scrum Team Leadership: Lead and coordinate a Scrum team, managing artifacts and events for effective implementation.

Role Definition: Clearly define and manage the responsibilities of Developers, Product Owner, and Scrum Master within the Scrum framework.

Facilitation Skills: Facilitate key Scrum events, including sprint planning, daily stand-ups, and retrospectives, to ensure smooth team collaboration.

Collaborative Decision-Making: Implement effective collaborative techniques to enhance team decision-making and adaptability.

3.0 Units

This course provides an overview of agile software development with an emphasis on popular software development practices like test-driven development (TDD) and behavior-driven development (BDD). It covers best practices, techniques and tools used in TDD and BDD, providing an overview of testing methodologies, including black box and white box testing in the evolving Agile/Scrum model. You will learn how to use Git for version controlling and GitHub for source code management. The course introduces xUnit framework based test automation using Python pyUnit and nose as well as Selenium WebDriver based functional test automation. Test coverage concepts, strategies and tools such as coverage are also addressed. By the end of the course, you will gain hands-on exposure to cutting-edge tools heavily used in the software industry. You are encouraged to bring laptops to class.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe all the common software testing categories and their general usages

Discuss and apply agile development using TDD/BDD, automation of unit, functional, and web-based testing

Explain code coverage, continuous integration and continuous testing/deployment processes

Identify strategies to apply unit testing very early in the development process

**Skills Needed:** Coding knowledge of any general purpose programming language such as Python, Java, C++, Ruby, or C# is required. Students without prior programming experience in Python are encouraged to go through a quick learning guide such as www.learnpython.org before the first lab starts.

## *AI-Driven Embedded Systems | EMBD.X424*

2.0 Units

Edge AI is revolutionizing embedded systems by bringing powerful machine learning capabilities to low-power devices. This hands-on course explores how AI can be deployed for visual AI (object detection with a camera), audio AI (keyword and command detection), and even lightweight large language models (LLMs) for natural language processing.

Designed for aspiring engineers and developers, students will explore how to leverage AI to enhance the capabilities of embedded hardware like low-power MCU-based systems on a chip ESP32-S3 by Expressif. Over eight sessions, participants will learn the fundamentals of AI, build and optimize neural networks, and deploy custom AI models for real-world applications.

With a strong emphasis on practical application, this course blends in-class exercises, homework assignments, and project-based learning to ensure a deep understanding of AI's potential in embedded systems. Whether you're new to AI or looking to enhance your expertise, this course offers the tools and knowledge to innovate in the rapidly growing field of embedded AI.

Learning Outcomes

At the conclusion of the course, you should be able to:

Explain fundamental AI concepts and neural network principles.

Implement the AI applications using tools like TensorFlow Lite and Edge Impulse on OpenMV.

Train and optimize models for embedded systems, focusing on performance and efficiency.

Develop a capstone project that integrates AI into a practical embedded solution.

Skills Needed:

You will need programming experience in Python.

## *AI, Empathy, and Ethics | AISV.806*

1.0 CEU's

**Now available through Coursera!**

This exciting new course is now being offered in a self-paced, online format via the Coursera learning platform. You are invited to enroll in it today!

"Enroll in AI, Empathy, and Ethics with AI architect Kelvin Lwin."

More about this course:

This nontechnical course provides an overview of artificial intelligence advancements and the ethical challenges we now face as we navigate the development, implementation, and ubiquitous global use of AI.

When we demystify AI technology, we encounter intrinsic ethical challenges such as privacy, bias, diversity, equity, explainability, and robustness-all foundational aspects of effective business stewardship.

In this course, we confront the ethical considerations of enterprise AI adoption while providing a deep understanding of how to leverage AI in ways that benefit both corporate and society at large.

We begin the course with an introduction to AI, including an overview of machine learning, deep learning, neuro-linguistic programming, and autonomous systems. Then, we explore the broader impact of AI technology on enterprise and society and discuss ethical values and frameworks in industry case studies, the future of work, and the training, reskilling, and retention of needed talent.

Key topics

AI hype v. reality

Business and managerial implications of AI

Successful integration of AI into your organization

Key principles of building responsible and explainable AI

Various aspects of ethics and how to apply ethical parameters to AI

Ethical frameworks supporting collaboration between people and AI machines

Ongoing industry initiatives on AI ethics

By the end of this course, you will be able to create a business roadmap and ethical framework for the implementation of AI in your specific domain areas and present a 20-minute pitch on incorporating and building ethical AI frameworks in existing or new projects.

## *AI Essentials | AISV.813*

0.5 CEU's

In this introductory course, students will learn about the latest developments in the field of artificial intelligence as well as their practical applications. They will explore ChatGPT, Auto-GPT, Chatsonic, DALL-E, and other AI systems, and have the opportunity to interact directly with the technology to experience its potential and limitations. This course is ideal for anyone who wants to gain an understanding of emerging AI technology and its industry applications. It prepares you to pursue our developing AI program series as a user or developer, and is suitable for individuals who are considering a career in data science, machine learning, or AI.

**Learning Outcomes**

At the conclusion of the course, you should be able to: Discuss the fundamental characteristics of AI systems and the technologies used in AI-powered applications.

Describe applications of AI in the real world.

Demonstrate basic skills interacting with generative AI applications.

Discuss the current state of AI development, its promise, the potential dangers, and ethical considerations.

**Topics Include**

Overview of AI, machine learning, deep learning, and generative AI

Applications of AI

The development and deployment processes of AI applications

Limitations, pitfalls, and dangers

Future directions in AI

Career opportunities and basic requirements to qualify for these jobs

## *AI for Autonomous Driving Systems: Concepts to FPGA | VLSI.X416*

3.0 Units

The Silicon Valley-led shift from conventional, fully human-driven vehicles to autonomous driving (AD) systems empowered by artificial intelligence has created a huge demand for engineers and researchers who know these emerging technologies. In this course, which is open to students with a basic knowledge of programming and digital logic, we will explore the fundamentals of AD systems—machine learning, computer vision, and hardware implementation on a field programmable gate array (FPGA). We will cover critical concepts such as object, vehicle, and lane detection, as well as traffic sign classification, AI, and deep learning algorithms. You will study practical systematic design of typical FPGA applications in AD systems using the hardware description language, Verilog before moving to testbench development, simulation for bit-true design verification, and complete system design synthesis.

The course is designed to strengthen theoretical understanding and provide hands-on experience with hardware. By the end of the course, you will have hands-on experience with FPGA design and be able to design, test, and implement a complete digital system on an FPGA device including interfacing to external devices.

**Learning Objectives**

At the conclusion of the course, you should be able to

Define, develop, and model image processing and machine learning basic algorithms

Understand and differentiate computation platforms for AD

Develop basic RTL designs for FPGA

Develop image processing algorithms on FPGA

Implement, verify, and simulate a working design on FPGA for AD applications

**Skills Needed:**

Some programming knowledge (Python, MATLAB, VHDL, Verilog, SystemVerilog) and digital system design experience is preferred, but not required.

## *AI Technology Workshop Series: AI Enhanced Project Management* | *AISV.817_W9*

0.3 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss AI technology available to Project Managers

Explain the transformative potential of Generative AI in improving project planning, resource allocation, and stakeholder communication

Demonstrate an ability to properly and effectively use Generative AI for Project Management Tasks and Processes, reducing errors, optimizing workflows, and saving time and resources

**Topics Include**

Benefits of Adopting Generative AI for Project Management

Effective Prompt Engineering to Optimize Generative AI usage along with Case Examples

Identifying Use Cases for Generative AI in Project Management

AI-Driven Insights for KPI & Project Performance Measurement

**Students are required to bring laptops for class exercises**

## *AI Technology Workshop Series: AI in the Semiconductor Industry* | *AISV.817_W4*

0.3 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss modern AI tools and techniques for Semiconductor Design and Manufacturing

Identify use cases for the applications for Generative AI in the Semiconductor Industry

Discuss EDA advancements in the Area of ML/AI

**Students are required to bring laptops for class exercises**

## ***AI Technology Workshop Series: AI Model Development Lifecycle* | *AISV.817_W12***

0.5 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Acquire knowledge/skills on the fundamentals of AI model development process

Explain the critical steps required in building and refining AI models

Demonstrate ability to identify key testing activities of an AI model

**Topics Include**

Planning for the AI model: Data accuracy cleaning, augmentation, visualization, Structured/unstructured data

Designing algorithms, constraints, assumptions

Evaluating AI models, bias testing, edge case analysis

AI model deployment strategy, platform selection, model packaging and implementation

Maintenance: performance monitoring, model retraining and versioning

**Students are required to bring laptops for class exercises**

## *AI Technology Workshop Series: For Instructors and Educators | AISV.817_W1*

0.3 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss modern AI tools and techniques for instructors

Identify use cases for the applications for Generative AI in education

Demonstrate an ability to properly and effectively use Generative AI tools and techniques for educational purposes

**Students are required to bring laptops for class exercises**

## *AI Technology Workshop Series: For Product Managers | AISV.817_W6*

0.3 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss modern AI tools and techniques for Product Managers

Identify use cases for the application for Generative AI in Ideation, strategy development, design, operations, go-to-market, sales, and customer support functions

Demonstrate an ability to properly and effectively use Generative AI tools and techniques for market research, hypothesis validation, strategic planning, product development, marketing, and customer success using innovative and iterative approaches

**Topics Include**

Basics of AI technology - supervised, unsupervised, deep learning, gen AI techniques

Overview of the use cases related to product management - monitoring and data visualization, prediction models, content creation, support bots

Performing market research

Building and validating market/product hypotheses

Fast and iterative strategy artifacts addressing what, why, why now aspects

Building Product and Market requirement documents

Co-pilots for fast iterative product development

Creating compelling web and social demand channels using multimodal content

Running effective and efficient marketing and sales campaigns

Bot based approach to effective customer success

**Students are required to bring laptops for class exercises**

## *AI Technology Workshop Series: For the User Experience Professional* | *AISV.817_W5*

0.5 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss modern AI tools and techniques for user experience

Identify use cases for the applications and techniques

Through a project, demonstrate an ability to effectively use AI tools and techniques in design deliverables

**Students are required to bring laptops for class exercises**

## *AI Technology Workshop Series: Github Copilot For Programmers (C/Python) | AISV.817_W2*

0.3 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss GitHub Copilot system architecture and the mechanics of using Copilot within an IDE

Identify use cases and examples of where GitHub Copilot enhances programming productivity and testing

Demonstrate an ability to properly and effectively use this tool to create and test programs

**Students are required to bring own their laptop with Github Copilot installed. Instructions will be provided 24 hours prior via Canvas**

## *AI Technology Workshop Series: Humanoid Robotics | AISV.817_W10*

0.3 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss the basic technology at the foundation of modern humanoid robotics

Identify use cases, applications and trends for the technology in industry

Demonstrate an ability to properly and effectively evaluate challenges for the technology's adoption and deployment

**Topics Include**

History of Humanoid Robotics

Current Applications and Industry Trends

Architecture and Components

Generative AI / Foundation Models and Today's Robots

Challenges for Adoption

## *AI Technology Workshop Series: Large Multimodal Models LMM | AISV.817_W8*

0.5 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss modern Large Multimodal Models (LMM)

Identify use cases for Large Multimodal Models in industry

Demonstrate an ability to properly and effectively employ Large Multimodal Models in real world projects

**Topics Include**

Introduction to the technology

The technology’s importance and impact in the workplace

Practical use cases

Demonstration and hands on lab with the technology

Resources for those who wish to learn more

**Students are required to bring laptops for class exercises**

## *AI Technology Workshop Series: LLMs and Prompt Engineering | AISV.817_W7*

0.4 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss how Large Language Models (LLMs) work

Identify use cases for the application for Generative AI.

Demonstrate an ability to properly and effectively use Prompt Engineering to receive the best results when working with Generative AI

**Topics Include**

How tokenization and embedding are essential to predicting the next word

Real-World Examples of Language AI Models

Prompt Engineering Techniques for Effective AI Responses

Practical Applications of Language AI Technology

**Students are required to bring laptops for class exercises**

## *AI Technology Workshop Series: Model Context Protocol | AISV.817_W15*

0.5 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications.

Learning Outcomes

By the end of the workshop, participants will be able to:

Explain the core principles and motivations behind the Model Context Protocol (MCP), including its role in AI Agentic system communication and AI model integration.

Identify the structure and components of an MCP message and understand how context is preserved and passed across tasks or AI agents.

Implement simple MCP interactions in a controlled setting using real-world tools and libraries.

Evaluate the strengths and limitations of MCP in current AI Agentic system architectures, including scalability and interoperability.

Topics Include

MCP Basics: What is Model Context Protocol and why does it matter in AI pipelines and agent interoperability?

Message Anatomy: Structure, metadata, tokens, and temporal context.

Live Demo: Walking through an MCP message lifecycle-create, modify, pass, and interpret.

Hands-On Lab: Building a mini MCP-based interaction (e.g., agent-to-agent communication or contextual memory pass).

Challenges & Use Cases: Real-world applications, common pitfalls, and current limitations.

Prerequisites : Knowledge of LLM and AI Agents.

Note: Please bring a laptop and have Google, GitHub and Hugging Face accounts to participate in hands-on exercises.

## *AI Technology Workshop Series: Open Computer AI Agent by Hugging Face | AISV.817_W13*

0.5 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe the architecture and core components of Hugging Face’s Open Computer Agent and its relation to the Qwen2-VL model and E2B Desktop environment.

Explain how to operate the Open Computer Agent via a web browser to perform complex tasks such as writing, summarization, and file management.

Develop a custom AI workflow by connecting Open Computer Agent to Hugging Face Spaces for automating personalized tasks like sending emails or launching apps.

**Topics Include**

Open Computer Agent overview

Qwen2-VL and E2B Desktop

No-code virtual machine usage

Prompting for task automation

Connecting to Hugging Face Spaces

Custom agent task workflows

Automating everyday computer actions

Ethical use of AI agents

**Students are required to bring laptops for class exercises**

## *AI Technology Workshop Series: Practical uses of DeepSeek/Llama* | *AISV.817_W11*

0.4 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Explain the core architecture and capabilities of the DeepSeek-R1 vs Meta's Llama model.

Analyze real-world applications and industry use cases of open source LLMs.

Apply LLMs effectively in practical projects, optimizing its performance for various tasks.

**Topics Include**

Introduction to DeepSeek-R1 and Llama: Overview of its architecture, key features, and advantages.

Industry Applications: How open source LLMs are transforming different sectors, from AI-driven automation to research.

Practical Implementations: Step-by-step guidance on integrating LLMs into real-world workflows.

Hands-on Lab & Demonstration: Interactive session to experiment with Llama model in action.

Further Learning & Resources: Where to find additional materials, research papers, and community discussions.

## *AI Technology Workshop Series: Spiking Neural Networks | AISV.817_W14*

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss the fundamental principles of Spiking Neural Networks (SNNs), including spike-based data representation, key neuron models (e.g., Leaky Integrate-and-Fire), synaptic operations, the current state-of-the-art in neuromorphic hardware, and the realistic short-term and long-term potential of SNNs in the broader AI landscape.

Explain the differences between Spiking Neural Networks (SNNs) and traditional Artificial Neural Networks (ANNs), articulating the motivational factors for SNN adoption such as energy efficiency and event-driven computation.

Demonstrate an ability to properly and effectively implement simple SNN applications (e.g., the XOR problem and a more complex use case) using tools like Nengo, understanding how information is encoded and processed through spike trains, and applying different training approaches for SNNs while contrasting them with traditional backpropagation and evaluating the challenges and opportunities in SNN learning.

**Topics Include**

**Introduction to Spiking Neural Networks:** What are SNNs? Visualizing spike-based computation.

**Why SNNs Matter:** Motivations (energy efficiency, neuromorphic hardware), real-world applications (robotics, IoT), and a realistic look at when they are most beneficial.

**Core Concepts of SNNs:** Spike-based representation (events, timing, frequency), simplified neuron models (LIF), synaptic function, and encoding strategies (rate vs. temporal).

**Hands-On with SNNs (Nengo Demo):** Interactive exploration of spike generation, parameter tuning, and visualizing network behavior.

**Problem Solving with SNNs:**

The XOR problem: Understanding challenges with discrete logic.

Applying SNNs to continuous, real-world analog-like problems.

**Training Spiking Neural Networks:** Exploring alternatives to backpropagation (e.g., evolutionary

computation, PSO) and understanding the associated challenges.

**The Neuromorphic Landscape:** Introduction to key neuromorphic hardware (e.g., Intel Loihi, BrainChip Akida), their architectures, and real-world case studies.

**Current Limitations and Future Outlook:** Discussing speed vs. efficiency, challenges in tooling and frameworks, and the short-term and long-term vision for SNN adoption.

**Students are required to bring laptops for class exercises**

## *AI Technology Workshop Series: Unit Testing Tooling and Strategies | AISV.817_W3*

0.3 CEU's

Welcome to our immersive AI technology workshop series. During these sessions you will be introduced to new and established AI tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss modern AI tools and techniques related to unit testing

Identify use caseswhere these AI tools and methodologies can be applied

Demonstrate an ability to properly and effectively use these AI tools and techniques for unit testing purposes

**Students are required to bring laptops for class exercises**

## *AI Tools for the Office | AISV.815*

2.0 CEU's

Streamline your everyday office tasks by leveraging the power of AI and machine learning technology. Using common office software tools, such as Microsoft Copilot, Google Gemini, and NotebookLM, you'll discover how AI converts natural language input into actionable productivity tasks, streamlines and automates your workflow and enhances efficiency across document creation, spreadsheets, presentations, calendars, and emails.

This course is designed for nontechnical professionals looking to harness generative AI. You'll explore tools like ChatGPT, DALL-E, and NotebookLM, gaining hands-on experience in AI-driven content creation, summarization, and automation.

You'll be skilled in prompt engineering and be able to use MS or Google Drive office software more efficiently and effectively, helping you to succeed in today's fast-paced work environment.

Please bring a use case to solve with generative AI.

**Learning Outcomes**

At the conclusion of this course, students will be able to:

Identify and utilize commonly available AI-enhanced tools like Microsoft Copilot, Google Gemini, and NotebookLM

Use natural language prompts efficiently to generate useful answers and content.

Work more efficiently and effectively with documents, pdfs, spreadsheets, presentations, email and calendars.

## *Analog IC Design, Introduction | VLSI.X401*

3.0 Units

Today's mobile, wireless, and consumer electronics employ ASICs and high integration SOCs (System on Chip) that often include the analog blocks for signal processing and the associated analog-to-digital interface circuits. Most MEMS, sensors, photovoltaic and electro-optical devices also require analog components. Understanding the basics of analog IC is essential for application engineers as well as circuit and system designers in a wide variety of electronic fields. This course introduces analog IC design fundamentals including single/multiple-transistor amplifiers, current mirrors, current/voltage reference, output stages, frequency response, feedback, stability, noise, nonlinearity, and mismatches. Transistor models and CAD tools for analog design will also be covered. Students will gain a basic understanding of analog IC design and become familiar with circuit analysis and simulation tool flow. The fundamentals presented in this course prepare students to tackle advanced analog IC topics such as Op-amp, PLL, ADC and DAC.

Students will have access to simulation and waveform tools to test the performance of analog IC designs in our lab. Upon completion, students will have gained experience with circuit simulation and an in-depth understanding of the basic analog functions in IC.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Identify basic building blocks in analog integrated circuits

Analyze performance parameters such as gain, impedance, and bandwidth using small-signal models

Design analog ICs of small to medium complexity and verify them using simulation tools

**Skills Needed:**

Basic knowledge of microelectronics circuits, semiconductor devices and physics. Experience with UNIX/Linux systems and commands is required for the lab.

## *Applied Digital Media Planning and Platforms | MKTG.X419*

2.0 Units

The Applied Digital Marketing course introduces students to the world of integrated digital marketing. This program provides students with strategic and tactical skills they will need to identify, engage, and develop successful relationships with customers in today's digital environment. The course is designed to explore best practices and practical applications of search (SEO/SEM), display, mobile, video, social media, email (CRM), and the reporting/analytics behind running successful multichannel campaigns.

Learning Outcomes

At the conclusion of the course, you should be able to

Explain the core concepts of multi-channel and digital marketing strategies and tactics

Employ digital best practices to drive desired marketing results in their media mix

Use current digital marketing tools for research, planning and execution of digital initiatives

Build a digital marketing plan

## *Applied Project Management | PPMT.X417*

3.0 Units

This is the final course in the certificate program and enables students to apply what they've learned from previously completed project-management courses, by developing a simulated but realistic team project. Students will be given project-management tools to facilitate the development of their project. Emphasis will be placed on practical application of project-management principles, processes, and techniques, including project control, cost management, project tracking, and project outsourcing.

Students will also learn how to control project schedules, budgets, and scope, using methods that minimize or completely eliminate "scope creep." Techniques such as fast-tracking, critical-path crashing, stochastic estimating, and exploiting activity lead-lag times will enable students to develop fast, accurate project schedules. In-class exercises and case studies lead students to skills they can take back to work and immediately apply to their own projects.

Learning Outcomes

At the conclusion of the course, you should be able to

Work in a self-organizing agile team to iteratively develop and deliver complex products

Define project scope definition of deliverables with clear traceability to requirements

Define a delivery release plan using a phased-gate Work Breakdown Structure

Construct and utilize schedule networking diagrams for planning project schedules

Develop project schedules using critical path and critical chain processes

Determine the most cost-effective schedule compression techniques

Apply techniques for identifying and quantifying project threat and opportunity risks

Identify and develop cost effective risk responses

Apply detailed project cost analysis and future value cash flow projections

Monitor and control projects using the Earned Schedule management process

Understand how to effectively identify and outsource portions of your project

Topics Include

Project portfolio management techniques

How to estimate project costs and forecast investment returns

How to apply cybernetic-control techniques to schedules and budgets

How to use earned-value management (EVM) to track and control projects

How to fast-track and crash the project's critical path

How to use stochastic techniques to ensure accurate project schedules

How to apply project management principles in a simulated team project

### *Artificial Intelligence Application Development Certificate Completion Fee | O-CE0422*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

### *Artificial Intelligence for Robotics | AISV.X405*

3.0 Units

The AI robotics industry is rapidly growing, driving demand for professionals who can implement intelligent robotic systems in real-world settings. In this AI for Robotics course, you'll explore how AI enables robots to perform complex tasks across diverse applications - from logistics and manufacturing to healthcare and autonomous navigation. We'll dive into advanced AI techniques for perception, manipulation, reasoning, and learning, and examine how these capabilities are integrated into robotic systems. You'll gain hands-on experience training deep learning models for tasks such as object detection, classification, and segmentation. The course also covers the AI software development life cycle, including data preparation, model training, and validation, with a focus on the unique challenges of deploying AI in robotics.

Learning Outcomes

Through discussion, technical demonstration and hands-on practice, you will learn to

Design, develop, and deploy AI-driven applications for real-world robotic systems.

Translate real-world use cases into effective AI-powered robotics solutions across various industries such as logistics, manufacturing, and healthcare.

Apply machine learning techniques such as computer vision, sensor fusion, and decision-making models to enable robotic perception, control and autonomy.

Topics Include

Industry use cases and case studies in AI for robotics

Robotics architecture

Data acquisition and sensor fusion

SLAM (simultaneous localization and mapping)

Computer vision

Object detection and segmentation

Autonomous mobile robots

Natural language processing

Foundation models for robotics

Vision-language-action models

Demonstrations and project presentations

Deep learning applications

Skills Needed

Students should be proficient in programming languages, such as C++ or Python. Knowledge of AI/ML

solutions and related frameworks is suggested as well as familiarity with algebra and higher-level mathematics.

## *ASIC Physical Design, Advanced | VLSI.X402*

3.0 Units

This lab-based course covers advanced topics of ASIC front-to-back design automation. At 32nm node and below, ASIC physical designers have to face multi-vdd, multi-vt, high power, noise, and an explosion of process design rules—all while accounting for chip reliability. The course further develops the students' advanced ASIC design skills by introducing state-of-the-art EDA back-end design tools and methodology. The course provides a 28nm library for students to practice techniques learned in class. After reviewing the design challenges, the course covers UPF-based synthesis and placement. The instructor will give an example of congestion analysis and reduction, and proceed with detailed route analysis and optimization. Students will learn the Clock Tree Synthesis (CTS) and how to optimize timing sign-off in nanometer technology. The course also introduces the hierarchical design flow, power mesh synthesis, and IR drop analysis. The instructor will share tips from extensive professional experience in ASIC implementation over many generations and will also provide basic scripts to facilitate lab exercises.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Demonstrate advanced knowledge of ASIC backend design skills

Perform digital design work across all aspects of the design flow from RTL to GDS using the latest process nodes/technologies

Utilize EDA and Intelligent System Design tools such as Synopsys’s Design Compiler, IC CompilerII, IC Validator, StarRC, and PrimeTime; and Cadence's Innovus PNR tool

**Topics include**

Advanced physical design challenges

DC-topo multi-vt/multi-vdd UPF synthesis

Power mesh synthesis and optimization

Placement and IR drop analysis and reduction techniques

Congestion analysis and reduction

CTS analysis and optimization

Detail route analysis and optimization

Sign-off optimization

Hierarchical multi-vt/multi-vdd flow

**Skills Needed:**

Basic knowledge of the backend design flow from netlist to GDSII. Knowledge and hands-on experience with Linux/Unix will be required for lab exercises. **Students enrolling in this class should be able to answer 'yes' to six of the eight questions on the linked** Google Quiz.

## *Assistive Technology for Learning Differences | EDTH.X310*

3.0 Units

Technology can help struggling students leverage their learning strengths and bypass weaknesses to improve performance, independence, and self-confidence. In this online course aimed at teachers, learning specialists, educational therapists, and parents, you will learn about a wide range of tools to support students with learning disabilities, attention-deficit/hyperactivity disorder (ADHD), executive functioning deficits, and issues with processing information and memory. Through readings, lectures, video demonstrations, and hands-on activities, you will learn:

How various tools address specific learning needs.

How to match students with appropriate tools.

Practical methods and strategies to implement technology solutions and integrate with curricula.

How technology can facilitate Universal Design for Learning (UDL) practices in the classroom.

Learning Outcomes

At the conclusion of the course, you should be able to Provide a working definition of assistive technology (AT) devices and services in the context of accommodations for learning.

Explain the principles of Universal Design for Learning (UDL), and provide examples of how technology can facilitate practicing UDL in the classroom and why accessible education materials (AEM) are important to students using AT.

Demonstrate understanding of how specific technology features address the functional limitations that students with learning differences encounter with a wide range of essential academic tasks.

Apply a process for analyzing an individual's AT needs and creating a plan to implement selected tools and strategies.

Name and differentiate between the main laws that govern AT in education and describe their implications for students with learning differences.

Topics Include

Components of an effective AT solution

Basics of Universal Design for Learning (UDL) and Accessible Educational Materials (AEM)

Tools and associated strategies for various academic tasks

Applying a process for tool selection, implementation, and evaluating effectiveness

Working knowledge of:

Students should have a basic understanding of the academic challenges faced by individuals who have learning disabilities, ADHD, and executive function issues. This can be satisfied in various ways, including (but not limited to): Professional experience addressing the needs of students with learning differences.

Completion of "Understanding Learning Differences" (EDTH.X309) or equivalent coursework.

Prior review of material on learning differences (provided by the instructor).

Other requisites may be approved in advance by the instructor.

## *Attention Deficit Hyperactivity Disorder (ADHD) in the Classroom | ECED.X318*

3.0 Units

The average classroom may include several students who exhibit symptoms of Attention Deficit Hyperactivity Disorder (ADHD). Many educators need to build skills to meet the educational needs of these children. This course provides the tools needed to better understand, identify and evaluate the ADHD student. It addresses school-related problems associated with ADHD. In-depth coverage of practical, effective instructional strategies is offered as well as social skills training activities that can be easily incorporated into the regular curriculum. You'll learn how to implement effective classroom behavior management systems.

Learning Outcomes

At the conclusion of the course, you should be able to Gain a strong sense of what it is like to have ADHD.

Be familiar with the DSM V definition of ADHD.

Understand the myriad ways ADHD impacts every aspect of a person's life.

Understand that ADHD requires a multi-disciplinary approach.

Develop strategies for both the classroom and private practices.

Topics Include

25 Things to Love About ADHD

Sensory Integration Disorder and Its Connection to ADHD

Sensory Strategies for the Classroom

Special Resources for Non-Compliant Children

Additional Information

Practical, effective instructional strategies are offered. Because low self-esteem and weak social skills are a major problem for ADHD students, social skills training activities are presented that can be easily incorporated into the regular curriculum. Participants also learn how to implement effective classroom behavior management systems. This course is recommended for educators at all grade levels, administrators, other professionals, and parents.

## ***Basic Printed Circuit Board Design | EMBD.800***

3.0 CEU's

This course covers the entire basic printed circuit board (PCB) design process, including component library creation, schematic capture, and PCB layout. Students learn to use industry-standard software tools like Altium Designer to create detailed schematics and translate them into PCB layouts. Emphasis is placed on best practices for component placement, routing techniques, and design rule checks to ensure manufacturability and functionality.

Through hands-on learning, students develop a strong understanding of component libraries, schematic best practices, and various methods for wiring schematics. They also explore the PCB structure setup, including mechanical layer assignments and layer stack-up considerations. The course covers design rule checks (DRC), component placement strategies, routing methodologies, and the use of polygons, pours, and planes in PCB design. Additionally, students learn about PCB verification, cleanup processes, and documentation preparation for fabrication and assembly.

Upon completion, students can produce industry-standard documentation for analog and digital multi-layer, flexible, and high-speed PCBs, adhering to current IPC standards. This course provides the foundational knowledge and technical skills necessary for entry-level positions in the electronics industry or further study in advanced PCB design.

Learning Outcomes

At the conclusion of the course, you should be able to:

Explain the fundamentals of the PCB design process including library principles, schematic creation, PCB design, and documentation.

Demonstrate proficiency in using industry-standard tools such as Altium Designer and other PCB design software to create schematics and layouts.

Create and manage component libraries, including symbol creation, footprints, and part data.

Design multi-layer PCBs by integrating concepts of layer stack-ups, signal integrity, power distribution, and thermal management.

Apply design rules and constraints to ensure PCB manufacturability and functionality, using design rule checks (DRC).

Implement techniques for signal, power, and ground planes, including using vias and differential pairs.

Prepare and evaluate manufacturing documentation such as Gerber files, assembly drawings, and bill of materials (BOM).

## ***Benefits Management: A Comprehensive Study of Employee Benefit Programs* | *HRMT.X407***

2.0 Units

The unprecedented nature of the COVID-19 pandemic and its aftermath have had a tremendous impact on companies and the human resource professionals who are navigating new competitive benefit programs, paid leaves, and mental health strategies. The crisis has not only significantly shifted how we look at and craft our new benefits. It has changed the way we communicate about their offerings.

This course presents a comprehensive view of this new benefits landscape, including the latest approaches for analyzing and negotiating benefits programs and funding options. A key focus will be developing strategies to reduce healthcare costs. Students will learn to evaluate employee needs and help them better understand and use their coverage.

It is highly recommended that students new to Human Resources begin with "Human Resource Management.” After that, courses may be taken in any order.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe the role and responsibilities of a benefits manager’s job.

State a corporation’s employee benefits philosophy and goals.

Define various laws and regulations that govern the administration of employee benefits programs.

Describe principles of risk and how this relates to the design of insurance benefits plans.

Describe the role of the broker and the relationship with the benefits manager.

Define managed care and consumerism in health care benefits plans.

Describe various funding alternatives for insurance benefits programs.

Understand financial benefits including 401(k) and stock option plans.

Topics Include

Health and welfare plans, including cafeteria plans

The Affordable Health Care Act and Covered California

Qualified retirement plans such as 401(k) plans

Vacation and sick leave programs, incidental benefits

Overall benefit cost management workforce

Professional Credit

SHRM-CP® or SHRM-SCP® 19.25 PDCs.

## *Big Data, Introduction | DBDA.X401*

3.0 Units

In the new paradigm of Big Data where we trust distributed systems to process information across server clusters, we increasingly rely on technologies to manage the massive amounts of information generated by social media, online transactions, web logs, and sensors. These technologies include handling unstructured, semi-structured, and structured data, as well as processing, real-time analytics, and visualization. They are especially useful for reporting in circumstances where a relational database approach is not effective or is too costly. In this comprehensive introductory course for managers, analysts, architects and developers, you will gain insights into cloud-based Big Data architectures. We will cover Hadoop, Spark and other Big Data platforms based on SQL, such as Hive.

This course includes an overview of the Big Data technologies and frameworks such as HDFS, MapReduce, Spark, Kafka and Hive. The final project will give the ability to design the Big Data Pipeline with the understanding of all acquired knowledge of Big Data Technologies.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe big data concepts, characteristics, data management and warehouse

Explain the significance of big data and industry use case references

Compare and contrast NoSQL with Hadoop, leverage Hadoop ecosystem for analyzing big data and use Hive/NoSQL for data analysis

**Topics Include**

Evolution of Big Data

Big Data use cases

Big Data applications architecture

Understanding Hadoop distributed file system (HDFS)

How MapReduce framework works

Introduction to HBase (Hadoop NoSQL database)

Introduction to Apache Kafka

Introduction to Spark and SparkSQL

Developing Spark/SparkSQL applications

Managing tables and query development in Hive

Introduction to data pipelines

**Skills Needed:**

Moderate level of programming knowledge in Python and SQL

## *Biochemistry | BIOL.X100*

5.0 Units

This course provides an introduction to proteins, protein structure and function, membranes, bioenergetics, and metabolism. The course is intended to provide strong preparation for health professional schools and their entrance examinations. The course is designed to impart a deep understanding of how life works at the molecular level, as well as an understanding of the methods and logic used to study and manipulate biological molecules. Throughout, we will study examples of how the principles of biochemistry serve as a foundation for basic research into how life works, as well as a foundation for understanding medicine, including the development, mechanism and specificity of drugs.

Learning Outcomes

At the conclusion of the course, you should be able to

Develop a comprehensive understanding of the physical structure and chemical properties of biological macromolecules, building on foundational knowledge from Organic Chemistry.

Analyze the principles of thermodynamics and kinetics to understand the energetics of biological reactions and the catalytic properties of biological macromolecules.

Gain insight into the metabolic pathways and mechanisms by which cells produce and utilize building blocks, as well as how they communicate with their extracellular environment.

Explore real-world applications of biochemical concepts, such as genetic mutations and diseases, and the biochemical mechanisms of drugs.

Topics Include

The basic principles of molecular interactions, as well as the structure and function of biological macromolecules.

The principles of molecular recognition and specificity that are essential for understanding how proteins and nucleic acids execute their functions within cells, and how drugs work.

The energetics of biological reactions and the properties of biological macromolecules that enable them to catalyze chemical reactions with incredible specificity and efficiency.

How and where the building blocks of the cell are made. We will discuss principles and energetics of metabolism, and how cells can communicate with their extracellular environment.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: Cell and Molecular Biology, Development and Physiology, and Organic Chemistry II (or equivalent courses).

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their

major's course requirements.

## *Bioinformatics Certificate Completion Fee | O-CE0060*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the "Certificate Completion Fee" to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Bioinformatics Tools, Databases and Methods | BINF.X400*

3.0 Units

Bioinformatics plays a crucial role in the storage, search, and analysis of biomolecular sequence and structure data. A significant amount of data is now available on the web, along with software tools for data search and analysis. It is essential that professionals working with biological sequences or structures in public and private sectors are knowledgeable about these databases and tools.

This practical course introduces the main public domain tools, databases and methods used in bioinformatics, including DNA and protein databases such as Genbank and PBD, software tools such as BLAST, and methods for aligning sequences. Topics include multiple alignment, phylogenetic analysis, microarrays and system biology. The course emphasizes the needs of the user of bioinformatics tools and databases, rather than complex algorithm development and advanced computational methods.

The course includes computer lab exercises and online demonstrations of the various databases and tools on the web. It is intended both for life scientists and computer engineers and is the recommended first course for those wanting to gain skills in bioinformatics.

Learning Outcomes

At the conclusion of the course, you should be able to Understand the need and importance of bioinformatics in industry and research

Learn how to access and use bioinformatics tools and databases on the internet

Learn how to evaluate DNA and protein sequences using bioinformatics tools from the internet

Learn how to predict and understand protein structure using homology and comparative modeling

Learn how bioinformatics is used in the fields of genomics and proteomics

**Topics include**

The subspecialties of bioinformatics

Sequence alignment

The basics of molecular biology

Single nucleotide polymorphisms and genome-wide association studies

Additional Information

We will download the Sars-CoV-2 reference genome from the National Center for Biotechnology Information (NCBI) database; do BLAST to compare sequence similarity with bat RaTG13 CoV; use Clustal Omega, MUSCLE and T-COFFEE for multiple sequence alignment

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 30 contact hours

## *Biology of Cancer | BTEC.X402*

2.0 Units

This course provides a comprehensive exploration of the fundamental biology of cancer, essential for developing new therapies and diagnostic tools. We will examine how cancer alters normal cell behavior, with a focus on the key genetic changes driving its progression. The course will cover the roles of oncogenes and tumor suppressor genes, the dysfunction of which can lead to uncontrolled cell growth. We will investigate how the overexpression of oncogenes and inactivation of tumor suppressor genes disrupt cellular balance. Additionally, we will delve into mechanisms that alter gene expression, such as promoter methylation, and their impact on various cancers, including breast cancer. A critical part of the course will be studying the breakdown of apoptosis in cancer cells, a crucial factor in tumor development. As we progress, we will explore emerging cancer treatments and prevention strategies. By connecting biological insights to practical applications, students will gain a comprehensive view of current cancer research and future directions in oncology. This knowledge is fundamental for advancing cancer treatment and prevention, equipping students to contribute effectively to this vital field of study.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the cellular and molecular basis of cancer and tumor progression

Discuss therapeutic strategies for the treatment or prevention of cancer.

Demonstrate research skills and be able to search current Internet resources and databases for genes involved in cancer.

Topics Include

Cellular and molecular biology of cancer

The pathology and genetic basis of cancer

The immune system and cancer immunotherapy

The use of genetically modified T cells (CAR-T cells) to treat cancer

The role of infectious agents and environmental carcinogens in the disease process

Developing independent research and designing therapeutic strategies.

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 20 contact hours

## *Business Administration Certificate Completion Fee | O-CE0405*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Business Analytics Science Certificate Course | APBS.804*

8.0 CEU's

This course is provided in partnership with Ziplines.

**Follow this link to learn more and enroll in the Business Analytics Science Certificate Course.**

## *Business Communications | BUSM.X404*

2.0 Units

This course is designed to develop the essential communication skills required for success in the world of business. Learn key communication and leadership skills vital to success: listening, storytelling, public speaking, and meeting facilitation, while building confidence and your ability to positively influence others.

Through interactive activities, role-play, and problem-solving team assignments, students will develop the confidence and competence to communicate effectively in a business setting. You'll have the opportunity to deliver impromptu and prepared speeches, improve your listening skills, enhance your credibility, and learn new modes of business communication. In addition, you will learn how to facilitate meetings with ease, while being creative, flexible, and adaptable in real-time.

This course will include assignments that involve reading, researching, and creating content to share during class. By the end of the course, you will have a well-rounded communication skill set to help you succeed in your career.

Learning Outcomes

Practice speaking techniques to communicate effectively.

Design, author and deliver powerful presentations of different types.

Understand the role of influence, persuasion and power to inform relationships and how you can enhance your effectiveness in the workplace.

Develop and implement the power of story in your speeches, training, coaching, and one-on-one work with others.

Improve your listening skills in various settings, including one-on-one interactions, group environments, in-person and virtual meetings, and phone conversations.

Apply results-oriented techniques for planning and implementing effective meetings.

Topics Include

Interpersonal communication skills

Persuasive communication techniques

Storytelling

Meeting management

Group communication

Skills Needed

For best success, it's suggested you possess the following capabilities:

Fluency with the English language (written and spoken).

Internet access with ability to upload/download files, bandwidth to support continuous video throughout class.

Ability to log on to Zoom, use Chat, Share Screen, and enter/exit breakout rooms.

Professional Credit

HRCI®---PHR®, SPHR® and GPHR® general recertification credit: 19.25 hours.

SHRM-CP® or SHRM-SCP® 19.25 PDCs.

## ***Business Intelligence Solutions | DBDA.X402***

3.0 Units

In this comprehensive course aimed at business intelligence (BI) developers and analysts, students get to review BI tools in a hands-on environment. You will learn to convert relevant information into knowledge that supports better strategic decisions through the exploration of various business intelligence tools capable of integrating multiple data sources, processing data analysis, and building interactive dashboards. You will also work with databases that are often used with data management, reporting, and analytics capabilities. Using the Microsoft BI stack as an example platform, you will learn how to create supercharged pivot tables with Power Pivot, a Microsoft Excel add-in application and a data model that makes Power Pivot perform amazingly fast allowing you to analyze the data in new and interesting ways.

We'll also use Power Query to do some data munging—shaping, cleaning and transforming data using intuitive interfaces without having to use code. Additionally, we'll build dashboards, charts, and maps using Power BI, Microsoft's premiere analytics and reporting tool.

By the end of the course, you will have experience building BI solutions with multiple data sources using popular tools.

Note that while SQL Server experience is not required, the basic concepts of relational database design will not be covered in this course.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the principles of business intelligence and apply these principles to real-world projects

Discuss with business management the best BI tool to purchase which will shed light on your business challenges

Explain how to build an enterprise level BI data flow

Identify key performance indicators to measure success in your business

## *Business Law and Its Environment | BUSM.X409*

3.0 Units

The business environment has become more complex and litigious; therefore, knowledge of general principles of business law is more important than ever.

In this course we'll review the American legal process, business law and its development, and organizational structures in the context of the managerial challenges in today's highly litigious environment.

Through analysis of actual cases, group discussions, and lectures, you will develop the knowledge and skills necessary to identify and analyze legal issues, assess the legal implications of business decisions, and develop strategies to mitigate legal risks.

Learning Outcomes

At the conclusion of the course, you should be able to

Understand the U.S. court system and basic legal terms and doctrines

Describe legal issues and laws that impact businesses.

Explain strategies to minimize legal risks to businesses and employers.

Identify legal risks and strategies for more effective business administration and decisions.

Topics include

An overview of the American legal system

Contracts

Negligence

Product liability

Federal and state civil procedure

Torts

Business entities, including limited liability companies

Real property and leases

Bankruptcy issues

Employment laws including discrimination and sexual harassment

Law of agency

## ***Capstone Building Integrated AI Applications | AISV.X490***

2.0 Units

This course provides developers a practical, industry-oriented training on how to develop integrated artificial intelligence (AI) applications for enterprises. Leveraging knowledge acquired through various elective courses, you will learn to apply your skills to cutting-edge AI applications during hands-on classroom sessions using machine learning frameworks.

In the classroom, we'll focus on convolutional neural networks and how they work, and perform training and inference using Tensorflow/Keras for image detection, recognition and segmentation. You'll learn various aspects of designing and deploying applications in the real world and work on a final project encompassing the new technologies you've learned.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe the technical and non-technical aspects of planning, designing and deploying an AI-based enterprise application

Train and fine-tune a deep learning model on the cloud with existing datasets

End-to-end application services design and considerations, deployment, and support

Develop and deploy an enterprise cloud based application

Explain what federated learning and continuous learning are and why they are needed

Describe and demonstrate AI techniques

Topics Include

DNN and how it fits in AI and traditional ML techniques

Concepts of supervised deep learning models

End-to-end application services design and considerations, deployment, and support

Understanding of various AI cloud services and their deployment models

Scoping a project, setting requirements, timelines, and deliverables

MLOps overview

Federated learning and on-device learning

Skills Needed

A working knowledge of GCP.

Notes

Students will use the Google Cloud Platform - GCP for course exercises and assignments.

### *Capstone User Experience Project | UEWD.X490*

2.0 Units

One of the most important ways to impress potential employers is to show strong examples of your user experience projects. This final project course in the certificate program gives you the opportunity to bring all your skills together and create a site or project that demonstrates your abilities. You will seek out your own real-world client and work independently to complete your design project. In this course, you will complete the entire process of analysis, design, development and deployment of a website. You'll begin by preparing a requirements document that defines the client, the site objectives, the users, and the target technology platform. Then, you will design the information architecture, interface and visual design before implementing the site.

Your project implementation may include HTML5, CSS3, and JavaScript as needed, as well as other development languages such as Swift for iOS, Java for Android. You may also use content management system tools such as WordPress or Drupal, if required. Some of these tools require advanced skills, and you must provide a well-defined justification for their use in your proposal and obtain instructor approval before proceeding. The course also addresses cross-browser compatibility and briefly reviews jQuery and other JavaScript libraries.

Throughout the course, you will explore current trends in website design patterns and frameworks. By the conclusion of the course, you will have presented your design and implementation process and produced a fully functional website or a front-end interface for a web page to add to your portfolio.

Learning Outcomes

At the conclusion of the course, you should be able to Demonstrate independent work, responsibility and UX project management skills

Complete a design project from a concept to production.

Understand how to work with clients

Creating a website or an application that solves a real-world problem

Utilizing design methods and strategies in a real-world problem

Include a significant design project in their portfolio

Topics Include

How to produce a requirements document

How to produce design deliverables

How to produce a website

How to validate a website

Working knowledge of:

Designing Web pages or executing user experience design processes. Visual design and design implementation courses are strongly recommended. Also required is a code editing tool suitable for Web development, such as TextWrangler, BBEdit, Notepad++, Sublime, Dreamweaver, etc. in order to implement the design and complete the project.

Additional Information

All prerequisite courses listed must be completed before students can enroll in the course. Students should have server space available for posting their projects.

## *Cell and Molecular Biology | BIOL.X001_A*

5.0 Units

This course offers a comprehensive and structured introduction to the fundamental principles of biochemistry, cell biology, molecular biology, and genetics, providing a solid foundation for undergraduates pursuing the life sciences and related disciplines. No prior coursework in biology or chemistry is required-if it has been some time since your last exposure to these subjects, rest assured that we will cover the necessary background to support your success.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe and analyze the molecular foundations of life, including the structures and functions of biological molecules, their interactions through chemical bonds, and their roles in cellular processes.

Explain cellular structure, function, and organization, recognizing cells as the fundamental units of life and understanding how enzymes drive biochemical reactions within the constraints of thermodynamic principles.

Illustrate and interpret the flow of genetic information, using detailed diagrams to describe the processes of DNA transcription, RNA translation, and protein synthesis.

Compare and contrast modes of reproduction and genetic inheritance, explaining asexual and sexual reproduction, the mechanisms of mitosis and meiosis, and their impact on genetic variation.

Apply critical thinking and data analysis skills to develop, evaluate, and refine hypotheses related to biological phenomena using scientific reasoning and evidence-based approaches.

Topics Include

The first module serves as an essential guide, providing an overview of the course structure, key topics, grading policies, and other critical information. Students are encouraged to review this module thoroughly before the first class session and refer to it as needed throughout the term.

The remaining modules delve into the core themes of biochemistry, cell biology, molecular biology, and genetics. We will examine each of these disciplines in sequence, allowing students to build a strong conceptual foundation while appreciating the intricate connections between them.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## *Clinical Data Management | CTDM.X400*

2.0 Units

High-quality clinical data are at the heart of a successful clinical trial. If the data are not complete or do not reflect the actual reported results, the analysis and the conclusions drawn from that analysis may not be reliable. This course provides clinical trial personnel a solid understanding of the steps involved in clinical data management from study site data collection through data extraction for analysis.

Learning Outcomes

At the conclusion of the course, you should be able to List the common tasks undertaken as part of clinical data management.

Understand the details and variations associated with each of those tasks.

Write a data transfer specification for collecting lab data.

Write a quality specification and query message for cleaning Case Report Form (CRF) data.

Define the deliverables and responsibilities when working with Contract Research Organizations (CRO).

Write a data management plan.

Topics Include

A planned approach to clinical data management

Basic design and specification of the database and cleaning rules

Required documentation, standard operating procedures (SOPs), and quality control

Compliance with FDA/ICH guidelines

Working with other clinical groups and external contract research organizations (CROs)

Using electronic data capture (EDC)

Data security and confidentiality

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 20 contact hours

## *Clinical Project Management | CTDM.X401*

2.0 Units

This course presents the effective planning and management of drugs and biologics clinical research trials. Exercises and case studies will illustrate how to develop and manage activities, timelines and budgets; examine staffing and resource requirements; and lead and motivate effective teams. Strategic clinical development plans, team and clinical site performance problems are also discussed.

This course will benefit clinical research professionals who are planning to begin or like to manage clinical research studies.

Learning Outcomes

At the conclusion of the course, you should be able to Describe critical elements of a clinical trial projects, methods of project management and documentation

Discuss role of a clinical trial manager and/or clinical project manager, and strategies of risk assessment and mitigation

Discuss Clinical Trial Management Planning (Budgeting & Timeline)

Identify pathways and resources needed for successful clinical research trials, and tools of project management

Topics Include

Project development and management

Building a Quality Management Plan

How/Why Clinical Trial fails?

Using Metrics to improve trial management

Additional Information

Students should have a broad educational background with courses in computers and public health science management. Completion of a general course in the content area of Clinical Research, or 2 years of experience in the Clinical Research workplace.

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 20 contact hours

## *Clinical Statistics for Non-Statisticians | CTDM.X403*

2.0 Units

Clinical studies succeed or fail on the strength of their statistics. This course takes a practical approach to address the fundamental statistical concepts essential for non-statisticians involved in clinical research. Through lectures, discussions and in-class exercises, the instructor explores clinical study designs, hypothesis testing, sample size calculations, assumptions, controls, endpoints, data-management principles, data presentations and analysis plans, methods of analysis, and conclusions. You'll learn how to interpret the statistics commonly encountered in clinical research as well as how to communicate effectively with statisticians. The approach is practical, simple and qualitative. No previous background in statistics is required.

Learning Outcomes

At the conclusion of the course, you should be able to Identify quantitative methods for summarizing data

Explain concepts such as variability, confidence intervals, hypothesis testing, and p-values

Distinguish various study designs and identify techniques to avoid bias in clinical studies

Knowledgeably review the medical literature

Comfortably communicate with a professional biostatistician

Topics Include

Estimation and hypothesis testing

Parametric vs nonparametric tests

Clinical trial designs

Data-driven decision making

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 20 contact hours

## *Clinical Trials Design and Management Certificate Completion Fee | O-CE0113*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Coastal Climate Resilience | SRSV.800*

4.0 CEU's

This professional development course in Coastal Climate Resilience is a collaboration between the Coastal Science and Policy Program and the Center for Coastal Climate Resilience at UC Santa Cruz. Students in the Coastal Climate Resilience course will draw on UC Santa Cruz's expertise in coastal climate resilience and policy, including the application of nature-based solutions, local adaptation planning, and innovations. Participants will learn from experts in the academic, public, and private sectors.

Through cohort-based instruction and activities grounded in science, participants will build knowledge and skills relating to adaptation and resilience strategies, nature-based solutions, how to apply for funding, innovative financing, the insurance landscape, equitable engagement of interested parties, and more. This course is designed for those actively working in the field of coastal climate resilience with an aim to have practitioners apply learnings in real time.

The course aims to increase the number of practitioners in coastal communities that are knowledgeable and prepared to integrate a range of sustainability solutions. Practitioners will have the opportunity to network and workshop practical solutions that are applicable to their current role in coastal sustainability and resilience.

Students in the Coastal Climate Resilience course will learn to navigate coastal adaptation and sustainability projects from policies to practice for a resilient future. The course will help practitioners build a framework of opportunities, innovations, and practical solutions in coastal climate resilience.

Learning Outcomes

At the conclusion of the course, you should be able to

Identify a range of practical solutions for adapting to climate risks, including nature-based solutions

Know how to access resources for planning, evaluating, funding, and implementing a project

Understand the landscape of models and tools available for coastal risk assessments and adaptation planning

Engage interested parties in resilience and adaptation projects in an equitable way

Learn skills around communicating climate resilience topics, concepts, terms, and approaches to multiple audiences

Build an interdisciplinary network to collaborate on local and regional resilience projects

Topics Include

Principles of Coastal Resilience & Climate Change

Nature-based Solutions for Climate Adaptation: Case Studies & Tools

Policies Relevant to Nature-based Solutions

Equitable Engagement of Interested Parties

Sources and Steps to Financing Coastal Resilience at National & State Levels

Insurance and Innovative Financing for Resilient Communities

Data Sources, Tools & Models for Resilient Coastal Adaptation

Communicating Coastal Resilience

Skills Required:

This course is designed for those actively working in the field of coastal climate resilience with an aim to have practitioners apply learnings in real time. In order to be eligible to enroll students must meet this requirement.

## *Collaborative Design: Enhancing UX with AI | UEWD.X423*

3.0 Units

This course equips students with the knowledge and skills needed to effectively collaborate on User Experience (UX) and Artificial Intelligence (AI) projects, particularly in the context of business users. Participants will gain hands-on experience with industry-standard tools like Figma, FigJam, and Miro, essential for creating dynamic, interactive design environments. The course will also provide an overview of agile methodologies, covering meeting cadences, timelines, and project management tools such as Jira and Confluence. This practical training ensures that students can thrive in collaborative design teams and contribute to the development of UX and AI solutions.

Learning Outcomes

At the conclusion of the course, you should be able to

Apply industry-standard design tools (Figma, FigJam, Miro) to facilitate collaboration on UX and AI projects.

Implement agile practices and manage design project timelines, using Jira and Confluence to track progress.

Explain the unique requirements of Enterprise B2B UX design and apply them to real-world projects.

Communicate effectively within cross-functional teams, incorporating feedback and iterating on designs.

Design and manage collaborative workflows that promote productivity and innovation in AI and UX initiatives.

Topics Include

Collaborative design tools (Figma, FigJam, Miro)

Best practices for UX design in AI projects

Enterprise B2B design considerations

Agile project management basics (meeting cadences, timelines)

Introduction to Jira and Confluence for project tracking and documentation

Designing with cross-functional teams in mind

Facilitating effective collaboration and feedback loops

Managing iterative design cycles in fast-paced environments

## *Communicating and Negotiating with the FDA | REGL.X402*

1.5 Units

Regulatory affairs professionals interact with the U.S. Food and Drug Administration (FDA) throughout the life cycle of a biomedical product. Lectures, case studies and roleplaying are used to explore the range of interactions that industry has with the FDA, including inspections and key meetings. Students learn how to prepare for these important events. This course highlights the structure, mission, jurisdiction and roles of the FDA, reviews centers within the agency, and the field offices, and examines key societal, political, industrial and biomedical drivers that impact policies, priorities, and the current U.S. regulatory environment. This course benefits new and experienced regulatory professionals and anyone who interfaces with the FDA.

**Learning Outcomes:**

At the end of the course, students should be able to

Understand the importance of effective, objective-driven communication

Understand the role of the audience and objectives in determining the type of communication and message to be communicated

Develop a fundamental core competency in regulatory negotiation; communicate effectively and persuasively based on the science and framework of regulations

Understand the key elements of planning for successful meetings and correspondences

Note(s): This course was formerly titled "Interacting with the FDA"

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 15 contact hours

Approved for 14 RAC recertification credits

## *Compensation Management | HRMT.X404*

2.0 Units

The world of work is changing due to four forces: digitization; flexible work designs; the evolved nature of employee expectations and attitudes; and black swan events that require adaptations to work delivery systems. These existential challenges are impacting compensation systems. The era of total rewards management is here to stay.

We will take a wholistic view of total reward systems, looking critically at the compensation systems and how they are impacted by changes in our society and economy.

It is highly recommended that students new to Human Resources begin with "Human Resource Management.” After that, courses may be taken in any order.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe corporate compensation philosophy and goals Recognize what competitors are paying for comparable employees in relevant labor markets to permit the organization to attract and keep competent employees.

Understand the relationships among job requirements, employee knowledge, skills and abilities, and employer-provided compensation.

Develop a clear link between work required, performance demonstrated, and pay provided to each employee.

Develop incentive and indirect compensation programs to recognize achievement of individual, group and organizational objectives, improving the organization’s ability to attract and retain quality employees.

Link individual rewards to achievement of organizational objectives, corporate performance and total returns to shareholders plans.

Topics Include

The pay model—from compensation to total rewards

Motivation theories and the basis of pay decisions

Strategic perspectives

The changing nature of work

Current trends in reward systems

Pay and the changing workforce

Review of the evidence

Professional Credit

SHRM-CP® or SHRM-SCP® 19.25 PDCs.

## *Comprehensive Signal and Power Integrity for High-Speed Digital Systems | EMBD.X400*

3.0 Units

High-speed signaling technologies with multi-gigabit data transfer rates are critical to high-bandwidth communications. However, the physical limitations of the channel (in board, package, and connector), the transceiver circuits, as well as voltage and timing noises introduced along the signal paths, make the design of high-speed links very challenging. Accurate modeling and analysis of high-speed digital systems requires a good understanding of physical effects and system architecture in order to optimize the design parameters in the channel, transmitter, and receiver subsystems. This course in applied signal/power integrity gives students a set of skills for problem solving and strategies that bridge the gap between theory and real world applications by going through case studies from real designs. This course starts with a comprehensive overview of signal and power integrity analysis for high-speed systems. The instructor promptly moves on to cover the state-of-the art modeling and analysis techniques used in high-speed links. The course introduces accurate interconnect modeling including high frequency and second-order effects, and behavioral modeling of IO and ESD, including IBIS. Students will learn the concepts of equalization design and various signaling techniques (such as differential, NRZ, pulse, multi-level, etc.). At the system level, topics include clocking schemes and timing jitter analysis, as well as power analysis topics such as IR Drop, AC noise, simultaneous switching noise, and decoupling capacitor. The course concludes with a discussion of variations in manufacturing and methods to handle them in simulation and design.

Upon completing the course, students will have a strong understanding of signal and power integrity concepts and terminology. They will acquire the skills to design, model, and analyze high-speed interconnects. They will be able to relate various link blocks and parameters to system performance and make trade off decisions.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Understand signal and power integrity concepts and terminology

Perform design, modeling, and analysis of high-speed interconnects and systems

Explain the impacts of inter-symbol interference, jitter, power supply noise on the performance of high speed systems

Apply equalization, modulation, and advanced signaling techniques to increase system bandwidth

Identify and relate various high-speed link components and parameters to system performance and make trade off decisions

**Skills Needed:**

Students must have a basic understanding of signal integrity, electromagnetic compatibility, printed circuit boards or packages.

## *Computer Programming Certificate Completion Fee | O-CE0114*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Computer Vision and Image Processing | AISV.X406*

3.0 Units

Computer vision applications include industrial machine vision systems, optical character recognition, medical imaging, space exploration, image analytics for security surveillance, retail checkout, automotive safety, artificial intelligence in robotics, biometrics, and the emerging natural and intuitive human-computer interfaces. In this course, you will learn the concepts, methods, and applications of computer vision and image processing. You’ll build a foundation that can be used to develop practical applications and provide the basis for more advanced studies. The course begins with vision and image fundamentals, including image formation and display, digital camera and image capture, the human visual system, and visual perception. You will learn the basics of image processing, including spatial and frequency domain filtering techniques and applications and compression algorithms. The course further dives into neural network-based algorithms, such as CNN and Vision Transformers. The course covers practical image analysis and inference methods, including edge, contour, feature detection, image segmentation, matching, and stitching, as well as object and facial recognition. Additional discussions will cover the development of 3D computer vision, real-time human-computer interaction, emerging technologies, applications, and trends.

We will use Python and TensorFlow to develop these apps. Numerous well-illustrated examples and engaging hands-on projects will be used to demonstrate these principles in practical real-world computer vision applications.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Explain the concepts of Computer Vision

Discuss the computer vision applications, use cases, and challenges across industries and real-world problems

Compare traditional and neural-network-based imaging algorithms for their strengths and weaknesses

Apply neural-network-based imaging algorithms and techniques

**Topics Include**

Image formation, image understanding, pattern matching, geometry understanding, and synthesis

Image denoising, object detection, image superresolution, and image segmentation

## *Consumer Insights: Data Analysis and Interpretation | MKTG.X413*

2.0 Units

Students will build products that customers want and businesses cherish using real-life examples. We will study state-of-the-art qualitative and quantitative research tools, such as regression and conjoint analysis, to learn insights about our customers. We will forecast the success of a new product through modeling the size of the addressable market.

During in-class labs we will build positioning, promotional, and pricing product strategies used in the digital marketing industry today. Learn about the latest tools used to collect data, including customer research surveys, and begin data analysis using statistical and inference models. You will visualize results and create actionable recommendations.

The best part: Even though this class is data-driven, there is no programming required.

Learning Outcomes

Explain how to put ideas to test

Examine what the customer wants

Describe regression and conjoint analysis

Discuss how to estimate the market size

Topics include

Customer metrics

Idea creation

Customer survey research

Conjoint analysis

Actionable customer insights: value v. pricing

Market size estimation

## *C++ Programming | CMPR.X404*

3.0 Units

This course covers object-oriented programming using modern C++. Because most automation, embedded applications, gaming, and many large data processing applications are written in C++, it is essential that software developers understand and master it. Hardware engineers are increasingly using C++ and OOP in system verification tasks and as of the current decade, there has been a

noticeable shift from C to C++ on microcontroller systems. This course offers an excellent foundation in developing optimized modern C++ applications. The participants will learn to write faster and modular code, and the debugging techniques, for real-world applications. There will be assignments and exercises to accompany the lectures.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Apply object oriented concepts to software development problems using modern C++

Understand and use the basic programming constructs of C++

Manipulate various C++ data types, such as arrays, strings, and pointers

Write C++ code using principles of object-oriented programming

Understand design patterns in C++ using singleton pattern

Manage memory appropriately, including proper allocation/deallocation procedures using unique and smart pointers

Utilize best practices from C++ GSL or Google Abseil libraries

**Topics Include**

Principles of object-oriented analysis and design

Stream classes for input/output and to read/write files

User defined data types using structures and classes

Declarations of identifiers, pointers, function pointers and references

Reuse code and extend existing data types through inheritance

Memory management and dynamic array declarations

Create class/function templates and understand STL

Use static member variables and static member functions

Declare friend functions and friend classes

Function overloading and operator overloading

Polymorphism concept using virtual function

Understand exceptions handling techniques using try/catch syntax

**Skills Needed**

Experience with a high level programming language such as C/Java/Python.

## *C Programming I | CMPR.X400*

2.0 Units

C language is popular for engineering and commercial applications. It allows developers to maintain the structure and portability of a high-level language while having the detailed control, efficiency and speed of an assembly language. C is the leading language used in hardware application and in software compilers, libraries and interpreters. This course gets you started with application development using the C language. The course begins with programming and tools overview. It introduces the functions, data types, input/output, strings, operators, precedence, and expressions. It also demonstrates the use of control statements, arrays, and pointers for problem solving. Students will receive assignments to write non-trivial programs and learn to create modular programs with efficiency and readability. This course will benefit individuals who want to learn C programming language but have little or no programming background. The lectures stress the strengths of C providing students with the means of writing efficient, maintainable and portable code. Each instruction is supplemented with programming exercises.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Utilize C language to write non-trivial programs

Use variety of data types suitable to specific programming needs including your own data types

Use functions from C library and create and use your own functions

Use arrays and pointers as part of the software solution

Demonstrate the use of the various control flow features

Utilize modular features of the C language and demonstrate efficiency and readability

**Topics Include**

Compiling, linking, executing, debugging and running a C Program

Functions, data types

Input and Output, character strings

Arrays

Operators and precedence

Expressions

Control statement

Pointers

Advanced topics

**Skills Needed:** Technical aptitude and experience with a computer operating system or equivalent knowledge.

## *C Programming II | CMPR.X401*

3.0 Units

C remains one of the most popular programming languages. It is widely available on most, if not all, computing platforms. This language is highly valued for its speed, low-level capabilities and platform independent characteristics. It is also actively used in the development of other languages. This course will broaden your skills as a C language programmer by introducing sophisticated problem-solving and optimization techniques. This course delves into the design, implementation, and use of advanced data structures. Students will solidify their understanding of strings, arrays, pointers, structures, unions and bit manipulation. Emphasis will be on programming that employs and improves upon a variety of data structures. Through this course, you will learn to write efficient programs by understanding the complexities of various algorithms.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Define a data type and understand the memory layout for different variables.

Manipulate arrays of any data type, program with loops and control flow, play with pointers.

Define user created structures, use files to read the input data and write output.

Allocate structure memory dynamically, manipulate linked lists.

Sort complex data though simple and advanced sort routines.

Create tree structures, assign data elements in tree format and traverse trees.

Create graph nodes to traverse through them, find shortest path from a graph between two nodes.

Identify a minimum spanning tree of a graph created with the node information.

Describe the critical role of testing in building quality software.

Employ Generative AI for rapid prototyping and learning.

**Topics Include**

Data types, variables, operators, and operator precedence

Arrays in general, including two-dimensional and multi-dimensional configurations

Dynamic memory allocation

Pointers, strings, file input and output

Data structures such as linked, circular and doubly linked lists, stacks, queues, and hash tables

Binary trees in general, including implementation, traversal and drawbacks

Recursions and implementation of recursive algorithms

Huffman algorithm

Sorting routines, Big O notation and the complexity of algorithms

Graphs: their traversal and applications

Black Box and White Box Testing

Generative AI

**Skills Needed:** Students should have a good understanding of programming using data types such as pointers, structures, control flow, and iterative vs recursive programming.

**NOTES:** Development will be done on an online Linux platform. Generative AI will use Copilot on the Visual Code platform.

## *Creating the Successful Team | PPMT.X403*

1.5 Units

In this course for technical and non-technical professionals, students learn to establish high-performance teams by exploring the fundamental principles and characteristics that make them effective. By examining what makes individuals standout, you will better understand how to develop and leverage their contributions to a successful project team. The course focuses on key team development skills—trust building, goal setting, role agreement, and how to sustain commitment for the duration of a successful collaborative project.

The course also covers how to design and manage virtual teams. Through participating in a virtual team, you will learn to identify and respond to typical challenges, including group meetings and team decision-making. Concepts learned in the course are applicable to building highly effective strategic and tactical teams at all levels of an organization.

Learning Outcomes

At the conclusion of the course, you should be able to

Hire right talent and assign them to right role

Effectively manage a geographically dispersed team

Set right expectations and coach on team behavior

Effectively deal with conflicts in a team

Build trust between team members

Handle tough conversations

### *CRM: Customer Relationship Management | MKTG.X407*

2.0 Units

It is critical that companies provide a consistent experience to their customers across all channels of interactions, and listen and respond to them regardless of time, place and language. This course covers the history of customer relationship management (CRM) and its evolution to customer experience--the business needs that ultimately require an effective CRM strategy, and its accompanying tools and technologies. The course includes case studies and live demonstrations of software solutions. By the end of the course, you will know how to create a CRM strategy for your organization.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe why CRM is an important part of every organization’s survival strategy

Apply an approach to create a CRM strategy for their organization, regardless of size, industry or geography

Explain how to use industry standard CRM software tools

Topics Include

What is CRM?

How has it evolved over the years into Customer Experience?

How has it evolved over the years into Customer Experience?

The adoption of CRM strategies by organizations

How does CRM affect the marketing, sales and customer support functions?

Key success and failure factors for CRM project implementations?

Role of Social Media in a CRM strategy

CRM tools and technologies

## *Customer Acquisition Strategies | MKTG.X405*

2.0 Units

What determines whether or not your product proves to be a hit in the marketplace? An excellent customer acquisition strategy that targets the right customers in a cost-effective way is the key. A robust strategy encompasses an end-to-end customer focus: understanding what your target customer really wants, developing products that the target customer will embrace, designing compelling marketing communications, and delivering satisfying customer experiences. The course will cover online and offline measurable marketing techniques to gain awareness, educate prospects, and influence customers' buying behaviors. Numerous real world case studies are presented.

Learning Outcomes

At the conclusion of the course, you should be able to

Critique the models for Customer Purchase Process, including the critical decision-points

Understand the conflicting needs of Consumers, appreciating how this informs Purchase Decisions and adds complexity for the Marketer

Consider how Marketers influence the Hierarchy of Effects to encourage action by Consumers

Evaluate Marketing Tools, including Advertising, Advocacy, Promotion and Cause Marketing, which are used to encourage Trial, Repeat and Loyalty

Topics include

Gaining insight about customers

Describing the target market

Positioning

Metrics

Advertising

Packaging

Promotions

Distribution strategy

Pricing

Online and offline marketing

How to create acquisition strategy

Word of mouth

Consumer trends

## *Dashboards and Data Visualization | DBDA.X419*

3.0 Units

This course introduces dashboard and data visualization technologies with a hands-on approach. Dashboard is a presentation of key performance indicators (KPIs) important to an enterprise. Database and data analytics professionals often build, use, and support dashboards. Data visualization is the application of data science to extract intelligence from data sources, often in a graphical format. The course introduces the characteristics of dashboards and the principles of data visualization. It also covers how to select KPIs, identify dashboard content requirements, design and implement dashboards and scorecards, and apply data visualization techniques. In addition, you will learn how to identify and select the software tools used to create dashboards and their visual content, as well as common mistakes, tips, and best practices relevant to dashboards and data visualization.

You will learn how to choose data sources, extract required data, perform data analysis using an example tool, and visually present the results on a dashboard using tables, charts and maps. As a course project, you will identify and specify dashboard requirements (including selecting the appropriate KPIs), design the dashboard views, reports, layout and navigation, as well as create the dashboard and the data visualizations to be incorporated in it. You will learn new visualization techniques like ‘word cloud’, ‘Sankey Charts’,’Tooltip visualization’, and about the HYPER data format that enhances performance. In addition to these, you will also learn the newer features of the Tableau software. Your grade will be based on the project, in-class participation, a midterm and a final exam.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the core aspects of Dashboards and Visualization

Discuss the difference between Dashboards and Data Visualization

Explain the importance of Key Performance Indicators

Identify the use cases and demonstrate with examples

**Topics Include**

Key performance indicators (KPIs)

Understanding dashboards and scorecards

Data visualization principles

Advanced data visualization techniques

Dashboard planning, design and implementation

Best practices, common mistakes and tips

Identifying and selecting dashboard tools and vendors

**Course Note:** The Tableau software is available to students for learning purposes only for approximately three months. Students are required to install software on own computers (Windows Vista or newer or Mac OSX 10.8.1 or newer) and are encouraged to bring laptops to class. Also note that this is not a specific tool usage training course. Tableau is introduced as an example tool for data visualization.

**Skills Needed:** Knowledge of database concepts and any business experience related to decision-making.

## *Data Analysis, Introduction | DBDA.X404*

3.0 Units

Data analysis is the process of converting data into valuable information to inform decision-making. This course provides a foundation in the tools, techniques, and common practices used in the industry. It covers the full lifecycle of a data analysis project, including how to obtain, manipulate, explore, model, and present data.

We will explore different analytical approaches and frameworks, using popular tools like R and Python. The course emphasizes hands-on application, with R being the primary language for instruction and examples. You will learn to prepare raw data for use, perform exploratory analysis, and apply techniques like regression, simulation, and forecasting. We will also cover various graphing and visualization tools to help you understand and present your findings.

Additionally, the course now includes an introduction to leveraging Generative AI for data analysis. You will use an AI-based tool to generate and validate R programs, helping you streamline your workflow.

By the end of the course, you will be able to apply a working framework to any data analysis project and use R or Python to complete a large-scale project, including a professional write-up with insights and visualizations. All tools are open-source, except for a trial version of the AI tool.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe the framework necessary to approach Data Analysis problems

Discuss the importance of Data Analysis for Data Science, Data Visualization & exploration

Explain the basic concepts of R and using R for Data Analysis

Identify the right tools, concepts and functions that are required for Data Analysis

Leverage Generative AI concepts and how to generate R Programs with the help of AI.

Topics Include:

Approaches to data analysis: Templates, write-ups and illustrative examples

Overview of tools for data analysis: R, R-Studio (IDE) and comparison with Python

Obtaining data: Finding data sets and Web scraping, file formats

Data manipulation techniques: Data quality, reshaping data, appending and joining data sets

Plotting and visualization: Exploration and presentation

Exploratory data analysis: Visual inspection, descriptive analytics, insights

Regression models: Simple, multiple and logistic

Analysis report write-up and presentation, including graphs

Simulation techniques: Fitting distributions, simulating stochastic processes

Forecasting methods and applications: Smoothing, moving averages, time series, ARIMA

Skills Needed:

Some programming experience is recommended. (R will be covered in class and used in examples. Python experience can be helpful.) Basic knowledge of probability and statistics required, at the level of basic statistics textbooks (see example:  www.stattrek.com ).

## *Data and Workflow Management for Bioinformatics | BINF.X410*

This course explains where large data sets come from and how they are stored and managed. It also examines data sizes, accessibility approaches, and how data are transformed and used for AI consumption. You will examine the challenges and considerations when choosing data for training sets.

By the end of course, you will understand the types of data used in bioinformatics, how the data are collected, stored, managed and searched, and how the data are transformed for further processing and analysis. You will also develop skills on how to aggregate and normalize the data to be used for machine learning and/or AI training sets.

Learning Outcomes

At the conclusion of the course, you should be able to

Identify the different types of data used in bioinformatics, their sources, and how they are collected, stored, searched, and managed.

Explain how bioinformatics data are processed, transformed, and prepared for further analysis, including machine learning and AI applications.

Demonstrate skills to aggregate, clean, and normalize bioinformatics data to ensure quality and consistency for AI training sets.

Analyze the sizes, formats, and accessibility of bioinformatics datasets and understand key storage and management considerations.

Evaluate the challenges and key considerations in selecting bioinformatics data for AI model training, including data quality, bias, and ethical implications.

Topics Include

Pipeline Design

Workflow management systems and workflow analysis with open-source tools

Documentation skills / proof of concept with foresight

Using SQL for bioinformatics data

Data lakes (e.g, Databricks, Redshift and/or Snowflake)

Large data sets

Databases - how to store, move, and learn what AI models to use

## *Data Modeling, Introduction | DBDA.X421*

2.0 Units

Data modeling defines and applies structure to the information systems in an enterprise. Data stored in various relational databases needs data modeling to depict the relationship between entities in the databases. The models provide pictorial views of how the data flows across the enterprise, departments, or business areas. Before creating a database for any application, you need well-constructed data models to maintain the integrity of data and improve query performance. This course provides in-depth knowledge and hands-on practice in data modeling and design. After introducing the basic concepts and principles, the course addresses data modeling techniques and practices in four modeling areas: conceptual, logical, physical and dimensional. The course first addresses the collection of user requirements, followed by design approaches for logical and physical models. You will study real-world examples of data models for transactional systems, data marts and enterprise data warehouses. Expert instructors will share their practical experiences.

This is a hands-on course using an industry-leading data modeling tool in class. By the end of the course, you will be able to create data models for enterprise applications.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the various types and advantages of Data Modeling

Discuss the quantifiable values of Data Modeling

Explain the intricacies of Data Modeling

Identify the use cases for Data Modeling

**Topics Include**

Overview of data modeling

Principles of data modeling

Types of data modeling: Conceptual, Logical, and Physical

Logical data modeling: Building data models; Cardinality rules; Transformation rules

Physical data modeling: Database standards; Domains and classwords; Roll-ups and roll-downs; Data

model repository options

Dimensional data modeling: Star schema modeling; Snow flake modeling

Top ten mistakes to be avoided

## *Data Science and Data Analytics Certificate Completion Fee | O-CE0122*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Data Structures and Algorithms Using Java | CMPR.X407*

3.0 Units

There are two sides of a program: data structures, which are used to represent data, and algorithms. While entry-level programmers focus on learning programming languages, today’s employers seek professionals who know how to program with high reliability, and with efficiency, in terms of resource and performance. The way you represent a program’s data is as central to program design as the algorithm. This course focuses on the use of efficient algorithms with powerful data structures in the Java language—and offers the skills you need to stand out. This course covers data structures such as dynamic array, dynamic string, long numbers, lists, heap, hash, trees and graphs. You will learn to create objects from scratch using object-oriented Java programming concepts, and then build bigger objects using the objects that have already been built and tested. You will write algorithms on these objects using techniques such as recursion, greedy, divide and conquer, back tracking and dynamic programming. The course discusses algorithms such as searching and sorting, union find problems, knapsack problems and NP complete problems. You will also learn to compute the worst case complexity of the algorithms in terms of time and space in order to choose the best techniques, and to ensure that the objects scale with arbitrarily sized inputs.

The course emphasizes common problems and implementation details in Java and does not cover advanced Java features. It provides ample examples and testing of codes. Many of the problems solved in the class are coding questions that are asked in interviews and on popular coding websites.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Create effective and efficient programs using Java

Express ideas using efficient data structures

Apply operations to these structures

Prove the complexity of the data structures method in terms of primitive operations

**Topics Include**

Introduction to data structures and algorithms

Review of Java used for this course

Need for algorithms

Tools for computing complexity in terms of problem size rather than hardware used

Data structures for building extremely large objects like array, stack, heap, hash, trees and graphs

Algorithm techniques for solving problems like greedy, divide and conquer, back tracking and dynamic programming

Implementing objects and algorithms that scale for arbitrary large size problems

Proving the worst case complexity of each algorithm in terms of time and space

**Skills Needed:**

Working knowledge of Java or C/C++.

## *Data Structures and Algorithms Using Python | CMPR.X425*

3.0 Units

Deep knowledge of how to organize data and data structures, in addition to performing operations that result in meaningful algorithm answers, is essential in science and engineering.

In this course, students will use Python, a widely-used, general-purpose, high-level programming language, to learn a variety of data structures including array, list, stack, queue, heap, hash, binary trees, disjoint sets, and graphs. Python, which has a design philosophy that emphasizes code readability, has a syntax that allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. It is considerably easier to learn.

Students explore algorithm techniques like brute force, greedy, dynamic programming, and backtracking, and implement algorithms using those techniques. Both time and space complexities will be analyzed for all the code written in class.

By the end of the course, you will have experience with many data structures and algorithms and be able to implement them easily using Python. Mastering fundamental data structures and algorithms will help you confidently succeed in software engineering interviews at FAANG and other companies.

Learning Outcomes

At the conclusion of the course, the student should be able to

Describe and use abstract data types including stacks, queues, lists, tree, hash, and graphs.

Implement different algorithmic techniques such as divide and conquer, greedy algorithms, dynamic programming, and backtracking.

Explain the asymptotic performance of the algorithms studied in this course and understand the practical implications.

Analyze complex Python programs written by another author.

Prerequisite(s):

A course on C/C++/Java/Python.

## *Decision-Making Tools and Techniques | PPMT.X418*

1.5 Units

Project managers are, above everything else, decision makers and problem solvers. A project manager's effectiveness is directly proportional to his or her decision-making ability. This course is for those professionals who want to improve their decision-making skills through the use of modern-day computer tools and techniques. Participants learn how to make effective decisions relating to project schedules, product design trade-offs, project cost estimating, problem solving and project risk analyses. Examples, in-class exercises and homework using spreadsheet techniques and Internet tools enable participants to become confident in the use and application of practical decision-making methods.

Learning Outcomes

At the conclusion of the course, you should be able to

Recognize need of soft skills and make effective group decisions using soft skills

Understand and apply decision making process while making decisions

Make effective decisions using Analytical Hierarchical Process and Decision Trees

Effectively handle project cost and budget uncertainties by making right decisions and tradeoffs

Topics Include

Spreadsheet modeling and decision analysis

Decision tools for project schedule management

How to make multicriteria decisions using the Analytic Hierarchy Process (AHP

Making effective project cost decisions

How to use computer tools to optimize product designs

Decision trees: when and how to use them

How to make decisions when dealing with schedule and cost uncertainties

How to select the most appropriate decision-making tool

## *Deep Learning and Artificial Intelligence | AISV.X401*

3.0 Units

Deep learning, a branch of artificial intelligence and machine learning, uses multilayered neural networks to create highly accurate prediction models for image recognition, object detection, language translation, speech recognition, and other tasks. In this course, students will use open source and industry-standard machine learning libraries to build and deploy deep learning models.

Students will build deep learning prediction models of different complexities, from simple linear logistic regression to major categories of neural networks including convolutional neural networks (CNNs), recurrent neural networks (RNNs), long short-term memory (LSTMs), and gated recurrent units (GRUs).

By the end of the course, students will be proficient in best practices of using standard machine learning frameworks such as Pytorch, TensorFlow and Keras, and using datasets for solving common machine learning problems.

The class prepares students to pursue a career in data sciences and AI model development.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Use common deep learning architectures such as CNN and RNN

Discuss the significance of hyperparameters in the architectures

Prepare data for deep learning using Pandas and NumPy, the de facto standard for data prep in Python

Write scalable code and develop machine learning models that can be used to train deep learning architectures on real-world business problems

Debug and understand the inner working of deep learning architectures

**Topics Include**

Deep learning with standard machine learning frameworks including TensorFlow, Keras and Pytorch

Multilayer perceptrons

Advanced multilayer perceptrons

Convolutional neural networks

Image processing CNN architectures

Recurrent neural networks

RNN - prediction with multilayer perceptron

RNN - prediction with long short term memory networks

**Note(s):** Students are required to bring laptops for the classroom and work with Python3/ Jupyter Notebook environment.

**Skills Needed:** Moderate level of computer programming ability in Python, comfortable with an editor, familiarity with command-line operations on a laptop, and a basic understanding of Machine Learning models.

## *Deep Reinforcement Learning | AISV.X403*

3.0 Units

Reinforcement Learning from Human Feedback (RLHF) is a critical component of ChatGPT to improve rewards on the generated text. This course will introduce students to RLHF and how ChatGPT leverages PPO, a policy gradient-based reinforcement learning algorithm, in order to build a ChatGPT-like system. As an advanced AI course, students get hands-on experience with a variety of reinforcement learning (RL) and deep reinforcement learning (DRL) tools used to teach machines to make human-like decisions based on observation and interpretation of surrounding environments. The development of a plethora of DRL algorithms shows tremendous improvement in state-of-the-art games like Go and highly sophisticated multi-player games such as StarCraft and Dota, as well as control systems, natural language, self-driving cars, and robotics. After a quick review of deep learning building blocks, and RL and DRL fundamentals, we will dive into available promising DRL algorithms, illustrating them with concrete examples and simulation environments. Students will learn to solve everyday tasks in RL, including well-known simulations such as CartPole, MountainCar, and MuJoCo.

You will learn Markov decision process (MDP) formulation and an extensive collection of DRL algorithms: deep q-learning (DQN, DDQN, PER), policy gradients methods (A2C, A3C, TRPO, PPO, ACER, ACKTR, SAC), deterministic policy gradients methods (DPG, DDPG, TD3), and inverse reinforcement learning. To implement these DRL algorithms, students will code in Python 3, OpenAI Gym, tf2.keras, and TensorFlow-Agents. We will also review other popular DRL libraries, such as Google Dopamine, Keras-RL, and Facebook Horizon.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Formulate an MDP

Describe value functions, models, and policies

Define the purpose of the Bellman equation

Discuss the advantages and disadvantages of RL

Explain how the epsilon-greedy algorithm differs from a pure greedy algorithm

Explain the difference between model-based and model-free RL

Discuss how DL enhances RL

Discuss and implement the value-based and policy-based RL

Use and create RL environments with OpenAI Gym and TF-Agents

Apply learned RL algorithms to popular simulators and a lightweight ChatGPT-like system

**Topics Include**

Deep learning building blocks

Markov decision processes

Reinforcement and deep reinforcement learning

Value-based, model-based, model-free algorithms

Policy gradients-based algorithms

Proximal policy optimization

Various actor/critic algorithms

Deep RL libraries

Term project

Note: For this course there will be a term project related to ChatGPT

### *Design Control for Medical Devices | MEDD.X400*

2.0 Units

The successful development of medical devices requires that the design be controlled to ensure product safety and that the device can fulfill its intended use. This course provides a practical understanding of the engineering value of design control throughout the product lifecycle as it pertains to product quality. You'll learn to use the nine elements of design control to make design objectives clearer, products more testable, and to better satisfy customer requirements, thereby shortening the path to product and business success. The course highlights the practical implementation of the design history file, reviews and records, transfer planning, requirements engineering and project planning. You will also learn topics related to design verification and validation testing, such as process validation, biocompatibility, shelf-life, sterilization and packaging validation.

Learning Outcomes

At the conclusion of the course, you should be able to Identify the key elements of the quality system (including Design Control) and ISO 13485.

Explain the purpose of using Design Control from a regulatory and industry perspective.

Discuss the nine elements of Design Control and its practical implementation.

Topics Include

Design control, the quality system and ISO 13485: A brief introduction

Design and development planning

Design input, design output

Design review and peer review

Design change control

Design transfer to manufacturing

Design verification

Design validation and use of statistics

Design history file (DHF) Additional Information

Students are expected to read the FDA Guidance on Design Control prior to the first class session.

Professional Credit

Approved for 15 RAC recertification credits

## ***Designing, Building and Integrating RESTful API | SEQA.X407***

2.0 Units

Databases, websites, and business applications need to exchange data. This is accomplished by

defining standard data formats such as Extensible Markup Language (XML) or JavaScript Object Notation (JSON), as well as transfer protocols or Web services such as the Standard Object Access Protocol (SOAP) or the more popular Representational State Transfer (REST). Developers often have to design their own Application Programming Interfaces (APIs) to make applications work while integrating specific business logic around operating systems, languages or servers. This course introduces these concepts with a focus on the RESTful API. The course also introduces the data exchange mechanism and common data formats. For Web exchange, you will learn the HTTP protocol, including how to use SOAP with XML. The course compares SOAP and REST, then covers the concepts of stateless transfer. It introduces software API design and best design practices. The second half of the course focuses on RESTful API design and implementations using Python Django, the most popular web development framework. You will learn how to build and consume RESTful services using JSON and XML, and integrate RESTful API with different data sources through hands-on coding projects. Through four coding assignments, which form the course project, you will apply what you have learned to implement a Single-Page Application (SPA) with both the front-end (provided by the instructor) and the Django-based backend with REST web service.

This course is intended for software developers who use data in projects. It is also useful for data professionals who need to understand the methods of data exchange and how to interact with business applications.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Develop RESTful services and their clients using Python Django

Apply RESTful API design best practices to real-world software solution including integration

Demonstrate API design skills using real-world use cases and review of APIs

**Skills Needed**

Python programming experience is required for the exercises and the project.

## *Designing with Cascading Style Sheets: Advanced | UEWD.X407*

3.0 Units

This course provides an in-depth exploration into the expanding world of Cascading Style Sheets (CSS), covering responsive website designs that work with smartphone, tablet or desktop monitors. Lectures and hands-on exercises cover essential CSS3 properties, concepts, techniques, and applications of media queries, styling forms, fonts and structural pseudo-classes. You will also learn how to handle browser compatibility issues.

By the end of the course, you'll know how to use the latest CSS capabilities to create Web pages with clean, efficient and cutting-edge designs that meet the demands of mobile, tablet and desktop users.

Learning Outcomes

At the conclusion of the course, you should be able to Design Web pages that respond to media types (mobile phones, tablets, desktops).

Use child, sibling and structural pseudo-class selectors.

Style forms.

Create drop-down menus.

Use Flex Box

CSS Grid Layout

Understand browser compatibility issues.

Apply CSS3 properties

Topics Include

Designing Web pages that respond to media types (mobile phones, tablets, desktops)

Using browser development tools for testing purposes Vendor prefixes Child, sibling and structural pseudo-class selectors

CSS3 properties, including:

* Border radius

* Box and text shadows

* Gradients Web Typography CSS Animation properties Flexbox Grid Layout Drop-down menus

Style forms

Validation of HTML and CSS code Testing for Accessibility

## *Development and Physiology | BIOL.X001_B*

5.0 Units

This course explores the structure and function of plants and animals, from the cellular to the organismal level, with a focus on anatomy, physiology, and development. Students will examine the fundamental biological processes that govern growth, reproduction, and adaptation, gaining a deeper understanding of how organisms interact with their environments. Through an integrative approach, this course provides essential knowledge for students pursuing careers in the life sciences and related fields.

Learning Outcomes

At the conclusion of the course, you should be able to

Explain how evolutionary principles and surface area-to-volume ratios influence form and function across biological systems.

Describe the structure and function of cells, tissues, and organelles, and relate these to physiological processes such as homeostasis and metabolism.

Analyze key bioenergetic pathways, including cellular respiration, and explain how organisms acquire, process, and distribute energy and nutrients.

Compare the structure and regulation of major physiological systems-including cardiovascular, respiratory, nervous, endocrine, renal, and immune systems-and their roles in maintaining internal balance.

Describe the fundamental mechanisms of development, including cell differentiation and organogenesis, and how these processes contribute to organismal structure and function.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: Cell and Molecular Biology(or equivalent course).

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## ***DevOps Technologies | SEQA.X408***

3.0 Units

DevOps is a combination of software development and IT operations methodologies and technologies. DevOps introduces many functional and technical changes in how companies design, develop, and deploy technologies, infrastructures, and applications. DevOps combines Agile software development practices and IT automation techniques to achieve rapid rates of high quality deployment.

This course will focus on the technologies and tools used by DevOps engineers. Upon completion of this course students will understand the core technologies and tools used within DevOps environments.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Understand the core concepts used in virtual and containerized environments

Understand Microservices and SoC (separation of concerns)

Write scripts to automate the deployment and configuration of Virtual Environments

Write scripts to automate the deployment and configuration of Container-Based Environments

**Topics Include**

Why DevOps? What do DevOps engineers/teams do?

Automating Deployments

* Using BASH

* Programmatic ssh

Virtual Environments

* Virtual Machine Concepts

* Tools: Vagrant

* Automating N-Tier VM Deployments

Microservices

* Why Microservices

* Hybrid Microservice Architectures

Containers and Docker

* Concepts

* Deploying Microservices in Containers

* N-Tier Container Deployments

Deploying Containers in Virtual Machines

* Docker + Vagrant

Infrastructure as Code

* Git

* GitHub

**Skills Needed:**

Students must have basic programming experience using a high level programming language like Java, Python, C#, or a scripting environment like Bash.

## *Digital Logic Design Using Verilog | VLSI.X404*

3.0 Units

This course is a practical introduction to digital logic design using Verilog as a hardware description language. Students learn Verilog constructs and hardware modeling techniques using numerous examples of coding and modeling digital circuits and sub-blocks. Verilog remains the legacy hardware description language for digital designs in the industry. The course starts with the basic concepts of hardware description, then goes into the key Verilog language elements and data types. Students tackle key challenges and learn structural, dataflow and behavioral modeling in Verilog, including common constructs, considerations and coding examples. Instruction in the coding and testing of digital logic includes examples of combinational circuits (gates, mux/demux, encoders/decoders, and general Boolean expression), sequential circuits (various latches, flip-flops, shift registers, counters, RAMs and ROMs), and complex logic (flavors of ALU and FSM).

At the completion of the course, students are able to understand and implement Verilog modeling of basic digital logic. Ultimately, students write and simulate approximately 3000 lines of Verilog code. The synthesis and simulation of the test examples is done using freely downloadable tools with instructor guidance.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe a solution to complex logic design problems and implement a test solution using Verilog

Discuss how to implement a hardware solution through software

Explain how to implement and test complex combinational logic, sequential logic, arithmetic circuit, memory, DSP and finite state machine

Identify, debug and find a solution to an existing hardware problem

**Skills Needed:**

Knowledge of basic logic design and familiarity with a high-level programming language (e.g., C) and use of a text editor.

## *Digital Marketing Science Certificate Course | APBS.802*

8.0 CEU's

This course is provided in partnership with Ziplines.

**Follow this link to learn more and enroll in the Digital Marketing Science Certificate Course.**

## *Document Preparation: Protocols, Reports, Summaries | CTDM.X408*

1.5 Units

Clinical trial documentation must be clear, scientifically sound, conform to regulations and established standard operating procedures, and follow regulatory guidelines. Despite pressure to start the trial "yesterday," a clinical trial cannot begin without a study protocol in place. Many other documents are needed before and during the trial, and the trial does not end until a final report has been submitted. Documentation of the trial often continues with articles in the biomedical literature. This course provides insight into the processes for preparing effective study protocols, reports, and summaries. Participants have opportunities to practice preparing documents and applying the rules governing clinical trial documentation.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the importance of the Clinical trial documentation, regulatory submission requirements

Explain how clinical trial documentation fits in the common technical document (CTD) organization of marketing submissions

Identify documents that are essential for the conduct of a clinical trial

Describe the main steps in document preparation process

Identify key elements of a study protocol

Recognize and describe required elements of informed consent

Explain the importance of version control

Explain the reasons behind the importance of a well written informed consent form, SAE narrative, or monitoring trip report

Write sections of a brief Clinical Study Protocol and Report Synopsis

Topics Include

Regulatory requirements – CTD and eCTD – IND, NDA, BLA

Protocol development

Informed Consent (ICF), Health Insurance Portability and Accountability Act

Detailed Clinical Study Reports (ICH E3)

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 15 contact hours

## *Drug Development Process | CTDM.X418*

3.0 Units

The development of a new drug is a complex, lengthy, and expensive process. Since regulatory approval is required before a company can bring a drug to market and generate revenue, it remains one of the riskiest endeavors in the biopharmaceutical industry

In this course, you will explore the drug development process—from preclinical efforts to evaluate a drug's pharmacologic properties for safety and efficacy to the clinical trials required for regulatory approval. You will examine the objectives, mechanics, and ethical considerations of testing investigational drugs in human clinical studies. The course also covers how the U.S. Food and Drug Administration (FDA) reviews new drug applications and the post-approval requirements imposed on biopharmaceutical sponsors.

Through real-world case studies, you'll gain insight into the science and regulatory frameworks guiding drug development, as well as the challenges biopharmaceutical professionals face in bringing a new drug to market. These case studies illustrate the complexities of the process, providing a practical perspective on the regulatory and business considerations influencing the industry.

Designed for professionals across disciplines who are currently working in—or considering a move to—the biopharmaceutical industry, this course offers a foundational understanding of drug development and equips students with the knowledge needed to navigate the biopharmaceutical landscape.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Explain the key steps in drug development, including how investigational drugs advance through preclinical and clinical stages.

Recognize the different phases of clinical trials, including their objectives, structure, and the types of data generated.

Discuss the oversight role of the FDA, including its regulations governing clinical trials, pharmaceutical

law, compliance, Good Clinical Practice, ICH Guidances, and bioethics.

Develop critical thinking skills to assess the challenges biopharmaceutical companies face in drug development.

Evaluate the role of the biopharmaceutical industry in society, balancing its benefits with informed critique of its business model.

**Topics Include**

Drug safety, efficacy, risk-benefit analysis, pharmacokinetics, metabolism, and pharmacodynamics

Clinical trial design, objectives, ethical considerations, and the interpretation of trial data

The regulatory framework surrounding clinical development, including the FDA's role in reviewing drug applications, enforcing pharmaceutical regulations, and conducting inspections

The mechanics of conducting a clinical trial from start to finish

Job opportunities and career pathways in the biotech and pharmaceutical industry

Professional Credit

Professional Credit: CA BRN/LVN Credit--Provider #CEP13114, 30.0 hours.

## *Drug Discovery, Survey | CTDM.X419*

1.0 Units

Drug discovery is a complex and rapidly evolving process that brings together many different fields of knowledge. While the fundamental principles of drug discovery are well known, the tools, technologies and methods used are always changing and improving. Effective drug discovery requires that professionals have an understanding of the entire process and are using the best practices. This course introduces students to the key steps in drug discovery from choosing a target to improving drug candidates in the lab. Students will learn how various scientific methods intersect to find and develop new treatments. The course also explores current trends and special topics, including cancer drug discovery, precision medicine, and the use of artificial intelligence in research.

**Learning Outcomes**

At the conclusion of the course, participants should be able to

Explain the different aspects of the drug discovery process as they are practiced in the pharmaceutical industry.

Discuss methods of target validation and lead optimization strategies.

Describe the most recent tools and techniques used for discovering new drugs.

**Topics Include**

Target identification and validation

* Creating arrays, multidimensional arrays, strings, StringBuilder class, primitive wrapper classes Interfaces, Nested classes

Target selection (genomic and biopharmaceutical)

Lead optimization strategies

Preclinical development

Pharmacokinetics/toxicology

Emerging trends: leveraging AI tools in drug discovery

## *Drug Safety and Adverse Events Reporting | CTDM.X409*

1.5 Units

Regulators, the public, and the medical community are scrutinizing the safety profiles of pharmaceuticals more closely than ever. Thus acquiring, verifying and reporting quality safety data are crucial to obtaining and maintaining product approval. This course introduces fundamental concepts essential to drug safety and adverse event reporting and how to apply them to situations encountered during clinical trials and post-marketing reporting. You'll learn why safety reporting is crucial; the definitions of an adverse event and the key reporting issues of seriousness, expectedness, and relationship to the study drug. The course includes a brief overview of reporting requirements in the U.S. and abroad and the documents associated with these reports. The content is appropriate for CRAs, CRCs, drug safety associates, and regulatory affairs personnel. Learning Outcomes

At the conclusion of the course, you should be able to Describe fundamental concepts essential to drug safety and adverse events reporting

Assess adverse events for causation, expectedness and seriousness

Identify reporting requirements related to Study Drugs

Apply drug safety concepts to clinical situations

Topics Include

Background of Drug Safety in US

Drug safety during pre-clinical and clinical trials

Post-marketing drug safety surveillance

Reporting issues related to drug safety

Skills Needed

To be successful in this class all students should have working knowledge of Google's G Suite or Microsoft Office, proper email etiquette, and essential understanding of Canvas.

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 15 contact hours

## *Early Childhood Education Advanced Teacher Certificate Completion Fee | O-CE0421*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the "Certificate Completion Fee" to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Early Childhood Education Associate Teacher Certificate Completion Fee | O-CE0411*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the "Certificate Completion Fee" to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Early Childhood Education: Supervision and Administration Certificate Completion Fee | O-CE0095*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the "Certificate Completion Fee" to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *ECE 10: Supervision and Administration: Parents as Partners in Education | ECEA.X320*

5.0 Units

This course will examine ways of creating an environment where parents and teachers work in partnership for the education of young children. Attitude, understanding and skills which lead to effective communication and cooperation between home and school will be shared and explored.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the importance of family-teacher partnerships to improve educational outcomes for students

Discuss different types of communication with families, effective communication tools, and challenges to communication

Explain how the classroom environment and curriculum can reflect a family-centric approach

Identify key principles of home-school partnerships

Topics Include

Parent Profiles

Family-Teacher Partnerships

Communication with Families

Classroom & Curriculum

Families as Teaching Partners

Welcoming Families

Additional Information

Together we will explore effective and productive ways of engaging parents and families in partnering with day care, preschool, and other school professionals on their children's education. Current research and best practices in the field of early childhood will be presented.

Effective partnering with parents begins with our understanding of what families do at home and in the community to support their children’s learning and development. It also means providing systems of ongoing communication that engage families of diverse linguistic and cultural backgrounds.

The National Association for the Education of Young Children (NAEYC) identifies effective family engagement as an important and necessary practice of early childhood educators.

## *ECE 11: Supervision and Administration of Early Childhood Centers, Part A | ECEA.X321*

5.0 Units

This course focuses on the history of early childhood education, the laws governing early childhood centers in California, and the goals of early childhood education. You’ll also discuss the administrator's job description, budgeting, personnel selection and standards, records and reports, and staff policies. The course discusses laws and regulations pertaining to the operation of an early childhood program and examines how to budget administrative responsibilities. You’ll develop the skills necessary to create an early childhood environment which meets space, equipment, health and safety requirements, and evaluate your program quality using the Environmental Rating Scale. This course is a good fit for educators interested in obtaining the California Child Program Director Permit.

Learning Outcomes

At the conclusion of the course, you should be able to Identify the history of early childhood education

Identify the organization, function and relationship of the different types of programs for young children

Recognize laws and regulations pertaining to the operation of an early childhood program

Develop guidelines for selecting staff members for a program

Develop staff policies and procedures for an early childhood program

Plan early childhood environments which meet space, equipment, health and safety requirements

Examine budget and record keeping administrative responsibilities

Evaluate an early childhood program for quality using the Environmental Rating Scale. Topics Include

Framework for your work

Self-evaluation

Learning goals and action steps

Staff conflict resolution

Child care budgeting/approach assessment

Hiring (qualifications and job descriptions)

Licensing policies and procedures

Child care environment rating

Creating your program's vision

## ***ECE 12: Supervision and Administration of Early Childhood Centers, Part B | ECEA.X322***

5.0 Units

This course explores the challenges and issues related to the supervision and operation of preschool programs. Staff-administrator relationships, staff inservice education and working with parents are also covered.

Learning Outcomes

At the conclusion of the course, you should be able to Implement health and hygiene policies.

Understand key issues related to the inclusion of special needs students.

Establish anti-bias approaches to school administration.

Apply interpersonal communication skills.

Demonstrate staff supervision, evaluation, and termination strategies.

Establish and maintain quality family-school relationships.

Build Community Resources through identifying and supporting family needs.

Develop market techniques and handling of the media.

Apply techniques for accessing current legislative and published information essential to providing quality child care and early education programs.

Topics Include

Health, safety, and hygiene issues.

Anti-bias programming and special education topics.

Staff issues, including supervision, professional growth, conflict management probation, and termination.

Family - School relationships

School - Community relationships

Public relations and advertising techniques.

Updates on current research and developments in the field of Early Childhood Education.

### *ECE 13: Adult Supervision and Mentoring | ECEA.X323*

5.0 Units

This course examines the process of building a staff organization through development of effective communication and interpersonal relationships. Topics include the criteria for selection and evaluation of personnel, involvement of staff in the planning and evaluation of programs, the administrative role in promoting professional growth, teaching effectiveness and developing sensitivity to individual needs.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the roles of a supervisor, mentor, and coach in an ECE setting

Discuss expectations of a mentoring relationship

Explain how to make and communicate observations of teachers and the learning environments they create

Identify how to guide educators in facilitating professional development

Topics Include

Introduction to Developing Coaching & Mentoring Relationships

Relationship-Based Professional Development

Building Professional Relationships with Adults

Communicating to Support Teacher Awareness

Adult Learning and Planning for Teacher Development

Coaching to Connect Curriculum, Assessment & Teaching

Supervisors and Teacher-Leaders as Mentors or Coaches

## *ECE 1: Development in Early Childhood | ECED.X301*

4.0 Units

Participants explore human development from prenatal stages through middle childhood and study the interrelationships among social, emotional, physical and cognitive development, with a focus on the role of play in early childhood. Using observational techniques, the class identifies developmentally appropriate characteristics and activities.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the influence of various social contexts on development including family, school, childcare, the media, and culture

Discuss some views consistent with current knowledge and research in child development, based upon several current issues in child development

Observe, record, analyze and compare children’s behavior and relate it to course materials on development

Identify the major milestones in child development from birth through adolescence in social, emotional, cognitive and physical development

Topics Include

Examining the relationships of the child to their family, community, and culture.

Learning about expected behavior and growth patterns of infants through adolescence.

To study the social, emotional, intellectual, and physical development of the child from conception through adolescence.

Observing, recording, analyzing and comparing children’s behavior and relating it to course materials on development.

Recognize and appraise the influence of various social contexts on development including family, school, childcare, the media, and culture.

Examine the significance of various statuses and characteristics such as gender, disabilities and socioeconomic status on children’s development.

Additional Information

Students must have the required textbook for the first class meeting.

## *ECE 2: Introduction to Teaching Young Children | ECED.X302*

4.0 Units

This course studies the philosophy, history and development of early childhood programs. You'll examine the teacher-child relationship and how existing programs meet the needs of preschool children and review programs to evaluate how they meet the criteria of a quality learning environment. You'll get a chance to see how ECE programs operate in the real world by attending mandatory field observations at sites designated by the instructor.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the history of early childhood education

Discuss various guiding principles among early childhood educators

Know the differences among early childhood programs and how they are evaluated by checklists

Identify the differences among developmental stages of children

Topics Include

History of early childhood education

Types of programs

Defining the young child

Developmental and learning theories

Teaching: A professional commitment

Curriculum: Creating a context for learning and play

Issues and trends in early childhood education

## *ECE 3: Curriculum Development in Early Childhood Programs | ECED.X303*

4.0 Units

In this course, you'll examine basic child development theories in relation to design and implementation of curriculum for young children. Topics include the design of developmentally appropriate lesson plans and learning centers to fit the needs of specific age groups, the steps involved in curriculum development, material and equipment selection, planning group experiences, and basic guidance techniques for young children. The course emphasizes the value of play and learning environments and developmentally appropriate materials and activities.

Learning Outcomes

At the conclusion of the course, you should be able to Describe what the developmentally appropriate practices are according to NAEYC (National Association for the Education of Young Children)

Discuss various websites that could help an early childhood teacher with planning units of study

Explain why the 8 curriculum areas should be included in a quality early childhood program

Identify what the 8 curriculum areas are that should be included in lesson planning & curriculum

Topics Include

NAEYC Curriculum standards and 8 areas

Model fingerplays and picture books

## *ECE 4: The Young Child in the Family and Community | ECED.X304*

4.0 Units

This course focuses on the dynamics between the young child and his or her family, school and community, including various cultural and social influences. Participants explore ways to develop communication skills between young children and peer groups, parents and teachers. Community resources and social services, including healthcare, welfare and counseling, are reviewed.

Learning Outcomes

At the conclusion of the course, you should be able to Identify ways to support families around issues of attachment and trust

Describe social influence on children and families

Identify strategies to understand families' goals values and culture

Identify strategies for supporting families through community resources and networks

Explain RERUN procedures for problem solving.

Explain how social policy issues affect children and how to advocate for children Topics Include

Early care and education programs as community resources

Supporting families through community resources and network

Supporting families around issues of attachment and trust

Societal influences on children and families

## *ECE 5: Positive Guidance and Discipline for the Young Child | ECED.X305*

3.0 Units

Participants in this course learn to identify children's behavior to determine whether it is normal, developmentally appropriate or problematic. Cooperative discipline is explored in the wider context of classroom management, working with staff and parents. Behaviors are examined to better understand why children behave the way they do and to correct behaviors with a guidance and discipline strategy that is positive, respectful of both child and adult, and developmentally appropriate. Participants also learn to practice prevention of certain behaviors and guide children through the use of positive discipline. The focus is on how an adult can behave when a difficult situation arises and be as effective as possible in creating an atmosphere of safety that supports all children in reaching their fullest potential.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the developmentally appropriate behaviors of young children

Discuss positively and respectfully guiding principles

Explain the theoretical foundation of prevention strategies

Identify the effective communication approach to collaborate with parents and other teachers

Topics Include

Physical environments that promote positive learning

Positive vs. negative discipline

Approaches for problem solving when working with children

Additional Information

Be ready for some lectures, individual presentations, group discussions, class and group projects, and a “hands-on” project or PowerPoint slide presentation to be made as a final project.

## *ECE 6: Culture and Diversity in the Early Childhood Classroom | ECED.X306*

3.0 Units

This course explores diversity, values, culture, racism and oppression from the educator's viewpoint and the impacts these factors have on creating a positive multicultural classroom environment. You’ll learn various styles of communicating with parents, and role-play scenarios to practice handling awkward situations. Course assignments provide an opportunity to develop multicultural lesson plans that can be used in an early childhood classroom.

Learning Outcomes

At the conclusion of the course, you should be able to Make a distinction between awareness and politics

Define learning styles

Define cultural diversity

Develop self-awareness surrounding our own attitudes about students in our classroom(s)

Create a distinction between prejudice, discrimination, and racism

Discuss racism and oppression from the educator's point of view

Understand, acknowledge, and plan for the needs of diverse learners

Develop multicultural lesson plans for students in the early childhood classroom

Recognize the qualities and benefits of a safe space that allows all students to thrive

Create a multicultural learning environment that meets the needs of all children

Understand the importance of parent involvement in early childhood development

Brainstorm effective ways to involve parents in their children's learning

Synthesize course information and plan for future implementation

Topics Include

Diverse learners

Cultural diversity

Racism and oppression

Differentiated instruction

Multicultural lesson plans

Home-school partnerships

Confronting bias and overcoming cultural conflict

Additional Information

This course is designed to be consumed in chunks: each module contains a "chunk" of information or course of study and must be completed within the week it is allocated.

## *ECE 7: Practicum in Early Childhood Education | ECED.X307*

5.0 Units

This course provides early childhood education professionals with the opportunity to observe and evaluate children, applying theoretical and practical models from the field of early childhood education. Course activities include structured observation, analysis of the roles of adults, lesson planning, parent conferencing and reflective teaching.

Meets the California requirement of 3 semester units (equal to 5-quarter units) of supervised experience for teachers applying for a Children's Center Permit as described in the Child Development Permit Matrix see here: Child Development Permits- Worksheet

Learning Outcomes

At the conclusion of the course, you should be able to Plan and implement developmentally appropriate curriculum activities in the early childhood classroom

Locate and utilize professional resources

Understand and articulate the role of an early childhood educator

Demonstrate skills in appropriate guidance and disciplinary techniques with young children

Understand and implement skills in working with parents as partners in their children’s learning process

Create appropriate indoor and outdoor learning environments for young children

Demonstrate appropriate skills in interactions with young children

Interact with other teachers in a professional manner, and demonstrate professionalism in all aspects of their teaching

Topics Include

Understanding and guiding behavior

Observing and assessing children

Curriculum development

Additional Information

**ECE 7: Internship requirements: FAQ** This course requires 70 hours of work in a licensed Child Care Center, Pre-K or Kindergarten.

To obtain credit for this course, you need to be supervised by a mentor teacher at a school where you are teaching. The class meets three times, at the start, middle and at the end of the practicum. You are expected to complete your hours at a school and submit your assigned work on the last day of class and online. The Extension instructor is available for online guidance and support for both students and mentors.

PLEASE NOTE: Extension does not provide mentor teachers for the purpose of this practicum. You are responsible for finding your own mentor teacher.

Mentor teachers should be working in a licensed, preferably accredited, facility. Family child care is not permitted. It is acceptable to select a kindergarten teacher as a mentor.

Mentor teachers must have at least 5 years of experience working with children in the role of lead teacher or director. They should have a minimum of 24 units of training in early childhood education and meet the requirements for a master teacher permit. A site supervisor or director permit is desirable. The mentor teacher's credentials must be given to the Extension instructor at the first meeting.

To locate a licensed center in a convenient location see Social Services Community Care Facility Search.

## *ECE 8: Child Health, Safety and Nutrition | ECED.X308*

5.0 Units

This course is highly beneficial for anyone working in an early childhood educational setting. It introduces the theory, practices, and requirements for establishing and maintaining a safe and healthy learning environment. Topics include healthcare policies and procedures in the child-care setting, childhood nutrition and obesity, prevention of disease transmission and injuries, child abuse and neglect. You will also learn to provide a quick health check for children and plan healthy menus.

Learning Outcomes

At the conclusion of the course, you should be able to Understand health care policies and procedures in the child care setting.

Identify safe and healthy environments for young children.

Discuss prevention of disease transmission and injuries.

Identify appropriate care and intervention for the sick or injured child.

Describe Emergency preparedness.

Describe child abuse and neglect.

Understand emotional health.

Discuss preventive health practices.

Understand Nutrition and feeding issues. Topics Include

Outdoor Home Playground Safety

Indoor and outdoor activity spaces

Additional Information

Students are encouraged to obtain CPR certification

## *ECE 9: Language and Literacy for the Young Child | ECED.X309*

3.0 Units

This course covers the development of language in children and outlines experiences and techniques that enable children to further that development. You'll learn how to promote oral language abilities through the active use of books, poetry, dramatic play and group discussions. You'll gain insight into grammar, phonology and semantics; common speech problems, and language arts curricula that can help foster literacy in the classroom. The course also reviews the reading process along with various reading theories and issues.

Learning Outcomes

At the conclusion of the course, you should be able to Identify major factors that influence language development.

Understand the Maturation (Normative), Predetermined/Innatist, Cognitive, and Constructivist Theories of language

Define literacy, grammar, phonology, and semantics

Understand the role adults play in children's language development

Identify common speech problems

Understand differences in children's language

Understand the importance of early literacy

Describe ways that teachers can promote literacy growth

Incorporate Language Arts Curricula into daily instruction in order to support students

Design a classroom environment that supports literacy for children

Discuss multicultural book use

Describe how story-telling can improve children's language development

Understand how poetry and dramatic play can help improve children’s literacy

Understand the correlation of reading and writing

Analyze a parent's role in helping children's literacy

Topics Include

Predictable Routines

Strategies for lesson planning

The Essentials of early Literacy

Developing a literacy Environment

Additional Information:

In order to satisfy course requirements, class participants must participate in discussions, complete all course assignments on time (on or before the due date), and use graduate level writing/presentation for all written assignments. It is fine to turn in assignments ahead of time!

## *ECE: Brain Development in Early Childhood | ECED.X310*

3.0 Units

How does the human brain develop during the first years of life? How can a child learn two or more languages at the same time? How does stress slow brain growth? This course answers those questions, providing parents or teachers of infants, toddlers or preschoolers with the latest research in brain development, demonstrating how this information can enhance parenting and teaching practices.

This course will help you appreciate a child's unique qualities and your own strengths, as you work toward long-term success in parenting or teaching.

Learning Outcomes

At the conclusion of the course, you should be able to Identify brain development in children

Outline experiences and techniques that enable children to further their development

Identify different areas of the brain and how some of these areas are crucial at certain times in a child's development and need to be stimulated

Present topic of choice regarding brain research in children

Topics Include

Introduction to Brain Research

Diagrams and other helpful information on brain research

Additional Information

Be ready for some lectures, individual presentations, group discussions, class and group inquiries, and a "hands-on" project or PowerPoint slide presentation to be made as a final project by each person in class.

## *ECE: Creative Arts for the Young Child (Preschool Through Grade 3) | ECED.X312*

3.0 Units

You know intuitively that art activities engage children of all ages. But how can you make the most of your teaching with art? How can you---even without formal training---organize stellar lessons that leave the kids asking for more? In this fundamentals course, participants start with a review of art expression at each stage of early childhood development, then move on to understanding ways to foster creativity and the creative process. Next, participants work hands-on with basic art processes, such as painting, drawing, and creating designs. Through mini-lectures, discussions, videos, and readings, participants prepare age-appropriate lessons that build visual and spatial awareness and relate art to other key curriculum---science, mathematics, language arts, and social studies. Participants leave the course with an individualized portfolio, complete with lesson plans and objectives. Course activities include ample instructor modeling.

Learning Outcomes

At the conclusion of the course, you should be able to Select and develop age-appropriate, process-oriented art experiences for young children and share them with the class and instructor

Create a resource portfolio based on knowledge of media and resources in the field of creative art

Observe young children and assess the developmental level of children’s art expression and skills

Demonstrate through assignments and group discussion a knowledge of and appreciation for the role of creative art expression in the emotional, social, physical and cognitive growth of the child

Demonstrate judgment and decision-making in selection of art activities and materials for young children

Demonstrate integration of theory and practice by oral presentation of activities and written assignments

Demonstrate an appreciation for the role of creative expression in the individual through hands-on classroom experience

Topics Include

What is creative art?

How teachers can encourage creativity

Relating art activities to other curriculum areas (integrated curriculum)

Relating art to all four areas of development

Additional Information

Creative Arts for the Young Child is designed to meet the needs of teachers planning curriculum for preschool through third grade. This course includes practice in using age-appropriate methods with commonly available creative art media for children of various developmental stages, infancy through eight years old. This hands-on course will focus on the importance of individual expression of creativity, including problem solving, planning, and play through art activities. Students will learn to make, collect, and use various materials to develop an understanding of how art expression and skills change as children mature.

## *ECE: Infant/Toddler Growth and Development | ECED.X313*

3.0 Units

This course is designed for those who work or plan to work in child-care programs for children up to three years of age. The focus is on understanding growth and development and recognizing the range of individual differences within developmental norms. Participants engage in a variety of activities to promote theory learning and observation skills. Topics include gross and fine motor skills, perception, emotions and feelings, social skills, cognition and language.

Learning Outcomes

At the conclusion of the course, you should be able to Develop an understanding of the interactions among familial, cultural, social and physical environments that influence growth and development of infants and toddlers

Demonstrate knowledge of an infant's physical, perceptual, sensory motor, socioemotional, and

cognitive growth and development

Demonstrate understanding of theories and research of infant education and development

Recognize, analyze, and discuss quality environments and care for infants through the identification and interpretation of State regulations and California Department of Education’s Infant/Toddler - Learning and Development Program Guidelines

Identify and assess developmental expectations for infant learning and construct appropriate educational activities and materials

Identify requirements, regulations and program components and types of programs in infant care

Construct a philosophy and design a program for infant care and education

Topics Include

Routines/Schedules for feeding and changing

Adopting a problem-solving approach to conflict

Redesigning the toddler room

Notes

Having had a child or taking care of a young child is beneficial when sharing in class discussions. Please order your book ASAP.

## *ECE: Principles of Infant/Toddler Caregiving | ECED.X314*

3.0 Units

This course satisfies part of the State Licensing requirement for the application of infant/toddler caregiving principles. We encourage students to visit the cdss.ca.gov website for more information on the requirements. The course "Infant/Toddler Growth and Development" fulfills the remainder of the requirement. This course is designed for those who work with children up to three years of age. The course focuses on understanding the principles of high-quality caregiving. Topics include understanding the adult role in the development and implementation of curriculum for infants and toddlers, and essential curricula components such as physical setting, social environment and play.

Learning Outcomes

At the conclusion of the course, you should be able to Describe milestones of children ages 0, 1, 2 and the monthly development that they go through

Discuss many different theories that have been given by child development theorists of the past

Explain the differences between toddlers/infants as compared to older children in preschool and beyond

Identify strategies that are best to use with children ages 0-2 years old

Topics Include

The four stages in acquiring language

Motor milestones of Infants 0-12 months

Importance of brain development in the first five years

building brains together

Additional Information

This course is great for all interested in this age group even if they have not had children of their own yet. It is also informative for those who have had children as they can relate to many of the things the book focuses on.

In this course, you will study the theories, philosophies, and practices that are best for working with infants and toddlers two and under. This class is necessary and mandatory for all caregivers working with this age frame.

## *Ecology and Evolution | BIOL.X001_C*

5.0 Units

This course provides an introduction to ecology and evolution, exploring fundamental principles of evolution at the molecular, organismal, and population levels. Students will examine key ecological concepts and evolutionary mechanisms that shape biodiversity and species interactions.

Learning Outcomes

At the conclusion of the course, you should be able to

Explain the mechanisms of microevolution and macroevolution by analyzing processes such as mutation, natural selection, genetic drift, gene flow, and speciation, and applying the Hardy-Weinberg equilibrium to assess evolutionary change in populations

Interpret and construct phylogenetic trees using cladistics and phylogenetic inference to evaluate evolutionary relationships among organisms and trace the evolutionary history of life on Earth.

Analyze patterns of biodiversity and adaptation by exploring the evolutionary consequences of inbreeding, outbreeding, genetic bottlenecks, and polymorphism across ecological and evolutionary timescales.

Evaluate ecological principles across organizational levels, including population dynamics, species interactions, community structure, and ecosystem function within local and global biomes.

Apply behavioral and ecological theory to explain the evolution of animal behavior and its ecological implications in natural environments.

Topics Include

Foundations and Evidence of Evolution Explore pre-Darwinian science, the development of evolutionary theory, and the genetic and fossil evidence supporting evolution.

Mechanisms of Microevolution Examine how mutation, natural selection, genetic drift, gene flow, and non-random mating drive changes in populations, supported by population genetics models like Hardy-Weinberg equilibrium.

Speciation and Macroevolutionary Patterns Investigate how species form and diversify, including the roles of adaptation, reproductive isolation, genetic bottlenecks, and evolutionary trends over deep time.

Phylogenetics and the Tree of Life Learn how to construct and interpret phylogenetic trees using cladistics and molecular data, and trace the evolutionary history of life on Earth.

Ecological Principles and Biodiversity Study the interactions of organisms with each other and their environments through topics in behavioral, population, community, ecosystem, and global ecology.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: Cell and Molecular Biology (or equivalent course).

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## ***Educational Assessments I | EDTH.X303***

3.0 Units

Assessment is critical for determining what we've learned, how we learn, and how to best target and

bolster instructional approaches as we move ahead. This course introduces the assessment tools and procedures frequently used in educational therapy settings. Participants will gain experience using specific assessment instruments. They will have access to a limited number of assessment instruments which they may use for practice. Testing is limited to educational assessment tools, which are widely used by educational therapists and do not require credentialing as a school psychologist or licensing as a clinical or educational psychologist. The course offers insight into how to administer tests used by educational therapists and how to interpret psycho-educational evaluation reports.

Learning Outcomes

At the conclusion of the course, you should be able to Explain the purposes of formal and informal assessment

Read, understand, and summarize educational testing reports

Administer a standardized assessment correctly

Recognize common tests of phonological awareness, visual motor integration, expressive and receptive language, reading, writing, and math

Use test data to plan remediation in one academic area

Topics Include

Understanding why educational therapists give assessments and conduct interviews

How to identify which assessments are appropriate for educational therapists to administer

How to review psycho-educational reports and other allied professional assessments in order to develop an effective treatment plan

Additional Information

Please note that this course is designed for educational therapist candidates, general and special education teachers, school administrators, and allied professionals.

## *Educational Assessments II | EDTH.X304*

3.0 Units

This course introduces the formal educational assessment process from start to finish. Discussion is limited to educational assessment tools which are widely used by educational therapists and do not require credentialing as a school psychologist or licensing as a clinical or educational psychologist. Select assessment tools previewed in the previous assessment course (Educational Assessments I) are used for testing purposes, to generate a written report, and to verbally share findings. Participants will also learn how to interpret test results, reports, and findings from other allied professionals.

**NOTE** Participants will be required to find a volunteer school-aged student for the purposes of learning how to complete an educational assessment. Learning Outcomes

At the conclusion of the course, you should be able to Use 3 or more standardized assessment tools

Obtain a developmental history

Record test results and interpret them in writing

Topics Include

Obtaining informed consent

Maintaining confidentiality

Selecting, administering, and scoring educational tests

Summarizing testing data

Making educational recommendations

Presenting assessment findings

Notes

IMPORTANT: Students will be required to FIND A VOLUNTEER family/child for the purposes of administering educational assessments. Test administration is for training purposes only.

Students enrolled in this course will have access to published and copyrighted test materials. Once the course begins, students will receive written instructions regarding how to access and protect the integrity of these test materials.

Students will be asked to share their email address with the instructor as is required by select test publishers.

Students will need access to a printer.

## *Educational Therapy Certificate Completion Fee | O-CE0412*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Educational Therapy Practicum | EDTH.X390*

5.0 Units

This final course in the Educational Therapy Certificate Program provides an opportunity for the intern to practice all aspects of educational therapy under the supervision of an experienced professional in the field. To arrange your internship, contact UCSC Extension for information.

Learning Outcomes

At the conclusion of the course, you should be able to Set up a functional educational therapy practice / set up service as a self employed learning specialist

Administer and use formal and informal assessments to develop a client's learning profile.

Develop and implement an intervention plan, based on assessment data and contextual information.

Collaborate with the client, parents, teachers and allied professionals as part of a multidisciplinary team.

Abide by the AET ethical codes

Reflect upon one’s own professional practices as an Educational Therapist and engage in a systematic process of self-analysis.

Topics Include

Preparing for ET Services

Providing ET Services

Terminating ET Services

Potential Career Steps

## *Educational Therapy: Structured Literacy I | EDTH.X301*

3.0 Units

Structured Literacy I introduces you to the theories, issues, strategies, and materials related to literacy instruction and assessment for both reading and writing. While not focusing on students with learning difficulties, in this literacy course you will learn foundational skills for supporting all your students.

We will emphasize the science of reading and structured literacy, as well as best practices of instruction and informal assessment. You'll also practice developing materials and gain the skills to teach literacy to a broad range of students. A two-part series

While Structured Literacy I (formerly Reading I) focuses in depth on the teaching of literacy, Structured Literacy II (formerly Reading II), focuses on teaching literacy to students with learning disabilities, speech and language disabilities, ADHD, ASD, and other challenges.

Both courses are required for the certificate in Educational Therapy and are closely aligned to the

requirements of the Association of Educational Therapy.

You'll master the skills and knowledge you need to help all the diverse students who will come to you in your practice.

Learning Outcomes

At the conclusion of the course, participants will be able to:

**Neurobiology of Literacy Learning** Differentiate brain processes used for oral language from those used for written language

Describe the main components for mastery of literacy

Define key terms—phonological processing, phonemic awareness, and phonics—and explain how each one contributes to the development of literacy

**Structured Literacy** Define the components of structured literacy and describe their importance

Apply the current science on reading to assess the quality of reading and writing programs

Create and implement effective lessons based on best practices in structured literacy instruction

**Speech to Print** Compare and contrast speech-to-print and print-to-speech approaches

Evaluate quality programs following each approach

Describe the bidirectional influence of spelling on reading and vice versa

Apply current science behind best practices to design an effective spelling intervention

**Comprehension** Explain Scarborough's Reading Rope and its implications for comprehension

Compare and contrast the effects of decoding and oral language proficiency on reading comprehension

Evaluate and implement programs and techniques to build comprehension

**Assessment** Describe and justify the components of a quality assessment for literacy

List and describe both informal and formal literacy assessments

Describe the assessment to instruction cycle and how best to use assessment to inform teaching

Topics Include

The neurobiological underpinnings of literacy learning

Structured literacy: what it is and why it is important

Speech to print: an important update in the science of reading

Teaching writing from bottom to top

Scarborough's Reading Rope and comprehension

The stubborn persistence of the reading wars

Additional Information

Formerly titled "Educational Therapy: Reading I"

As a hybrid class, the expectation is that students will make every effort to attend each zoom class meeting as well as complete independent reading and written assignments. Assignments have specific due dates each week, so please make sure to keep up.

### *Educational Therapy: Structured Literacy II | EDTH.X313*

3.0 Units

This course is part II of a two-course series, Structured Literacy I and II. Spreading the content over two courses offers us the luxury of focusing more in depth, first on the teaching of literacy and then on teaching literacy to students with learning difficulties. Both courses are required for the Certificate in Educational Therapy, and are more closely aligned to the requirements of the Association of Educational Therapists, as well as providing a more thorough mastery of the skills and knowledge base necessary to adequately teach all of the students who will come to you in your practice.

Structured Literacy II builds upon Structured Literacy I foundation to explore how to teach, remediate and support students with learning difficulties, whether due to dyslexia, speech and language disability, ADHD, ASD, a mismatch between home and school culture, learning English as a second language, or a number of other challenges. The course emphasizes neurobiological and neurocognitive underpinnings of literacy, the science of reading and structured literacy, best practices of instruction, using informal and formal assessments to guide instruction, and the development of materials and skills to teach literacy to a broad range of students.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the characteristics and elements of structured literacy

Analyze student's individual learning needs and apply best practices to modify structured literacy to their needs

Analyze the complex interplay of overlapping challenges and create a multi-leveled, multi-faceted approach to best support each student

Apply both informal and formal literacy assessments to create an accurate student profile and a learning plan that responds to the changing needs of each student

Topics Include

The who, what, when and why of literacy instruction

Structured Literacy: what it is and why it is even more important for students with disabilities

Understanding differential diagnoses to align instructional practices with the specific needs of individual students

How socio-economic, cultural and a wide-range of identity issues affects literacy acquisition and instruction; and their interconnections with identification and treatment of language-based learning disabilities

Assessments for literacy difficulties and dyslexia

### *Effective Employee Relations | HRMT.X414*

1.5 Units

HR generalists, business partners, and newly promoted human resources specialists will deepen their understanding of employee performance programs in this extensive and practical overview of workplace relations.

We will learn current legal and practical methods for handling employee relations, performance management strategies, and provide a special focus on common workplace issues such as on-the-job behavior which accounts for 80 percent of terminations.

We will also explore topics such as employee communications, handling employee complaints, resolving employee conflicts, and workplace harassment as well as how-to conversations that coaching managers employ to help with employee issues; performance management; voluntary and involuntary terminations, abusive behavior, and the impact of mergers and acquisitions. More importantly, we will also focus on the new world of work and how teams influence new employee behaviors.

It is highly recommended that students new to human resources begin with the introductory "Human Resource Management” course. After that, courses may be taken in any order.

Learning Outcomes

At the conclusion of the course, you should be able to

Understand the full concept and interpret best practices regarding employee relations.

Coach managers through employee performance, mental health, and other personal issues.

Implement and outline (for managers) a comprehensive performance improvement plan.

Train managers in performance management for ER.

Innovative approaches and research regarding performance management systems in 2022.

Understand the impact of teams regarding employee performance.

Deal with employees during the integration process of change and realignments.

Explain the investigative process today in workplace harassment and other complaints.

Professional Credit

SHRM-CP® or SHRM-SCP® 16.5 PDCs.

## *Effective Negotiations: Principles, Strategies, and Techniques | BUSM.X416*

1.5 Units

Negotiation is an integral part of our daily life. Whether you are seeking project resources, deciding on a new hire’s salary, or inking a high-stakes deal for your company, your success depends on your skills as a negotiator.

In this foundational course, you will gain insight into the psyche of an effective negotiator and learn to steer clear of the most common pitfalls in deal-making. You'll practice each stage of a business negotiation, from initial planning to the final handshake and memorandum of agreement. We’ll discuss 10 negotiation principles, including how to use the four basic forces in every business negotiation: power, information, timing, and approach. The Negotiation Matrix, developed by Roy Lewicki and Alexander Hiam, is used to shift from ineffective negotiating strategies and tactics to more cooperative and mutually beneficial approaches. Through group exercises, you will learn how to execute proven tactics, refine your personal negotiating style, and improve your ability to make a deal successfully and ethically in any situation. Along the way, you will gain new appreciation for how negotiating skills can help you overcome a wide range of challenges—at work and beyond.

This course, which is designed for anyone who wants to enhance negotiation skills and work more productively with customers, colleagues, partners, and vendors. No prior training in negotiation is required.

Learning Outcomes

At the conclusion of the course, you should be able to

Enjoy optimal results in both formal and informal negotiations.

Apply strategic thinking to your negotiations.

Build confidence in your bargaining power and abilities.

Improve negotiations by managing your emotions and influencing others.

Build positive, productive relationships with all parties at the table.

Create value and “enlarge the pie” to produce win-win outcomes.

## *Effective Performance Management | HRMT.X402*

2.0 Units

Effective performance management systems involve goal setting, coaching and feedback, motivation, measuring performance against goals, no rating systems, employee check-ins, performance appraisals options, employee development and retention strategies.

In this overview course for managers, supervisors as well as human resources business partners, you’ll learn how a PM program can benefit your team, how to implement the complex components above and techniques to effectively partner with line managers to enhance your process.

We will watch and defend a mock performance appraisal review, listen to guest speakers discuss best practices in performance management, and review manager training at various companies. By developing high potential employees and identifying successors for senior level positions within an organization, you will see how employee coaching and leadership development tie in with succession planning. We will also review and implement the key elements of a performance improvement plan.

Learning Outcomes

Proper performance management techniques and pitfalls to avoid

Management of employee behavior and job performance

Organizational alignment and results. What about positive feedback?

Employee check-ins and employee development in a performance management process and a performance appraisal system

Performance management implementation in diverse organizational cultures

Leadership development and succession planning

Performance management research, neuroscience, and employee analytics

Professional Credit

SHRM-CP® or SHRM-SCP® 19.25 PDCs.

## *Embedded Firmware Essentials | EMBD.X403*

2.0 Units

All embedded systems require firmware to enable their features. In addition to C programming, firmware engineers must understand system and CPU architecture, as well as the IO and memory interface. They must also master techniques to manage limited memory and tasks, and code programs that are suitable for hardware bring-up and application development. In this course you will learn practical, in-depth knowledge and coding exercises for firmware development. We'll review embedded system architecture and hardware configurations specifically on the Espressif ESP32 and its CPU core architectures. You will be introduced to C codes, how to enable hardware features, and work with real-time operating systems, task management and interrupts as well as various inter-chip communication interfaces and access to the outside world. We will introduce the wireless functions of these devices.

Most firmware development in industry is done on Linux systems. You should have solid C programming skills and be ready to complete all class projects with GNU tools. You'll gain experience working on several on-hardware projects. This course prepares you for additional embedded software courses covering a wide range of product interests.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Understand key fundamental concepts of embedded firmware programming

Set up and use an embedded firmware development environment

Design firmware applications that take advantage of the many I2C and SPI sensors available

Describe and explain various wireless protocols for IoT devices

**Notes:** Students are required to purchase a hardware starter kit, a small board, breadboard, resistors, LED, and wires (estimated $45-$60, not included in the tuition) to do class projects on their laptops. These are available on Amazon https://a.co/d/bmhGjaY or https://a.co/d/7ZHsEDG and should be purchased before the first class. For additional sensors or actuators depending on the student's interest, please contact the instructor.

## *Embedded Linux Design and Programming | EMBD.X423*

3.0 Units

This course covers the fundamentals of building and installing a custom embedded Linux for an ARM processor platform, and provides hands-on experience for creating cross-platform environments using the GNU tools. Basic concepts for designing, testing, and customizing embedded Linux will be covered, including how the Linux scheduler is implemented, and how to write Linux kernel modules and remotely debug embedded Linux applications.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Explain the basics of designing embedded Linux

Master the requirements to setup a Linux cross development environment

Use GNU tool chain to compile Linux Kernel and applications code

Develop and download applications to run on an embedded Linux target system

Describe the steps to write, compile and load/unload Linux Kernel modules

Summarize the Linux File System and initramfs (Initial RAM File System)

**Topics include**

An overview of embedded and real-time systems

Creating a cross-compiler

Linux device tree usage

Building and configuring a custom Linux kernel

Building and debugging Linux application source code using a GDB debugger

Writing kernel modules and user applications for embedded Linux using C language

Linux sysfs interface for GPIO

The basics of POSIX threads and the RTAI (real-time application interface) environment

**Note(s):** To do projects, students are expected to have access to Debian Linux on their computers. Options include Virtual Box, LiveCD, disk partition or separate drive. Instructor will not cover the Linux installation topic in class. For students needing help with Linux, "Introduction to Linux" is recommended. Students should come prepared with knowledge of the suggested prerequisites.

This course requires students to purchase a board (approx. $50, not included in the tuition) to complete the assignments. Students may either use Raspberry PI 2 Model B or Raspberry PI 3 Model B (details

to be discussed in class). Students are expected to use their own Linux-based computers to do the programming project.

**Skills Needed:**

Working knowledge of C programming language and UNIX/Linux operating-system internals. Advanced C programming recommended.

## *Embedded System Hardware Architectures, Introduction | EMBD.X415*

3.0 Units

Beginning technical professionals who want to learn the big picture of embedded systems will get a solid grounding in key concepts of embedded systems hardware design, one of the particularly hot areas for U.S. engineers today. Embedded systems are computer systems designed to perform one or more dedicated functions. They are found in a wide range of electronic devices, including PDAs, consumer electronics, networking equipment, industrial controllers, and military electronics. Gaining an inside look at some of the most common embedded systems and the functional blocks within those systems, students in this course examine hardware components and their interfaces as well as important considerations with regard to procurement and design. They learn embedded systems design considerations and several approaches to system building common in the industry. Other key concepts in embedded hardware design include memories used in embedded systems and their interfaces, basic concepts in microprocessors, microcontrollers, digital signal processors (DSP), and the typical buses used at the system level.

After completing the course, you will see how the key concepts in embedded hardware design fit together, including the interaction of these hardware components as well as important considerations with regard to procurement and design.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe how microprocessors, memory subsystems and other hardware components interact

Discuss key design considerations

Explain key concepts in hardware design

Identify bottlenecks in choice of hardware in order to make more effective decisions

**Topics Include**

Functional blocks and tear-down analysis

Hardware design considerations

Design methodology (ASIC, FPGA, COTS)

Memory subsystem and hierarchy, types (SRAM, PSRAM, DRAM, Non-volatile memories)

Microprocessors, microcontrollers

Inter-IC communications overview (SPI, I2C, Parallel Bus)

**Skills Needed:**

Some familiarity with the hardware components of a computer system is required.

## *Embedded Systems Certificate Completion Fee | O-CE0071*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *European Medical Device Regulation: Clinical Evaluation and Post-Market Surveillance | REGL.X408*

3.0 Units

Regulations for medical devices in the European Union are going through the most comprehensive revision since they were created in the 1990s. These revisions are driven in part by technological advancement. They are also aimed at ensuring safety and effectiveness of medical devices in response to several high-profile product scandals in recent years. Key changes have resulted in clinical evidence requirements, pre-market review of the technical file by notified body, post-market surveillance and vigilance, transparency and traceability through Unique device identification (UDI) and strengthening of the oversight of the medical devices by the notified body.

As the EU transitions to this new standard of regulations, medical device companies need to prepare to be in alignment with new standards. Not only do new device designs need to be in compliance with new standards, but all existing products and technologies must be recertified.

Students in *European Medical Device Regulation* will learn the details of the new regulations, and how to serve their organizations’ needs for highly qualified regulatory affairs, clinical affairs, and quality assurance professionals.

Learning Outcomes

At the conclusion of the course, you should be able to Learn medical device regulations definitions and requirements, including how to implement medical device regulations program for existing and new

products, and the impact of quality management systems (QMS) due to medical device regulations (MDR).

Understand scope of changes from current medical device directive (MDD) to MDR.

Know MDR classification and conformity assessment.

Implement clinical evaluation plan and report.

Identify economic operations in your supply chain.

Recognize unique device identification (UDI), the European database on medical devices (EUDAMED), and information technology requirements.

Deploy post-market surveillance, report serious incidents, and field corrective actions.

Employ smart strategies to reduce the overall cost of implementing the medical device regulations.

Avoid ISO audit and EU competent authority inspection observations by following a sound regulatory path.

Topics Include

Supply Chain & Economic Operators

Clinical Data & Evaluation

UDI, EUDAMED, IT requirements

MDR Implementation Program

Additional Information

Prerequisite Courses:

MEDD.x407 - Quality Systems for Medical Devices FDA QSR, ISO 13485 (recommended), and REGL.x410 - Foundations in Medical Devices (recommended)

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 30 contact hours

## *Experimental Methods in Molecular Biology | BINF.X401*

3.0 Units

This course will give students a theoretical and practical introduction into important methods in molecular biology. This is a lecture-based course that provides a theoretical overview of the key molecular biology techniques used in basic life science research and by the biotechnology and biopharmaceutical industry for the discovery of novel therapeutics. Students will understand how to

work with molecular biological laboratory equipment and identify biological solutions relevant for molecular biology research. Laboratory safety aspects will also be a focus. Along with the practical aspects of the course, there will also be a particular emphasis on the planning, presentation, and critical evaluation of the results in the form of a laboratory report or oral presentation. You'll also learn about high-throughput sequencing and microarray expression analysis, methods that generate massive amounts of biological data. The instructor discusses the types of data these techniques generate, the relevance to bioinformatics, and their uses in the diagnosis and treatment of human disease.

Learning Outcomes

At the conclusion of the course, you should be able to Explain the principles of basic methods in experimental molecular biology

Describe experimental molecular biology techniques, quantitative methods, and instrumentation used in functional genome research and biotechnology

Apply learned techniques when solving molecular biological problems

Understand the general safety regulations for laboratory work in molecular biology

Interpret experimental data

Critically evaluate and discuss experimental results

Topics Include

Gene cloning, manipulation and sequencing

PCR

RNA interference

Gene expression analysis

Protein expression, engineering, and structure determination

Fundamentals of experimental design

Introduction to AI for Bioinformatics

## *Facilitation Skills | HRMT.X406*

2.0 Units

This course focuses on how facilitation skills are applied to create and support learning activity designed to improve individual, group, and organizational performance. Participants also learn how these skills can be applied to other organizational needs related to training: effective meetings, team-building efforts, and individual training and development programs. This experiential course gives participants an opportunity to practice facilitation skills and receive feedback on how to improve their performance.

Learning Outcomes

At the conclusion of the course, you should be able to

Identify facilitation strengths and opportunities for development through experience, feedback, observation and reflection

Identify and understand the facilitator's role and application in group settings

Explain the difference between process and content as it relates to facilitation

Understand and experience elements of the group development process

Build a facilitation tool kit for use in the workplace

Refine and practice group observation skills to better manage group processes

Identify and observe the roles of group members for functional and nonfunctional behaviors

Topics Include

The values of facilitation

Building and maintaining a learning environment

Group development skills

Group observation skills

Experimental techniques for interacting with groups

Recording theory and practice

Examination of key processes necessary in successfully leading learning activities (such as needs assessment, priorities and goals, conflict resolution, decision making, problem solving, and communication)

Professional Credit

SHRM-CP® or SHRM-SCP® 19.25 PDCs.

## ***Finance for the Business Professional | BUSM.X403***

1.0 Units

Business professionals and students interested in learning financial accounting skills get hands-on experience in this course analyzing and evaluating the information behind financial statements and relevant data. Master basic business accounting concepts and processes, financial statements, budgets, and financial ratios. Get the financial literacy you need to succeed in the business world.

Learning Outcomes

At the conclusion of the course, you should be able to

Discuss the importance of financial statements for a company

Explain underlying business activities' effects on financial statements

Describe a budget and its importance to a company

Identify the importance of the Sarbanes-Oxley Act in relation to a company's operations

Determine the overall strength of a company using various financial tools

Professional Credit Note: Effective Summer 2025

HRCI(R)---PHR(R), SPHR(R) and GPHR(R) general recertification credit: 13 hours.

SHRM-CP(R) or SHRM-SCP(R) 13 PDCs.

## *Finance I, Fundamentals | BUSM.X405*

3.0 Units

This course addresses financial management, including fundamental principles, planning and evaluation, and appropriate financial tools. Through lecture, readings, group discussion, and a group project, this course covers the concepts and tools of the financial marketplace.

This course is designed for managers and team members from corporations, nonprofit organizations, municipalities, and those self-employed who are increasingly required to address the organization's goals for financial planning, working capital, capital budgeting and return on investment for goal alignment with corporate planning to meet stockholder goal of wealth maximization.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe what financial management is

Analyze and interpret the most basic of financial statements to develop courses of action

Assess how revenue, profitability, break-even, and time value of money all influence financial decision making

Topics Include

Key financial ratios for business analysis

Financial statement analysis

Funding, financial forecasting and risk analysis

Cost of capital, time value of money

Capital budgeting and investment risk

Valuing stocks, bonds and preferred stocks

Capital budgeting systems

Working capital and cash management

**Skills Needed** A foundation in basic financial accounting knowledge is recommended.

### *Foundations in Medical Devices: Developing Premarket U.S. Regulatory Strategies and Working in a Regulated Environment | REGL.X410*

2.0 Units

New to the industry? Or maybe you need a basic understanding of the U.S. FD&C; Act and U.S. FDA regulations? Maybe you have a medical device that you'd like to commercialize in the U.S.? Maybe you just want some practical regulatory advice for working in the industry or how to do remote work? This online synchronous-lecture course will give you the medical device industry basics all from the comfort of your home. The course will answer your questions such as: how to work in a regulated environment, what are the roles available to you, and what are the differences between regulatory affairs, quality assurance, quality control, compliance, and quality engineering. This course will also help you create or be a part of producing a regulatory strategy for your medical device, IVD, stand-alone software, or combination product. Live discussions, class group games, etc. will be used to help you in navigating through the US FDA regulations including California's FDB requirements. You'll learn about the various US FDA device classifications, including the various regulatory pathways 510(k), De Novo, PMA, and HDE. You'll also learn about the different programs such as Q-submissions, Investigational Device Exemptions (IDE), Breakthrough Designation, Pilot Programs, and more. Including the medical device program enacted by FDA during emergency situations such as the COVID-19 pandemic: Emergency Use Authorization (EUA).

Learning Outcomes

At the conclusion of the course, you should be able to Discuss FDA’s jurisdiction and the reason for food, drug, and cosmetic laws

Define the various regulatory pathways available for medical devices, including requirements for combination products, IVDs, and stand-alone software

Understand individual roles/responsibilities and how the medical device industry works in general

Topics Include

Regulatory Writing

Federal vs State level requirements: FD&C; Act, FDA’s CDRH, and California’s FDB

US Product Classifications I, II, III and Regulatory Pathways 510(k), De Novo, PMA, HDE

Submission Considerations: Breakthrough Designation, Emergency Use Authorization, Sterility, Biocompatibility, Labeling, Pilot Programs, etc.

Additional Information

REGL.x410 replaced REGL.X404 Regulation of Medical Devices and Diagnostics. If you have enrolled into the program using the former requirements, you will not need to take REGL.X410. If you are interested in establishing candidacy & enrolling into the program using the new requirements, please contact student services. Student services will guide you on the steps needed to request REGL.X404 earned credits to count towards the updated program requirements.

The student is responsible for ensuring pertinent emails and Canvas notifications do not go to spam as well as completing all assignments by the due date. There are no late submissions accepted.

The modules in Canvas are set up as the roadmap for each class lecture week.

## *GANs for Data Synthesis | AISV.X404*

3.0 Units

In this course, students explore the theoretical and mathematical framework of GANs and experience hands-on guided workshops and practical applications in the data synthesis space. We focus on image synthesis while learning the fundamental concepts, mathematical formulation, and practical aspects of building and training generative models required to create innovative AI systems. This course will also introduce ChatGPT-like systems.

GANs are one of the most valuable components of modern AI, be it computer vision, anomaly detection, or language models. In language modeling alone, GANs and other neural network

techniques have shown remarkable milestones for text generation, text summarization, language translation, question answering, and more. The recent success of DALL-E 2 and ChatGPT highlight these accomplishments.

ChatGPT leverages the GANs framework and facilitates text-based conversation with humans by generating, synthesizing, and allowing interactive responses to questions. ChatGPT engages in communication just like another human and is just the beginning, with many more excellent AI applications on the horizon. This GANs course teaches you the fundamentals required to build such innovative AI systems and lays a path to the future.

Working in a research environment, you'll learn the problems and challenges associated with GANs and overcome them at the production level. Students will perform image translation and synthesis tasks with state-of-the-art networks, such as Pix2Pix and CycleGAN. You'll implement deep learning algorithms from technical papers for deep generative models and focus on building an intuition of efficient training of DL and GAN models.

**Learning Outcomes**

At the conclusion of the course, you should be able to:

Define the generative models and their use cases

Build the generative adversarial networks (GANs) framework

Train GANs with variants of their cost functions

Explain the generator, discriminator, GAN loss function, and adversarial loss

Build conditional GANs and WGAN

Perform image translation and synthesis tasks with state-of-the-art networks, such as Pix2Pix, CycleGAN

**Requisite Knowledge**

You need to be familiar with probability theory and linear algebra, programming, and deep learning.

## *General Chemistry I | CHEM.X001_A*

5.0 Units

This course explores the foundational principles of chemistry, from atomic theory and the periodic table to chemical bonding and molecular structure. Students will examine intramolecular forces, chemical reactions, and stoichiometry, developing both conceptual understanding and analytical skills essential for advanced studies in chemistry and the health sciences.

Learning Outcomes

At the conclusion of the course, you should be able to

Apply fundamental quantitative skills, including mole calculations, molar mass determinations, and solution composition analysis, to solve problems in general chemistry.

Balance and interpret chemical equations, using stoichiometric relationships to predict product formation, determine limiting reactants, and perform calculations involving mixtures and solutions.

Explain atomic structure and electron configuration, drawing on foundational principles of quantum mechanics to understand trends in the periodic table and the behavior of elements.

Describe and predict chemical bonding and molecular geometry, using Lewis structures, VSEPR theory, valence bond theory, and molecular orbital theory to explain bonding behavior and molecular properties.

Analyze and compare intermolecular forces, and apply stoichiometric principles to quantify relationships in chemical reactions occurring in both pure substances and solutions.

Topics Include

Quantitative Chemical Problem-Solving The course builds foundational quantitative skills, including mole calculations, molar mass determination, and solution composition analysis, equipping students to solve a range of chemical problems with precision.

Stoichiometry and Chemical Reactions Emphasis is placed on balancing equations, identifying limiting reactants, and applying stoichiometric principles to predict product formation and analyze chemical mixtures and solutions.

Atomic Structure and Periodic Trends Students explore atomic theory through quantum mechanics, gaining insight into electron configurations and the periodic behavior of elements.

Chemical Bonding and Molecular Geometry Using Lewis structures, VSEPR, valence bond, and molecular orbital theories, students learn to describe bonding behavior and predict molecular structure and properties.

Intermolecular Forces and Solution Chemistry The course concludes with the study of intermolecular forces and their role in chemical interactions, tying in solution stoichiometry to quantify relationships in both physical and chemical processes.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: CHEM.X001_A (General Chemistry I) with a grade of C or better or equivalent non-UCSC course. Previous or concurrent enrollment in Precalculus or higher.

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## *General Chemistry II | CHEM.X001_B*

5.0 Units

This course explores chemical equilibrium, acids and bases, solution pH, buffers, and chemical kinetics. Students will analyze reaction dynamics, equilibrium shifts, and the factors influencing reaction rates, building essential skills for advanced studies in chemistry and the life sciences.

Learning Outcomes

At the conclusion of the course, you should be able to

Apply the gas laws to describe and predict the behavior of gases under varying temperature, pressure, and volume conditions in both theoretical and practical contexts.

Analyze chemical and physical equilibrium systems, including gas-phase and aqueous equilibria, to determine the direction and extent of chemical reactions.

Explain the principles of acid-base chemistry, including strength, dissociation, pH calculations, and the behavior of acids and bases in different chemical environments.

Apply the laws of thermodynamics to evaluate energy changes, entropy, and spontaneity of chemical reactions, and interpret their implications for reaction feasibility.

Identify and balance redox reactions, and describe the flow of electrons in chemical processes involving oxidation and reduction.

Topics Include

Quantitative and Stoichiometric Reasoning Students develop core quantitative skills-mole calculations, molar mass, and stoichiometry-to analyze chemical reactions, including those involving gases, solutions, and redox processes.

Gas Laws and Chemical Equilibrium The course examines the behavior of gases and the principles governing equilibrium in gaseous and aqueous systems, emphasizing the dynamic nature of reversible reactions.

Acid-Base Chemistry Students explore the properties, equilibria, and reactions of acids and bases, including pH, buffer systems, and titrations, through both conceptual and quantitative lenses.

Thermodynamics and Reaction Energetics Key thermodynamic principles-including the First and Second Laws, entropy, and Gibbs free energy-are used to evaluate the spontaneity and energy changes in chemical reactions.

Redox Reactions and Electron Transfer The course concludes with oxidation-reduction processes, focusing on electron flow, energy transfer, and stoichiometric analysis of redox systems.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: CHEM.X001_A (General Chemistry I) with a grade of C or better or equivalent non-UCSC course. Previous or concurrent enrollment in Precalculus or higher.

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## *General Chemistry III | CHEM.X001_C*

5.0 Units

This course covers thermodynamics, redox reactions, electrochemistry, phase changes, and solution properties. Students will explore energy flow, reaction spontaneity, and phase behavior, building a strong foundation for advanced chemistry studies.

Learning Outcomes

At the conclusion of the course, you should be able to

Students will understand and apply the principles of redox reactions and electrochemistry, including balancing redox equations and analyzing electrochemical cells.

Students will explore the factors that influence reaction rates and mechanisms, developing the ability to interpret and predict chemical kinetics in various systems.

Students will analyze phase changes and solution behavior, including the energetics and colligative properties of solutions.

Students will gain foundational knowledge of carbon chemistry, organic compounds, and isotopes, and

apply this to understanding chemical structure and reactivity.

Students will integrate and apply chemical concepts to solve problems involving reaction energetics, mechanisms, and solution properties.

Topics Include

Redox Reactions and Electrochemistry The course begins with a review of redox reactions and advances into electrochemical principles, focusing on electron transfer, voltaic and electrolytic cells, and the relationship between redox processes and energy.

Chemical Kinetics and Reaction Mechanisms Students explore the factors that influence reaction rates, including concentration, temperature, and catalysts, and analyze stepwise reaction mechanisms to understand how molecular events govern chemical change.

Organic Chemistry Foundations An introduction to carbon-based compounds and isotopes provides students with foundational insight into organic structures, bonding, and reactivity relevant to broader chemical and biological systems.

Phase Changes and Solution Behavior The course covers the energetics of phase transitions and solution formation, including colligative properties such as boiling point elevation and freezing point depression, highlighting the physical behavior of substances in different states.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: CHEM.X001_B (General Chemistry II) with a grade of C or better or equivalent non-UCSC course.

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## *General Chemistry III Lab | CHEM.X001_C_L*

2.0 Units

The second laboratory course in the general chemistry series, this lab-based course emphasizes science skill development through guided experimentation and collaborative learning. Students are introduced to key concepts and practices including laboratory safety, essential experimental techniques, chemical handling, waste disposal, accurate data collection and analysis, and scientific writing and communication. The course also fosters teamwork through structured small-group collaboration.

Learning Outcomes

At the conclusion of the course, you should be able to

Perform core quantitative laboratory techniques, including titration, spectrophotometry, and electrochemical analysis, with accuracy and adherence to safety protocols.

Apply chemical principles such as redox reactions, absorption spectroscopy, chemical kinetics, colligative properties, and the Nernst equation to real-world experimental scenarios.

Accurately record, analyze, and interpret experimental data, incorporating error analysis, significant figures, and appropriate use of laboratory instruments.

Communicate scientific findings effectively through lab notebooks, WebAssign submissions, and structured writing assignments that demonstrate clear reasoning and data-supported conclusions.

Demonstrate preparedness and initiative through completion of pre-lab assignments, critical analysis of lab procedures, and active participation in laboratory discussions and activities.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: CHEM.X001_B_L, (General Chemistry II Lab) and previous or concurrent enrollment of CHEM.X001_C (General Chemistry III) or equivalent non-UCSC course(s)

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## ***General Chemistry II Lab | CHEM.X001_B_L***

2.0 Units

This course builds foundational science skills through immersive, hands-on experience in a general chemistry laboratory environment. Students will develop core competencies in laboratory safety, chemical handling, waste disposal, precise data collection and analysis, and scientific writing. Emphasis is placed on collaborative learning through small-group work, equipping students with the practical and communication skills essential for future lab and research settings.

Learning Outcomes

At the conclusion of the course, you should be able to

Demonstrate foundational laboratory skills, including the proper use of pipettes, measurement techniques, and safe handling of chemical reagents and equipment.

Apply key general chemistry concepts-such as equilibrium, solubility, acid-base reactions, and buffer systems-through guided laboratory experiments.

Collect, analyze, and interpret experimental data with an emphasis on significant figures, error propagation, and scientific reasoning.

Maintain accurate and organized laboratory records in notebooks and communicate findings effectively through formal lab reports.

Collaborate and problem-solve in a laboratory setting, following safety protocols and contributing to team-based experimental investigation.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: CHEM.X001_A (General Chemistry I) and previous or concurrent enrollment of CHEM.X001_B (General Chemistry II) or equivalent non-UCSC course(s)

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## ***Generative AI for Marketers | MKTG.X420***

2.0 Units

No coding skills needed for this hand-on course showing aspiring digital marketers how to use generative AI to automate content creation, content publishing and customer interactions and analytics. We will survey the rapidly evolving landscape and explain the foundations behind this disruptive technology. We will introduce tools, frameworks and workflows that can automate most aspects of digital marketing. Students will implement several examples step-by-step, both in class and as homework assignments and end of the class with confidence to supercharge their productivity using generative AI.

Learning Outcomes

Create new marketing content automatically

Publish marketing content to multiple platforms automatically

Review and respond to customer feedback automatically

Create and fine-tune business virtual assistants

Measure and explain marketing campaign performance

Topics Include

Introduction to Generative AI

Survey of SOTA large language models

Generative assistants

Prompt engineering

Creating content

Augmented assistants

Personalization

Generative agents

Automating workflows

Reading and processing data

Generating reports

Multi-modal use cases

Artificial general intelligence (AGI)

### ***Generative AI Fundamentals | AISV.814***

2.0 CEU's

This comprehensive course introduces participants to the world of generative AI and its transformative impact across industries. Suitable for beginners and professionals, this course delves into the practical applications of generative AI, from text and image generation to music composition, and its expanding role in healthcare, finance, and other sectors. Throughout the course, you'll gain a solid understanding of the underlying technology, including deep learning and neural networks, as well as the architecture of ChatGPT, its variants, and prompt engineering. You will also learn about the tools, resources, and best practices for building generative AI models. Moreover, you'll have the chance to explore emerging trends, ethical considerations, and future opportunities in the field.

**Learning Outcomes**

At the conclusion of the course, you should be able to Explain the fundamental concepts, principles and technology of generative AI.

Describe the generative AI landscape and its practical applications across various industries.

Apply prompt engineering effectively from understanding its techniques and patterns.

Gain hands-on experience building simple generative AI applications.

Discuss emerging trends and future directions in generative AI, including ethical considerations and challenges associated with its use.

**Topics Include**

Practical applications

Text, image and sound generation

Deep learning and neural networks

Transformer and ChatGPT/variants

Prompt engineering

Model training and fine tuning

Open Source large language models

Best practices and ethical considerations

Emerging trends

**Skills Needed**

Python and Machine Learning Basics are recommended but not required.

## *Generative AI in the Enterprise: RAG and AI Agents | AISV.818*

2.0 CEU's

This engaging course introduces students to the exciting world of modern generative AI applications in professional settings. We will demystify advanced AI concepts and prepare professionals to confidently apply these innovative tools in their fields. We will explore two key technologies—retrieval-augmented generation (RAG) and AI agents. Students will learn how to use these tools in their own work and appreciate the potential of these technologies on productivity and decision-making.

**Learning Outcomes**

At the conclusion of the course, you should be able to Implement basic RAG systems to enhance information retrieval and generation in workplace settings.

Design simple AI agent workflows to automate tasks and support decision-making processes.

Integrate generative AI tools with existing workplace systems to improve productivity.

Evaluate potential applications of RAG and AI agents for specific business needs.

Identify ethical considerations and best practices in applying generative AI technologies..

**Topics Include**

Generative AI basics.

The latest tools, using real-world examples.

How RAG systems improve information retrieval and generation

AI agent task automation, workflows, and how they support decision making

Ethical Considerations

Future Trends

Throughout the course, students will examine relevant case studies from various industries.

**Skills Needed**

Generative AI and LLM basics. Python for Machine Learning recommended but not required.

## *Gene Therapy: Hacking the Genome | BINF.X409*

1.5 Units

With double-digit annual growth in the global gene therapy market, people with the skills to treat or prevent disease through experimental gene techniques have never been in higher demand. This course brings you closer to the exciting discoveries in genetics by providing a foundational survey of the existing technology for gene editing and helps you understand the tools of discovery.

Learning Outcomes

At the conclusion of the course, you should be able to Understand the current technologies used in gene therapy treatments for human disease

Understand why each technology is used in gene therapy and how the technology was developed.

Understand how the whole process works for each of the covered topics, including what reagents are used and the editing process.

Learn how to pick guide RNAs from sequences using CRISPR

Topics Include

Gene therapy landscape overview

Uses of viruses in gene therapy

RNAi

Car-T gene therapy

CRISPR gene therapy

Skills Needed

Prior molecular biology coursework or background is strongly recommended.

Notes

This class offers a detailed analysis of the biology underlying each technology and analyzes the advantages, disadvantages, and limitations of each.

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 15 contact hours

## ***Genomics and Next Generation DNA Sequencing: Methods and Applications | BINF.X408***

3.0 Units

Next Generation DNA Sequencing (NGS) has transformed our understanding of genomics. The ability to sequence a human genome at an incredibly low cost has vastly expanded the potential applications of genomics in cancer diagnostics, pathogen identification, forensic human identification and genetic disease diagnosis. For researchers, NGS is a powerful tool that allows you to address questions that were impossible to pursue just a few years ago. This course, taught by a leading expert in the field, begins with the basics of this revolutionary process and then delves into specific applications of NGS in research and clinical settings. You will develop the knowledge needed to perform analyses from sample prep to generating the final data.

The course begins with an introduction to genomics. It then reviews the primary methods used for highly parallel sequencing technologies. The course covers standard workflows from sample prep to final data analysis. This is the only course available in the Bay Area that builds comprehensive knowledge in next generation DNA sequencing.

Learning Outcomes

At the conclusion of the course, you should be able to Gain an understanding of the principles of Next generation sequencing.

Learn how to generate NGS data.

Apply NGS for research and clinical applications.

Topics Include

Primary Approaches to Generating Massive Amounts of DNA Sequence Data

The Four Main Steps to Next Generation DNA Sequencing

The Four Main Research Applications of DNA Sequencing

Clinical Applications

Additional Information

Completion of "Bioinformatics Tools, Databases and Methods or Experimental Methods in Molecular Biology" is recommended.

## *Global Medical Device Submissions and Strategy | REGL.X401*

1.5 Units

The global nature of the medical device industry presents both opportunities and challenges for medical device companies and regulatory affairs professionals who must navigate a diverse regulatory terrain. Through interactive lectures and facilitated group projects, students gain a practical understanding of international medical device requirements and regulations for major and emerging markets around the world, with emphasis on the US, EU, Canada, Japan, and China. A comparative approach highlights

regulatory and process similarities and differences between countries and underscores the impact they have on global regulatory and business strategies. This course will benefit regulatory affairs professionals who need to help their organizations understand the barriers to entry into the global medical device market.

Learning Outcomes

At the conclusion of the course, you should be able to Describe what a medical device regulatory strategy is and its elements

Discuss the various regulatory submission types, their contents, and format

Explain why a strategy is important and how it drives the business

Identify common pitfalls of submissions and strategies

Topics Include

Submission elements

Regulatory Intelligence

Interacting with Regulatory Agencies

Developing a strategy

A outline for a strategy document

## *Good Clinical Practices | CTDM.X411*

3.0 Units

Clinical research is governed by a set of broad regulatory requirements, industry standards and recommendations. Interpreting and implementing these “best practice” standards presents a challenge for all the stakeholders involved in human research. This course explores the framework and principles of Good Clinical Practice (GCP) as it relates to the roles and responsibilities of various stakeholders like the FDA, Investigator, Sponsor, IRB and the study subject. Through lectures, homework, quizzes and the final exam, you will gain knowledge of regulations (federal, state and local) and learn to apply the principles of GCP.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the fundamental principles of Good Clinical Practices (GCP)

Discuss the roles and responsibilities of key players and stakeholders as it relates to Human Subject Protection

Explain the principles of GCP to answer questions arising from everyday clinical research situations

Identify various regulations that directly or indirectly impact GCP

Topics Include

Regulations, Standards and Principles

Sponsors and Protocol

Institutional Review Board and HIPAA

Study Documentation, Source Data and Test Article

Quality Management (Monitoring)

Patient Recruitment, Financial Disclosure and Compliance

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 30 contact hours

## *Good Manufacturing Practices | REGL.X400*

3.0 Units

Familiarity with the Good Manufacturing Practices (GMP) regulations is necessary for employees engaged in the manufacture, regulation, quality assurance, and control of drugs and biologics. Through lectures, discussions, and case studies, you'll gain an understanding of the FDA GMP and Good Laboratory Practice (GLP) regulations. While primarily aimed at the manufacturing, quality control, and quality assurance worker, the course is also useful for regulatory affairs and clinical research professionals, as well as anyone who wants to understand which regulatory controls apply to the manufacture of drugs and biopharmaceuticals for human use.

Learning Outcomes

At the conclusion of the course, you should be able to Understand how the GMP and GLP regulations affect the work environment in a pharmaceutical company.

Develop an understanding of how GMP regulations are applied in daily operations, and why the regulations are considered necessary.

While primarily aimed at the manufacturing or quality systems worker, the course should also help the regulatory or clinical affairs worker to understand what controls are expected during the manufacturing of all products for human use.

As a general objective, the course will seek to have the student develop an understanding of why certain practices, attitudes, and environments exist within a mature pharmaceutical company.

Topics Include

History, Regulation, Good Laboratory Practice

General Provisions

Control of Components and Drug Product Containers and Closures

Biologics and Good Tissue Practice

Additional Information

The course will consist of four 6 hour sessions with a 45 minute lunch break and ~15 minute breaks every 1.5 hours.

The Instructor will provide the required text material in electronic format. By the end of the course, the student should have read the entity of the GMP regulations for drugs, biologics, and cell therapies. While the instructor may suggest the reading of guidance documents and other material, the GMPs will be the only required reading material.

Professional Credit

CA BRN/LVN Credit--Provider #CEP13114, 30 hours.

## *Hands-On Data Engineering | DBDA.X424*

3.0 Units

Formerly: Data Engineering with Hadoop Big Data platforms are distributed systems that can process large amounts of data across clusters of servers. They are being used across industries in internet startups and established enterprises. In this comprehensive course, you will get up to speed on the use of current Big Data platforms and gain insights into cloud-based Big Data architectures. We will cover Hadoop, Spark, Kafka and other Big Data platforms based on SQL, such as Hive.

The first half of the course includes an overview of the frameworks for MapReduce, Spark, Kafka, and Hive as well as some aspects of Python programming. You will learn how to write MapReduce/Spark jobs and how to optimize data processing applications and become familiar with SQL based tools for Big Data. We use Hive to build ETL jobs. The course also includes the fundamentals of NoSQL databases like HBase and Kafka.

The second half of the course covers stream processing capability and developing streaming applications with Apache Spark. You'll learn how to process large amounts of data using DataFrame, Apache Spark's structured data processing programming model that provides simple, powerful APIs. In addition to batch and iterative data processing, Apache Spark also supports stream processing, which enables companies to extract interesting and useful business insights at near real-time.

The course consists of interactive lectures, hands-on labs in class, and take home practice exercises. Upon completion of this course, you will possess a strong understanding of the tools used to build Big Data applications using MapReduce, Spark, and Hive.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the role Hadoop plays in the analysis of big data

Discuss the inner workings of Hadoop's computing framework, including MapReduce processing and Hadoop's file system (HDFS)

Develop programs/small applications in Spark and Hive

Use Hive and NOSQL databases for data analysis

Leverage the Hadoop ecosystem to become productive in analyzing data

**Topics Include**

Big Data applications architecture

Understanding Hadoop distributed file system (HDFS)

How MapReduce framework works

Introduction to HBase (Hadoop NoSQL database)

Introduction to Apache Kafka

Introduction to Spark and SparkSQL

Developing Spark/SparkSQL and Hive applications

Managing tables and query development in Hive

Introduction to data pipelines

**Skills Needed**

Basic SQL skills and the ability to create simple programs in a modern programming language, like Python are required. An understanding of database, parallel or distributed computing is helpful.

**Notes**

This course uses AWS EMR and Databricks for Spark, Hive and HDFS programming. Students are required to have accounts with AWS and Databricks.

## *High Efficiency Switch-mode Power Supply, Design Overview | EMBD.X405*

3.0 Units

The power supply is a critical component in any system and has a major impact on overall reliability. System designers need to understand the designs and requirements of their power supplies to meet the evolving needs of the system, and to satisfy regulatory requirements for energy efficiency and standby power. This course covers both analog and digital switch-mode power supplies.

This course starts by introducing the fundamental concepts of a real switch-mode power supply and its functions, operations and interactions. Discussions will cover the various topologies as they relate to power supply operation, design, component selection, and rating for a particular application. The course focuses on the most popular topology: the Flyback converter. The case study includes the clamp, snubber networks, transformer, and EMI filter. You will learn the design considerations for EMI, thermal management, and product safety with detailed discussions of PCB design. Lastly, the course discusses the challenges of power supply development in the face of evolving system requirements and regulations. You'll learn how to meet requirements of high efficiency, high power density, digital control and reporting, and stringent ultra-low no-load standby power. The course has expanded practical discussions of digital implementations of a real switch-mode power supply with added features, enhanced performance, and programmability.

You'll gain practical power supply design knowledge and skills relevant to your hardware engineering environment and be able to satisfy actual market and regulatory requirements with practical component implementations. The course features live demonstrations and waveform observations of power supply behaviors using state-of-the-art solutions.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Understand the design and practical implementation of a high efficiency switch-mode power supply

Describe the evaluation approach and process in validating power supply designs

**Topics Include**

Fundamentals of power supply

Types of power converters and their operation

Power factor corrections

Understanding system power architecture for AI infrastructure and data centers

Modern design techniques for high density and high efficiency switch mode power supplies to power up AI & computer servers

Reducing ultra-low/no-load standby power and improving low load efficiency

Using digital technology to enable programmability and reporting/communications with AI and computing systems

Using digital technology to enable full digital control and AI technology implementation in power conversion

Environmental and safety standards applicable to power supplies

Practical design of a switch mode power supply with hands on testing

**Skills Needed:**

Knowledge of electronics and basic understanding of an electrical system design with power supply.

## *High-Performance Computer Architecture | VLSI.X415*

3.0 Units

Computer architecture focuses on techniques to design high-performance processors and is a prerequisite for both design and verification engineers, in any modern processor design project. This course covers computer architecture essentials, as well as some advanced topics, such as multi-threading, data level parallelism in GPUs and multi-core processors. Through a lecture-based approach, supplemented with practical problem sets, you'll navigate the intricacies of Verilog coding, timing graph walkthrough, and micro-architecture solutions. This course is intended for design and verification engineers interested in working on processor or complex digital system design projects.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Identify and resolve pipeline hazards and explain out-of-order execution.

Evaluate tradeoffs between various cache organization and replacement policies.

Understand virtual memory organization.

Design protocol meeting memory coherence and consistency requirements.

Explain data level parallelism.

**Topics Include**

Processor design

Multi-core processors

Data level parallelism in GPUs

Memory systems and hierarchy

Vectorization

Multi-threading

**Skills Needed**

Knowledge of digital system design with Verilog/SystemVerilog is required.

## *High Speed Interface Techniques | VLSI.X405*

3.0 Units

Formerly: IO Design Fundamentals

This course is an introduction to IO interfacing from one platform to another at both chip and board levels. With today's chips running over 1GHz, inter-chip communicating is often a limiting factor of the system. Examples of high-speed IO are HDMI, USB 3.0, and 100Base-T.There is no single solution and over the years numerous approaches have been taken, including lowering logic voltages, using differential signals and optical interfaces. The course reviews the various approaches that have been taken in the last two decades, and covers the advantages and disadvantages of TTL, CMOS, low-voltage CMOS, LVDS and optical, from the perspective of speed, power, cost, and complexity.

The course emphasizes fundamental concepts such as transmission line analysis, slew rate, termination, etc. It introduces the basic IO logic, timing analysis and package model, and covers bit error rate, bi-directional IO and decision feedback filters. It does not cover complete circuit designs of the latest IO schemes or board design. Because most solutions are silicon-based, ESD (electro static discharge) concepts and techniques will also be discussed. A circuit simulation tool will be offered to students for exercises but its instruction is not part of the course.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the techniques used in high speed data communications interfacing at the chip and system board level

Utilize IO Design techniques and tools to analyze and approach various interface problems

Demonstrate impedance matching, termination techniques as well optical interfacing circuits and techniques

Discuss suitable approaches for 3GHz and beyond

**Skills Needed:**

A basic course in circuit design and understanding of basic electromagnetic physics.

## *HTML5 Advanced and Javascript APIs | UEWD.X411*

3.0 Units

An increasing number of companies are using HTML5 to develop web and mobile applications. This course will acquaint you with the new standard of HTML. Through a combination of hands-on exercises and lectures, you will explore the evolution of HTML, XHTML and HTML5, and learn about the many new features available in HTML5. The course de-mystifies HTML5 and all of its long-awaited and powerful features. You will gain experience with redefined web forms, new extended audio and video controls, new page structures and syntax. You will learn and practice "meaningful markup", new canvas drawing methods, drag and drop, new JavaScript and CSS3 implementations, as well as geolocation.

The course includes a series of in-class exercises and lessons with homework. By the end of the course you will be able to build cutting edge web content, support multiple viewers and browsers, and determine what the best applications are for your web and mobile project.

Learning Outcomes

At the conclusion of the course, you should be able to Understand and apply the new HTML5 structure and semantics to a web page.

Apply new form elements and attributes.

Add video and audio to a web page.

Apply drag and drop capabilities to a web page.

Apply API's for geolocation and canvas capabilities.

Topics Include

History of HTML

What is HTML5?

New structure and syntax

Web Accessibility

Web forms

Audio and video

Canvas Element and API - graphics and animation

Geolocation API

Drag & drop API

## *Human Factors and Usability in Medical Device Development | MEDD.X401*

2.0 Units

Understanding and applying human factors is essential to ensuring product usability and user satisfaction. More importantly, consideration of human factors during the design and development of medical devices helps to ensure patient safety by minimizing the risks introduced by user error. This course begins with the fundamental principles of human factors and builds on that foundation each week to cover core concepts and demonstrate how human factors fit into the larger context of medical device software and hardware development. Lessons address the integration of human factors and usability into the product development lifecycle, regulatory considerations, including applicable FDA guidance and standards (ANSI/IEC), and human factors methods. The course is beneficial for professionals who already have a basic understanding of risk management and quality systems, as well as a broad range of technical professionals, including those with no prior medical device experience.

Learning Outcomes

At the conclusion of the course, you should be able to Define the role of human factors in the medical device design process

Understand appropriate human factors methodologies for the development of medical devices

Identify human factors standards relevant to medical device development.

Review human factors documentation against the standards and process.

Discuss human factors engineering requirements.

Identify usability issues related to product design.

Topics Include

Applicable Standards/Guidance Documents

Task/Workflow Analysis

Formative & Summative Evaluations

62366 Checklist

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 20 contact hours

## *Human Resource Management | HRMT.X400*

1.5 Units

Human resource management is a rapidly evolving profession. This seminar provides an exploration of modern HR and the role it plays in an organization. Designed for those who are new to the field, the course covers HR basics through lectures, class discussions and a team exercise. You will learn the fundamentals of HR functions and specialties, including workforce planning, compensation and benefits, training, talent acquisition, employee relations, and the latest theories in human resources.

Learning Outcomes

At the conclusion of the course, you should be able to

Identify the key concepts, theories and processes of HR within a business environment

Describe how to apply HR fundamentals for an organization

Recognize the specialties within Human Resources and their impact on the HR function and business

Identify the actions that contribute to the successful management of each area of HR covered in the course

Distinguish between advantages and disadvantages of various approaches to HRM in a business environment

Understand the value and importance of aligning HR strategies to business outcomes

Topics Include

Organizational development

Company culture

Recruitment

Workforce planning

Employee relations

Laws and regulations

Professional Credit

SHRM-CP® or SHRM-SCP® 16.5 PDCs.

## *Human Resource Management Certificate Completion Fee | O-CE0133*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Human Resources Business Partner (HRBP) Excellence | HRMT.X416*

1.0 Units

The 3-session Human Resources Business Partner (HRBP) Excellence course provides a comprehensive personal and professional development experience for the student who is either currently an HR Business Partner or aspiring to develop the skill set to grow into this role. Course participants will have the opportunity to take a "deep dive" into the craft of HR business partnering, explore the competencies required to become effective, and plan to reach heights of excellence in their current or future HRBP role. The HRBP Circle of Excellence Framework combined with the HR Functional Competency Dimensions will provide stimulating and robust content and insights for the student; all of which can be practically utilized on the job. As part of the program, every participant will have the opportunity to construct their individualized “action-oriented” development plan with respect to the knowledge, skills and abilities as detailed in the HRBP Excellence Framework.

The course will begin with a self-assessment based on the HRBP Excellence framework. Following this, targeted personal goals for development will be identified. An authentic HRBP case study will be analyzed by teams of students; including an interactive discussion and culminating in a presentation of their findings and recommendations out to the whole class. In addition, students will work in these same teams (using a study group approach) on a final project to be presented out to the whole group in Session 3. The final project will entail identifying real-life HRBP issues and challenges, selecting the most compelling scenario and then conducting a comprehensive analysis, applying the HRBP Circle of Excellence framework and functional competencies to the selected scenario (s). This project will be graded.

Learning Outcomes

At the conclusion of the course, you should be able to

Assess participant’s current operating HRBP skillset, including both their individual strengths and areas for improvement/development.

Discuss and gain an understanding of the skills and abilities required for demonstrating excellence in three core areas of focus: Develops Ideas, Advises/Influences and Promotes.

Explain what it means to have an “action-oriented approach” to develop the three core areas on a “deeper” more sophisticated level.

Identify the challenges and issues faced by the HRBP and be able to make solid and sound recommendations for action utilizing the HRBP Circle of Excellence framework.

Assess levels of functional competencies required to be effective in the HRBP role.

Apply a critical analysis approach towards the HRBP Circle of Excellence framework.

Professional Credit

SHRM-CP® or SHRM-SCP® 9.5 PDCs.

## *Implementing Marketing and Sales Strategies | MKTG.X403*

2.0 Units

In this introductory course students gain an integrated view of marketing and sales strategies by studying the concepts, framework, and techniques behind great strategic decisions. Learn how firms establish sustainable competitive advantages and develop customer strategies amid risk and uncertainty. You will see how to develop cohesive marketing and sales strategies to support revenue generation. Investigate key steps of the sale process, how buyers react at each stage, and the marketing tools that have increased the sophistication, productivity, and pace of selling.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe corporate and business strategies

Develop sustained competitive advantages

Apply selling strategies to systematically convert prospects into customers

Maintain customer relationships to maximize long-term profitability

Skills needed

There are no prior course requirements. However, it would be helpful if students have some marketing related experience or have taken a course such as "Principles of Marketing."

## *Integrated Marketing Communication | MKTG.X408*

3.0 Units

A proper integrated marketing communication plan is the best way to reach your appropriate target markets with consistent, meaningful and credible messaging in a cost-effective and measurable way. This course shows you how to develop an effective blend of public relations, advertising, internet marketing, direct marketing, personal selling, incentives and other marketing tools, so that they all convey a consistent message. Geared for students both on the client and agency side of marketing communications, you will learn from practical in-class team exercises, discussions, case studies and project presentations how to develop a plan and budget with a good return on investment.

Learning Outcomes

At the conclusion of the course, you should be able to

Explain the manager's role in the marketing communication process

Determine marketing communication objectives versus general marketing objectives

Properly identify the key messages for your target markets

Know and use the criteria for developing creative materials

Evaluate and integrate all the various marketing communication tools available

Select the appropriate traditional and modern digital media channels

Develop integrated budgets using the "Task Method"

Develop and implement measurement and feedback processes.

Properly identify Target Markets using PSYCHOGRAPHICS.

Skills Needed It is generally expected that you have had some marketing experience or have taken the "Principles of Marketing" course.

### *Intelligent Automation: Enhancing workflows with AI-powered RPA | AISV.816*

2.0 CEU's

In this course on robotic process automation (RPA), students in any industry will learn to automate some of the simple, repetitive software tasks encountered by general office workers, managers, and information workers. They will learn to automate transaction processing, data manipulation, digital systems communication, and alerts that trigger a response requiring limited cognitive intelligence. Students will discover the remarkable abilities of Intelligent Automation using AI agents and smart RPA with open source datasets and tasks, such as MiniWob++, WebShop, WebArena, and Mind2Web, a set of library environments of web-browser-based navigation and interaction tasks for computer control. We'll cover:

Simple button clicking

Complex form-filling

Dragging actions

Booking systems

Email app navigation

Throughout the course, we'll explore the intricacies of various MiniWob++, WebShop, WebArena, and Mind2Web tasks, observe how AI-agents work on these tasks, and analyze their performance in detail. We'll highlight tasks where our agent excels and tasks where humans outperform our agent. While we investigate the challenges posed by specific tasks, such as Simon-says and terminal, we'll shed light on the factors contributing to our agent's performance disparities compared to humans. Some of the intelligent open source agents we will learn in the class are: PIX2ACT, MINDACT, SEEACT, UFO, ProAgent, OpenAdapt, and CrewAI

We’ll also survey research and advancements in achieving human-level performance in smart and agentic RPA tasks; the strategies, techniques, and architectural choices that enable agents to achieve exceptional results; and uncover the challenges and opportunities in the field of RPA.

**Learning Outcomes**

At the conclusion of this course, students will be able to:

Describe RPA, their strengths and limitations

Examine the application of AI in RPAs

Evaluate the performance of our agent on MiniWob++ tasks by comparing it to what is in previous literature and establishing a state-of-the-art benchmark.

Analyze the strengths and weaknesses of our agent in different agentic tasks, identifying areas where it excels and where humans outperform it.

Investigate the challenges posed by specific tasks and identify the factors contributing to performance disparities between our agent and humans.

Discuss cutting-edge research, advancements, and architectural choices in achieving human-level performance in computer control.

Design, utilize and evaluate RPA agents for human-level performance in general and simple tasks.

## *Interaction Design and Prototyping | UEWD.X416*

2.0 Units

In this course, we’ll explore the designer’s role in crafting intuitive and visually compelling user interfaces. You'll master essential design principles, including color theory, typography, layout techniques, branding, and interaction fundamentals, all of which shape user experiences in digital media. These insights will inform the development of effective design strategies and interactive prototypes that resonate with user needs. The curriculum also covers responsive web and mobile design, optimizing graphics, and incorporating motion design to enhance interactivity. You’ll analyze corporate design systems, understand their role in tech-driven markets, and refine your collaborative skills through projects and potential guest sessions with Silicon Valley professionals, including visual and UX designers and researchers.

This course is ideal for graphic designers, web professionals, product managers, web developers, and anyone aspiring to build foundational skills in designing and prototyping engaging interfaces for digital media.

Learning Outcomes

At the conclusion of the course, you should be able to Create interactive wireframes and prototypes for web and mobile applications

Design user-centered interfaces with a focus on interactivity and usability

Apply visual design principles and implement industry-standard design systems

Explain the full user experience (UX) design process and the role of interaction and visual designers

Collaborate effectively with team members, including developers, product managers, and other stakeholders

### *International Business and the Global Economy | BUSM.X402*

3.0 Units

This course introduces students to the international business environment within the global economy, especially key changes stemming from the global pandemic. We'll leverage lessons learned from business economics and introduce students to non-economic factors influencing an international business in the global economy.

Drawing business insights from ethics, culture, and political economy, students will discuss international business scenarios through small case analysis.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe the basis of the international economy..

Discuss topics such as political economy, international business and international monetary system.

Explain the benefits of open economy trade and finance.

Identify possible opportunities and threat to international trade and finance.

Skills Needed

Intermediate Algebra. Familiarity with Online eBook (Pearson/MyLab), Microsoft Office, or another office suite, and Canvas.

### *Introduction to Machine Learning | AISV.X400*

3.0 Units

Machine learning (ML) is the foundation for many artificial intelligence (AI), and ML algorithms that underlie online shopping recommendations, credit card fraud detection, relevant social media content delivery, rideshare trip pricing, and traffic navigation. In this course you'll explore essential ML concepts, tools, and methodology, such as classical and modern algorithms that drive real-world applications such as search engines, image analysis, biometrics, industrial automation, and market

segmentation. You'll work with practical data-driven applications and gain a practical background for creating new products and improving existing ones.

Starting with an introduction to the mathematics underlying ML, we'll leverage open source Python-based libraries, including Pandas, NumPy, and Sklearn. You'll improve your intuitive understanding of the underlying algorithms, such as regression, classification, and clustering, as well as related Python-based code samples. You'll work in a small team or by yourself on a project to present during the final week of class.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Identify and formulate ML problems

Understand and implement algorithms to solve ML problems

Explain the implementation, working, and practical benefit of many ML topics

Analyze the performance of given or implemented ML solutions on practical datasets

**Topics include**

Defining ML using simple problems and intuitive solutions for supervised learning and Bayesian classifiers

Probability density

Linear classifiers—common straightforward classifiers with practical applications

Cross-validation in data-poor situations

Principal component analysis—correlation matrices, eigenvalues, and eigenvectors

Unsupervised Learning: Using accumulated buying histories from a customer database to evaluate the quality of clustering results

Neural networks and deep learning: Without using complex mathematics, learn how neural networks are trained (Tensorflow and Keras)

Natural language processing: How computer algorithms glean meaning and sentiment from written text and respond intelligently

**Skills Needed**

For best results in this class, the following topics are highly recommended, some of which are covered in the suggested prerequisite course (listed below):

Familiarity with Google Colaboratory and Jupyter Notebooks

Reasonably good programming/debugging skills beyond the basic or beginner level

Familiarity with Python programming, NumPy, and Pandas

Comfortable with basic knowledge of algebra, calculus, probability and statistics

## *Introduction to VLSI and ASIC Design | VLSI.X403*

3.0 Units

With shrinking process technologies, today's silicon chips are so complex that few engineers and managers fully understand every phase in the IC development cycle. This unique course provides an overview of all the steps in developing an ASIC, SoC, GPU or FPGA product. Key topics include transistor topology, standard cells, RTL synthesis, meeting timing, functional coverage, formal equivalence, physical design, signal integrity, DFT, chip tape-out, IC fabrication, and emerging packaging trends.

Through small hands-on labs and homework, students become familiar with the roles of architecture selection, micro architecture specification, synthesis, simulation, formal equivalence, and routing tools. The focus is on mostly-digital ASICs with multiple IP cores, low-power goals, and on-chip analog blocks.

Designed for professionals in the semiconductor field—whether experienced or entry-level—this course provides a deeper understanding of the product development process for silicon chips and SoCs. Knowledge gained in this course will improve cross-functional communication with other team members and prepare individuals for more rigorous study in the semiconductor design field.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the overall design and verification flows of digital design.

Discuss the latest design technology and methodology.

Respond appropriately to challenging VLSI ASIC and FPGA interview questions.

Describe the increasingly complex ASIC development flow.

**Topics Include**

Overview of SoC (System on Chip) architectures

Integration of IP cores

Overcome the verification bottleneck

How on-chip firmware code interacts with the chip’s hardware

Digital logic gates, metal layers and vias, place & routing insights, noise avoidance, DFM issues, timing

closure

Business practices with silicon foundries: sort, shuttles, corner lots

Comprehensive coverage of the chip design flow, from spec through tape-out to fabrication and packaging, equipping students for follow-on courses in RTL design, verification, DFT, and layout

**Skills Needed:**

General understanding of digital logic. Lab exercises require some knowledge of Linux.

## *Introduction to Web Programming: JavaScript and PHP | UEWD.X421*

2.0 Units

This course introduces the basic concepts and programming skills you need to create dynamic web pages, taking you beyond HTML and CSS into the world of JavaScript and PHP. Primarily used on the client side through the browser, JavaScript allows you to alter displayed document content with user interactions. PHP, a widely used open-source scripting language installed on web servers, is the language of WordPress, Drupal, and Joomla. The combination of JavaScript and PHP enables user friendly, secure form processing.

The instructor will provide examples of code and discuss basic programming syntaxes such as variables, data types, strings, expressions, and operators. We will analyze dynamic web pages that use JavaScript and PHP, discuss functions, events, decision-making and repetition for both languages. You'll learn to build forms and objects, take inputs, and reset forms. Using PHP for server-side scripting, you'll practice handling user input and processing form data creating an all-in-one form.

Learning Outcomes

At the conclusion of the course, you should be able to Describe appropriate uses for JavaScript and PHP

Identify elements of each language and their implementations on any website

Discuss, create, and debug semantically correct basic examples of dynamic web pages

Explain where and why to use each of these languages and how it fits in with other languages

Topics Include

Elements of dynamic websites

JavaScript basics

Variables, data types, expressions, operators, and strings

Working with functions, events, decision-making, and repetition

Form elements and objects, input fields, selection lists, submitting and resetting forms

Creating basic PHP scripts and building expressions

Handling user input, processing form data, creating an all-in-one form

Working knowledge of:

HTML and CSS basics

Additional Information

As an introductory course, we will not explore all features of JavaScript or PHP nor cover cookies or databases.

## *IO Concepts and Protocols: PCI Express and Ethernet | EMBD.X406*

3.0 Units

PCI Express has become the dominant intrasystem IO interconnect from the largest servers to mobile phones and embedded devices. In this course for developers and support engineers in hardware, firmware, software, and field-application, students will gain a stronger understanding of the protocol.

We will start with an introduction to IO concepts which will give us an understanding of why IO protocols behave the way they do. We will then dive into PCI Express including the **6.0 version.** PCI Express enables interfacing with Ethernet and other protocols to achieve intersystem communication. We will end with an overview of Ethernet and how PCI Express and Ethernet work together to enable communication.

Through lectures, homework assignments, and a final exam, students will gain a broad idea of how IO works in a modern computer system and be better prepared to work with device drivers and troubleshoot IO problems. Note: The course does not cover chip or board design aspects of IO.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe how IO works in a modern computer system.

Understand how a device driver communicates with the hardware it controls.

Explain protocol specifics of PCI Express and Ethernet.

**Topics Include**

Modern computer architecture in block diagram format

Flow of an IO request

IO concepts: MMIO, DMA, interrupts

Address spaces: configuration, memory, IO

Device discovery

Introduction to PCI Express, evolution from PCI, PCI-X

How MMIO, DMA, interrupts, and discovery work in PCI Express

Changes introduced in PCI Express 6.0

Introduction to Ethernet: CSMA/CD, frame format, VLANs, aggregation

Additional areas to explore to increase IO knowledge and skills

**Skills Needed:**

An introductory course or practical experience with operating systems internals, an introduction to computer architecture and organization, and systems programming experience.

## *Java Programming I | CMPR.X412*

2.0 Units

This course is an introduction to Java programming for those who are new to the field or need a refresher. The course covers how to apply key programming concepts and use Java programming environment for real world applications. This introductory foundation in Java programming will prepare students to start simpler programming projects for applications.

The course begins with programming concepts and Eclipse IDE. The instructor introduces basic and intermediate Java syntax, and then methodically addresses abstraction, object-oriented paradigm, procedural programming, elementary data structures, and more. Other useful topics include graphics user interface, collections and generics. Students will gain a strong conceptual foundation in these areas while starting to write programs for real applications.

The course consists of lectures and discussion, with some lab work. Students are expected to complete assignments on their own computers. By the end of the course, students should be able to program in the Java language and will be exposed to many useful programming concepts.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Understand concepts of programming languages and their usage

Use intermediate Java syntax

Use variety of data types suitable to specific programming needs and data abstraction

Differentiate procedural programming from object oriented programming

Demonstrate the use of the various control flow features

Develop programming concepts to write non-trivial Java programs

Build solid foundation of Java programming and be ready to take up advanced courses

**Topics Include**

Introduction to programming, JDK and IDE

Generative AI Assisted Programming

Data types, inputs/outputs

Strings, arrays, collection and generics

Java programming logic

Object-oriented programming

Graphic programming

Exception and file handling, debugging

**Note:** This course includes a module on "Introducing Generative AI Assisted Programming."

**Skills Needed:**

Students should have experience using logic. Some programming experience will be helpful. Ability to install and configure open-source software on own computers.

## *Java Programming II | CMPR.X413*

3.0 Units

Java is the premier development language for web servers, enterprise servers, network applications, embedded devices, appliances and wireless applications. This course, which covers Java 21+, teaches students to apply object-oriented concepts, design and develop Java applications, and use Java libraries. You'll learn to write, maintain and debug applications, and make effective use of standard packages. You'll also learn key design concepts and implementation skills needed for professional Java programming. Additionally, you'll explore leveraging AI tools to enhance coding efficiency and debugging.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the core features and syntax of Java language

Develop Java applications that correctly apply the principles of object oriented design

Use Java class libraries

Apply generic, multi-threaded, network, database and GUI programming techniques using java

Understand functional programming using lambda expressions

Demonstrate proficiency in utilizing AI tools to enhance learning, improve code and debug programs

**Topics Include**

Object-Oriented concepts

* Defining classes and methods, constructors, access modifiers, inheritance, overriding, overloading, polymorphism, constructor chaining, super keyword, abstract classes, static fields and methods, final keyword, MVC design pattern Arrays and Strings

* Creating arrays, multidimensional arrays, strings, StringBuilder class, primitive wrapper classes Interfaces, Nested classes

* Creating interfaces, difference between interfaces and nested classes, predefined interfaces, nested interfaces, static nested classes, inner classes, anonymous classes, records, sealed classes and interfaces, pattern matching for instance Input/output programming

* Reading and writing text and binary files, random file access, serializations Exception handling

* Try and catch blocks, exception class, creating custom exception classes, multiple catch blocks, run-time exceptions, the finally block Multithreaded programming

* The Thread class, interface runnable, creating threads, interrupting threads, thread synchronization, problems with threads Collections framework

* Generics, interfaces set, map and list and their implementations, iterators, set operations, wildcards, comparable and comparator interfaces JDBC

* JDBC API with driver managers, result sets, cached row sets, prepared statements Functional programming

* Functional interfaces, lambda expressions, streams AI-Enhanced Development

* Introduction to AI-powered coding tools for code improvement, debugging and optimization **Skills Needed:**

Foundational programming experience in Java or a language such as C or C++.

## *Law and Human Resource Management | HRMT.X405*

2.0 Units

This course outlines the laws and agencies that regulate employment relationships in California and on a federal level. These fundamental labor laws must be understood to prevent or, if necessary, defend against employment claims.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe legal issues and laws that impact human resources and

Explain strategies to minimize legal risk and

Identify legal risks and strategies for more effective HR administration

Topics Include

Wrongful termination

Employment discrimination under state and federal law

Sexual (and other) harassment

Workplace privacy

Overtime and other wage and hour regulations

National Labor Relations Act

Collective bargaining and labor unions

Leaves of absence

Noncompetition and trade secrets

Arbitration

Substance use and abuse in the workplace

Independent contractor vs. employee

Workers' compensation

Reductions in workforce

Paid sick leave

Professional Credit

SHRM-CP® or SHRM-SCP® 22.5 PDCs.

## *Leading People Through Change | HRMT.X412*

1.0 Units

The increasing rate and scope of change is having a profound effect on the workplace. In this course, you will learn essential leadership skills, including how to inspire and motivate individuals, manage talent, influence without authority, and lead teams. Managers, supervisors and Human Resource professionals often bear the responsibility of maintaining morale and productivity during difficult change processes. Doing this effectively requires grasping the impact of change on people, understanding the change process, acquiring critical coping skills, optimizing the positive payoffs from change, and implementing action plans for leading people through change. You will obtain practical resources and develop a personal action plan for leading people through change.

Learning Outcomes

At the conclusion of the course, students will be able to

Identify and explain the pressures for change

Explain the causes, consequences, and costs of mismanaging change

Assess strategies used by businesses in planning for and dealing with change

Understand the process of change management

Describe the role of a change agent

Develop a change plan

Describe how organizations can identify and evaluate the impact of change on corporate culture, employees and performance

Create and communicate your vision as a leader

Explore specific roadmap for managing change

Identify and explain different change models

Professional Credit

SHRM-CP® or SHRM-SCP® 6.5 PDCs.

## *Linux Kernel and Drivers, Advanced | EMBD.X422*

3.0 Units

Advanced knowledge of Linux kernel data structure and the ability to use its framework for writing device drivers is critical for Linux programmers.

In this course, students learn to differentiate between the kernel development environment and writing user space programs. They study Linux kernel subsystems, such as Linux scheduler, memory management, networking stack, and Linux block layer, all of which helps them build high-performing kernel drivers.

We will develop kernel modules that use kernel facilities and services to perform actions, such as interrupt handling, direct memory access (DMA), bus-independent device access, invoking kernel threads, and mapping device memory into the user space.

By introducing students to the proper use of available Linux synchronization primitives such as mutex, rwlock, semaphores, and read copy-update (RCU), students will learn to handle concurrency issues in the driver code.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Demonstrate how to avoid common mistakes and pitfalls when writing kernel code.

Apply Linux device driver APIs to Linux kernel subsystems.

Explain how to use kernel services for interrupt handling, DMA, memory mapping, and debugging.

Describe Linux device drivers and practical driver examples that can be readily applied in the work environment.

**Topics include**

Implementing device driver file operation methods: read(), write(), poll(), and mmap().

Scheduling driver tasks via timer API and delegates background work to kernel threads via work queues.

Exploring Linux device models and building user interfaces to driver functions via procfs and sysfs pseudo file system.

Building kernel modules via kprobe for debugging and profiling (eBPF) production drivers.

Developing a fully functional network driver for an emulated Realtek RTL8139 PCI ethernet card, as part of a final project.

## *Linux Kernel & Drivers | EMBD.X421*

3.0 Units

The growing popularity of Linux—the preferred operating system for servers, embedded systems, and mobile devices—is driving a huge demand for programmers who can modify the open-source kernel for optimal performance. In this course you will gain in-depth knowledge of the latest 5.x kernel so you can understand the architecture and write kernel code to achieve a desired output. The course introduces kernel-level programming in Linux and writing kernel modules, covering core kernel with a hands-on coding approach. We will start with the kernel source code organization, learn how it functions and address various data structures and algorithms used in the Linux kernel. Students will explore making static and dynamic changes to the kernel as well as the underlying portability considerations.

We will explore the design and implementation of device drivers in Linux, such as the interfaces to the Linux kernel for writing device drivers, resource allocation paradigms and error-handling best practices. Other topics include understanding concurrency from a driver perspective, for example, the impact of CPU hyper-threading and task preemption.

The instructor will share code samples and real-world experiences of device and kernel porting to augment your learning. In your assignments you will get to analyze, develop, and debug different modules and kernel drivers. Any distribution is fine so long as the Linux kernel version is recent.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Build a Linux kernel

Describe the implementation of system calls

Develop and build modules

Create and debug kernel and modules

Model Char, Block and Networking drivers

Design a fully-functional Char driver

Develop simple block and networking drivers

**Skills Needed:**

Proficiency of C programming language and knowledge of Linux Systems Programming or equivalent experience is recommended. You will need access to a Linux environment with root privileges. Options

include VMWare, VirtualBox, LiveCD, disk partition or dualboot.

## *Linux Systems Programming | EMBD.X420*

3.0 Units

In this course, you will explore the vital role of system calls in Linux and other systems, enabling user-space applications to connect with the kernel and perform privileged functions. System calls contribute to application and operating system compatibility and interoperability by offering a defined interface for accessing the kernel that is used for functionality. You will explore system call APIs to learn how to build interactive and service (daemon) applications that control the system and perform operations. We categorize based on the type of operation they perform: process management and file management. Practical projects include building standard Linux applications, such as ls, cat, etc. as well as some service processes, such as ftp.

Key topics covered include I/O control, file systems, access, and locking; signal handling; process and threads management; IPC using pipes and TCP/UDP sockets. Additionally, the course will address makefiles, man pages and packaging utilities.

By the end of the course, you'll have developed a complete ftp package and mastered the implementation of client-server programs using TCP, UDP, and RPC. This course adheres to the POSIX standard, ensuring a solid foundation, while also incorporating discussions on portability considerations for BSD extensions and SVR4 differences.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Design and demonstrate implementation of standard LINUX utilities (e.g. ls, wc, cat)

Explain programming interfaces and topics on I/O control, file systems, access and locking

Describe the use of signal handling interfaces

Describe Process and threads management

Describe IPC using pipes and TCP/UDP sockets

Discuss makefiles, man pages and rpm/apt packaging utilities

**Note(s):** To practice, students are expected to install or have access to Linux Operating System version 7, or higher (version 9 is preferred) on their home computers. Options include VMWare, VirtualBox, LiveCD, disk partition or separate drive or an embedded Linux system such as a Raspberry Pi.

**Skills Needed:**

A basic knowledge of C language programming and a working knowledge of the Linux/UNIX operating environment are required.

## *Logistics and Transportation Management | BUSM.X420*

3.0 Units

Logistics management is the art of moving and storing materials from one point to another on the globe. In this course for people interested in building supply chain expertise, we study various transporting modes for products through road, rail, water, and air. Students will gain an understanding of transportation models and inventory localization which are focal points in network planning strategies.

We will review the supply chain operations reference (SCOR) model with its focus on improving supply chain processes. Finally, we will discuss the increased costs of logistics resulting from the worldwide lockdown due to the COVID pandemic, and lessons learned.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe key elements of trade facilitation

Recognize international shipping terms used in the International Commercial Terms (INCOTERMS)

Analyze how global supply chains coordinate the flow of goods and services

Learn methods for network planning and transportation models

Examine the role logistics function in coordinated new product introduction

Describe risk pooling as a methodology for mitigating uncertainties in demand and lead-time

Topics include

History and evolution of logistics

Modes of transportation

Costs of transportation

Class and commodity rates

Transportation law and deregulation

Internal logistics and global supply chains

Leading technology and trends in logistics

Network design

Warehousing management

Risk pooling

Note

Course SCMT.X402 Logistics and Transportation Management and BUSM.X420 Logistics and Transportation Management is the same course.

## *Machine Learning and AI in Bioinformatics | BINF.X411*

3.0 Units

This course offers a hands-on introduction to machine learning (ML) and artificial intelligence (AI) in bioinformatics. Designed for those with a working knowledge of Python (or similar languages), it focuses on the practical application of existing ML/AI tools to solve real-world biological data challenges.

You will explore how AI and ML are applied across a range of bioinformatics tasks and investigate the factors that influence their performance-such as data quality, integration, model explainability, ethical considerations, regulatory issues, and infrastructure. By the end of the course, you'll have the foundational skills to apply AI methods to biological data and evaluate their effectiveness in research and clinical contexts

Learning Outcomes

At the conclusion of the course, you should be able to

Explain the role and applications of artificial intelligence and machine learning in bioinformatics research and analysis.

Evaluate data quality and the impact of data quality, integration, and preprocessing on the performance of AI models in bioinformatics.

Analyze model explainability and ethical considerations.

Demonstrate proficiency in using machine learning and AI tools for bioinformatics analysis by applying them to biological data and making informed predictions.

Discuss the computational and technological infrastructure required to implement AI solutions in bioinformatics effectively.

Evaluate practical AI case studies.

Topics Include

Practical AI applications through curated case studies

Loading and preprocessing data for AI analysis

Using AI to generate code templates for bioinformatics tasks

Building models with tools such as Graph TD or Microsoft Graph

Exploring use cases with Gemini Deep Research and/or OpenAI tools

Notes

Prerequisite Skills: Working knowledge of Python or similar programming language

## *Management of Clinical Practice | EDTH.X306*

3.0 Units

In this course educational therapists and learning specialists delve into the business realities of establishing a successful independent educational therapy or a learning specialist practice. Students focus on best practices for one-on-one instruction to young students and adult learners with learning differences. Learn how the role of the educational therapist/specialist includes working as an investigator/support person and strategically communicating with a client's family, school, community, and culture. Additional course materials encourage students to dig deeper into the psychosocial aspect of learning differences and address topics of transference, countertransference, and termination. Establishing and operating a successful private practice is a learning process for those just entering the field of educational therapy. This course fosters the confidence that comes with knowledge of basic business practices.

This is an online course, and all assignments and lectures are hosted though Canvas. In addition to lectures, students master the content by:

Analyzing case studies;

Interviewing parents;

Developing marketing collateral such as business cards, flyers, and essential information forms; and

Writing by prompt for self-discovery.

Learning Outcomes

At the conclusion of the course, you should be able to Articulate the role of an educational therapist/specialist

Assess the unique developmental needs of each client

Manage a caseload of multiple clients

Adhere to the ethical and professional standards of working with their clients

Develop a roadmap and toolkit for every stage of student instruction from intake through termination

Develop a personal outline/structure for their own clinical practice including details like marketing procedures, collaboration with other therapists, office procedures, record keeping, fee structure, time management, and work-life balance

Distinguish between the work of an educational therapist and other service providers

Establish appropriate partnerships/collaborations with other caregivers/service providers of each client

Topics Include

AET Code of Ethics

Developing Business Forms

Allied Professionals, Parents and Clients

## *Managing Global Supply Chains | BUSM.X421*

1.5 Units

The products that consumers use every day do not reach their local stores by accident. They are produced, assembled, and shipped from all over the world. Advanced modern technologies and pandemic-related changes have highlighted global interdependencies and challenges. Linear thinking of supply chain is out of date. The global supply chain is more and more a supply network.

In Managing Global Supply Chains, you'll learn how a product reaches its final destination and how the latest industry trends impact global supply chain network management. We'll cover how to make the best global sourcing decisions, choose alternatives to delivering products to customers, and ensure international supplier performance despite time zones differences.

It is highly recommended that students take "Evolving Role of Supply Chain Manager" as the first course prior to taking this course.

Learning Outcomes

At the conclusion of the course, you should be able to

Recognize how global supply chains coordinate the flow of goods and services

Understand how supply chain decisions can impact global channel structures

Review commonly used international shipping terminology

Topics Include

Planning and sourcing in the supply chain

Strategy development and market research

Operations, delivery and inventory management

Global logistics management and trends

International trade agreements

Technology tools in global logistics

Outsourcing and offshoring

Make or buy decisions

Note

Course SCMT.X405 Managing Global Supply Chains and BUSM.X421 Managing Global Supply Chains is the same course.

### *Managing International Projects | PPMT.X411*

1.5 Units

Increasing acquisitions, mergers, innovation, the pressure of change, and the shorter life cycle of competing products demand viable businesses to have global footprints. Multinational organizations rely on international projects for growth, as globalization affects nearly every industry. However, most projects, particularly international ones, are expected to fail to meet their stated or planned end goals due to challenges in adapting to cultural, technical, or collaborative processes. Surveys of various institutions indicate that only 40% of international projects meet their planned milestones.

In this course, we provide project managers with tools and practices to help them succeed in developing and managing international projects in the Generative Artificial Intelligence (GAI) era. You will learn critical success factors in managing global projects including the use of objective metrics, applicable methods and the latest GAI's enhancements. This course, at a high level, covers techniques for developing and managing projects in the international business arena and finding winning partners in emerging markets.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe Major Global Project Management Standards

Discuss business, technical, and organizational values of global projects

Explain unique characteristics of Managing International Projects

Identify challenges facing Projects Managers dealing with global projects

Topics Include

Global business trends

Characteristics of international projects

Critical success factors for international projects

AI Augmented international projects success factors

International organizational options

Intellectual property management

Managing international contracts and agreements

GAI applications in international projects

Effective communication management in a geographically fragmented project team

Unique international project costs and locating international partners

This course assesses students on practical problem-solving, applying the latest tools and techniques using Generative Artificial intelligence, and using exercise-based projects. This course is ideal if you're looking to expand your company's market reach or establish your start-up in emerging markets.

## *Managing Software Projects | SEQA.X406*

1.5 Units

New and experienced project managers wanting to improve their management of software projects need to include key planning elements, appropriate techniques, effective communications, and ideas for self-improvement. In this interactive course, new and experienced project managers explore the most common causes of project failure; and are introduced to up-to-date methodologies, principles, and practices for successful software projects.

The course is excellent for those seeking to improve their software project management skills for producing full scope, adequately tested, on time and on budget results. Students are guided to those processes outlined by the Project Management Institute

**Learning Outcomes**

At the conclusion of the course, you should be able to

Select appropriately among methods such as Agile, Critical Chain, and Critical Path

Discuss project processes that are aligned with the Project Management Institute

Explain the root causes of software project troubles

Identify preventative actions for ongoing and future software projects

**Skills needed** knowledge of software development fundamentals and the development lifecycle.

## *Managing the HR Staffing Function | HRMT.X409*

1.5 Units

Recruiting top talent for an organization is one of the most difficult challenges for staffing departments today. Those responsible for staffing are under immense pressure to obtain the talent necessary for organizations to meet business goals. This workshop explores critical issues related to managing the staffing function. Course exercises reinforce student understanding and student projects provide an opportunity to demonstrate the knowledge acquired.

It is highly recommended that students new to Human Resources begin with "Human Resource Management.” After that, courses may be taken in any order.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe how a company determines their need for staffing and what to do to fill the staffing need Discuss the processes involved for managing the staffing function Explain the necessary tools and methodologies to follow Identify the assumptions, strategies and tactics necessary to help a company achieve its staffing needs

Topics Include

Understanding staffing models

Workforce planning

Budgeting and managing staffing costs

Marketing the staffing function

Developing effective hiring processes

Selecting and evaluating resources

Maximizing the recruiting website

College recruitment and employee referral programs

Managing global requirements

Measuring performance

Professional Credit

SHRM-CP® or SHRM-SCP® 16.5 PDCs.

## *Managing the Triple Constraints | PPMT.X427*

3.0 Units

Project managers are largely judged by their ability to deliver planned scope on time and within the budget which is why this intermediate course dives into the complex interplay of the three components of the triple constraints—scope, schedule, and cost.

Often referred to as the Iron Triangle of Project Management, these components of each deliverable and project task contain elements of each of the triple constraints: What is being made? How much will it cost? How long will it take? Changes to any one of these factors will impact the other two. So, successful project management demands constant monitoring of each constraint and its mutual dependencies.

This course focuses deeply on how to manage the triple constraints, their interplay, and their impact on risk, quality, and procurement management throughout the project life cycle.

Project planning: Students learn a wide range of tools, processes, and techniques that are necessary to create effective schedules, budgets, and plans.

Project execution and control: Students focus on how to detect and manage variances from plans, how to perform root cause analysis, and how to manage project change.

Project closure: Students learn to archive project data and conduct lessons learned activities to promote better scope, time, and cost management in future projects.

Learning Outcomes

At the conclusion of the course, you should be able to

Define and size each leg of the Iron Triangle for any project.

Understand how changing one constraint—scope, time, or cost—will affect the others.

Prioritize and optimize all three sides.

Escalate with options as each leg gets close to its limits during execution for the project.

Skills Needed Some familiarity with execution of a project (not necessarily technical).

### *Marketing in Practice | MKTG.X491*

2.0 Units

In this capstone course for the Marketing Management certificate program, students apply knowledge gained from their marketing certificate studies, integrating the tools, concepts, and experience into a complete marketing plan.

Students will conduct external, internal, and market analyses to formulate a customer-driven, go-to marketing strategy that includes an implementation plan, budget, and controls.

Learning Outcomes

At the conclusion of the course, you should be able to

Analyze a company and its marketing strategy

Analyze the marketing environment

Develop a customer-driven marketing strategy with an implementation and monitoring plan

Note

It is important that you have already successfully completed the 3 Required courses (7 units) and 3 Elective courses (6 units) prior to enrolling in this final Capstone course. If you have any questions or have not met the prerequisite requirement, contact the department for approval by emailing extension@ucsc.edu before enrolling in this course.

### *Marketing Management Certificate Completion Fee | O-CE0406*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

### *Math Development in Young Children | ECED.X316*

2.0 Units

This course focuses on teaching math to young children and covers California math standards for early childhood. You'll participate in hands-on activities and create exciting math games for young children.

The course also addresses how young children recognize patterns in nature and how you can connect math to art. With ample instructor modeling, you'll practice ways to create unforgettable moments of discovery, enchantment, and magic by studying geometric patterns and numbers. This course is recommended for teachers, parents, and caregivers of preschoolers and kindergartners. A strong background in mathematics is not required.

Learning Outcomes

At the conclusion of the course, you should be able to Describe preschool through kindergarten standards for math

Describe patterns in nature and the importance of patterns in math

Discuss the value of hands-on activities for early learners

Explain relationships between math and art

Identify developmentally appropriate methods for teaching math to young children

Topics Include

Curriculum principles for early childhood mathematics

Mathematical learning for children ages 3 through 8

Mathematical processes in early childhood curriculum

Promoting development of key skills and concepts through math play

### *Medical Device Process Validation | MEDD.X411*

2.0 Units

Validation is a critical aspect of medical device development and manufacturing and insufficient or noncompliant validation is a common reason for warning letters. Through lectures, assignments, in-class games, you will learn about industry best practices in a hands-on manner on how to set up and maintain a validated process. Utilizing an example surgical device, you will gain a thorough understanding of when to validate a process, how to develop and conduct IQ/OQ/PQ, qualify methods through Gage R&R, and extend concepts to sterilization and packaging validation. You will also be provided templates for validation plans, validation protocols and reports that are compliant with US FDA regulations as well as harmonized regulatory requirements from the IMDRF (International Medical Device Regulators Forum).

Learning Outcomes

At the conclusion of the course, you should be able to Identify FDA and harmonized IMDRF requirements for validation of medical device manufacturing processes

Explain the criticality of validation and the consequences of insufficient validation on product quality and compliance

Develop a validation protocol based on risk-based analysis of the production process and conduct a validation study

Understand process monitoring to maintain a validated state, and developing impact analyses for design and process changes

Analyze measurement systems through Gage R&R; studies

Apply principles to other validation of processes like cleaning, sterilization and packaging based on identifying key international standards

Topics Include

Differences between verification and validation.

Validation planning and Master Validation Plan

How to Conduct Process Validation

Process Validation Aftermath

Working knowledge of:

The FDA quality management system requirements and ISO 13485:2016

Additional Information

This is an intermediate/advanced level class geared towards students and medical device professionals who work in quality engineering, product design and development, manufacturing engineering, quality assurance, quality compliance and regulatory affairs.

## *Medical Device Quality and Design Certificate Completion Fee | O-CE0403*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Medical School Application Workshop - Central Coast | PBSV.800_CC*

In this 4-weekend workshop, we will guide you through each step of the personal and complex medical school application process, demystifying the application timeline and costs. Over four weekends, with 4-hour sessions on both Saturday and Sunday, you will clarify your goals, identify the best medical school for you, and learn how to position yourself as a successful, holistic applicant.

Learning Outcomes

At the conclusion of the course, you should be able to

Articulate your personal rationale for a career in medicine and how you are suited for it.

Understand the medical school application process, associated costs, and finance options.

Demonstrate understanding of general medical school prerequisites.

Identify medical schools that are a good fit for you and the specific medical school admissions requirements.

Produce outstanding primary application essays that explain personal motivations and strengths for training in medicine.

Complete a competitive medical school application.

Topics Include

The holistic medical school applicant: who you are and what you want.

Choosing the right medical school.

The structure and process of applying to medical schools.

Finances: application and interview costs.

Presenting yourself successfully as an applicant.

How to request letters of recommendation.

Preparing a personal statement (describing significant personal experiences, gap year considerations, crafting a personal statement.)

Preparing secondary applications.

Interview techniques (recording reviews and feedback.)

Final application review.

## *Medical School Application Workshop - Silicon Valley | PBSV.800_SV*

In this 10-week workshop we guide you through each step of the personal and complex medical school application process, demystifying the medical school application process, timeline, and costs. When you've clarified your own goals, you will be able to identify the best medical school for you and know how to best position yourself as a successful, holistic applicant.

## *Medical Writing | CTDM.X413*

2.0 Units

All biopharmaceutical companies must produce scientific reports and summary documents for regulatory agencies. Good documentation should be not only scientifically sound, but also clear, effective and concise. This course provides the practical skills needed to write effective documents for the healthcare industry. You'll gain practice through hands-on exercises and group projects based on documentation used in pharmaceutical development.

Learning Outcomes

At the conclusion of the course, you should be able to Demonstrate the basics of effective writing, with an emphasis on the English skills required to write clearly, concisely, and effectively.

Streamline the process to go from raw ideas to finished documents.

Develop an understanding of various medical communication and regulatory documents and how they fit into a regulatory submission.

Identify and discuss writing scientific review articles, clinical study protocols, clinical study reports, investigator brochures, scientific posters, and press/news releases.

Topics Include

The essentials of good writing required for any profession, including the proper use of grammar and punctuation

Copyright, permission, and ethics

Working with journal editors and regulatory reviewers

Writing letters to the editor, scientific review articles, clinical study protocols, clinical study reports, and press releases

Preparing scientific posters

Drafting documents that are user-friendly and comply with regulations

Creating clear and concise content

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 20 contact hours

## ***Mobile Application Development - Android and iOS, Advanced | CMPR.X422***

3.0 Units

In this course students move from the introductory concepts of our first Mobile Application Development course to a more comprehensive coverage of popular concepts and architectural topics required for developing successful, high quality mobile applications. Students will enhance their understanding and skills using a more advanced technology stack including background operations, web operations, and image handling. You will also practice interactions with operating system features-audio, video, camera, telephony, maps, location services, notifications, advanced GUI layouts, and navigation bars. This course also covers performance and memory management recommendations. Through coursework and classroom exercises of increasing depth, students will create a fully functional mobile application involving multiple advanced features and cloud back-end.

To truly complete the picture, you will explore the basics of cloud-based backend infrastructure and its integration with mobile applications. Using the Firebase cloud platform from Google, we will focus on essential topics such as user authentication, data synchronization across multiple mobile devices, analytics, and continuous application monitoring. This course also covers fundamentals of cyber security techniques for both Android and iOS mobile platforms, an extremely valuable skill set for any professional developer.

Learning Outcomes

At the conclusion of the course, you should be able to

Discuss advanced architecture and design for applications on both platforms - Android and iOS

Demonstrate the best practices of development

Explain design patterns used towards solving common problems

Create a professional quality mobile application with cloud backend services and in line with the fundamentals of mobile cyber security guidelines

Topics include

Background operations

Navigation and notifications

Web and connectivity

Common operating system functionalities

Maps and location services

Backend cloud services

Cyber security fundamentals

Memory management and performance

Skills Needed:

Familiarity with at least one higher-level language such C++, Java, C#, Python, or PHP and Introduction to Mobile Application Development.

## *Mobile Application Development - Android and iOS, Introduction | CMPR.X421*

3.0 Units

In this comprehensive overview course, both beginning and experienced students learn mobile application development for Android and iOS while exploring Flutter, Google's latest cross-platform development framework; and the Kotlin and Swift programming languages. Through coursework and classroom exercises of increasing depth, students will create a fully functional mobile application.

You will get exposure to the latest technologies while learning the fundamental building blocks of application development, such as understanding architecture, life-cycles, GUI, and MVC design pattern. Developing a basic Android and iOS application during the class gives you valuable hands-on experience. A combination of theory and practical programming experience will best prepare you for your career.

We will also use AI coding assistance to help increase efficiency and productivity, allowing developers to focus on more complex aspects of coding, such as problem-solving and creativity.

This course also benefits individuals in management or on developer teams who want to efficiently execute on mobile application projects. At the end of the course, students will understand the fundamentals of building a cutting-edge mobile application on Android and iOS and how to publish it as well.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Explain the fundamentals of mobile application development with an in-depth understanding of architecture and design for application on both platforms – Android and iOS

Implement development best practices

Discuss design patterns used towards solving common problems in application development

Efficiently create basic mobile applications

**Topics include**

Development environment setup

Android architecture

iOS architecture

Flutter framework

Hello mobile app

GUI development

Swift and Kotlin overview

Persistent data storage

Tips and tricks

Publishing on Google Play

Publishing on App Store

Overview of advanced topics

**Skills Needed:** Familiarity with at least one programming language.

## *Mobile Health, SaMD, and AI/ML Devices | MEDD.X404*

1.0 Units

This self-paced learning course will help students understand the regulations, standards and guidance related to the evolving mobile health technology sector. Mobile health is developing novel technological solutions that span the scope of healthcare, from wellness to patient and clinician support, to chronic disease management to digital therapeutics. Through lectures, case studies, and assignments, you will learn in a hands-on manner on how to develop and implement a mobile health device regulatory strategy, develop supporting clinical evidence, handle post-market changes to devices, and handle aspects of privacy, confidentiality. The course will extensively review current FDA policies on General Wellness, Mobile Medical Applications, Software as a Medical Device (SaMD) and AI/ML devices.

Learning Outcomes

At the conclusion of the course, you should be able to

Demonstrate knowledge of current framework for FDA regulatory oversight of mobile medical devices

and apps

Demonstrate knowledge of how to develop and execute a mobile medical device regulatory strategy

Explain regulatory aspects related to privacy, cybersecurity and confidentiality of mobile medical devices

Develop strategies to handle the regulatory implications of post-market changes for software and AI devices

Topics Include

Mobile apps, SaMDs

Devices with AI/ML algorithms

Bench and clinical performance data to support premarket submissions

Elements of an SaMD 510(k)s

Clinical decision support, general wellness, MDDS, cybersecurity

Post-market, FDA initiatives (PreCert, DHCoE)

Additional Information

Formally Titled: Mobile Health: The Evolving Industry and Regulatory Landscape

Professional Credit

Approved for 9.25 RAC recertification credits

## ***Mobile Interface Design and Gen AI | UEWD.X412***

3.0 Units

There are hundreds of thousands of mobile apps in the App Store, but only a small portion of them have innovative design principles, friendly user interfaces, and most importantly, widespread adoption by users. In this hands-on lab and lecture course, you will learn the core design thinking and strategy principles for creating effective user interfaces for mobile app design to the development of artificial intelligence (AI), augmented reality (AR), and virtual reality (VR) interfaces, including wearable user experiences such as Apple Watch and Android Wear, and smart device experiences. You will actively create these diverse experiences through hands-on design work using an iterative and user-centered design process. Designing your own prototype will provide opportunities to explore new types of touch and gesture-based user interaction that can expand the functional possibilities of your apps. This exercise will demonstrate how mobile products can be rapidly developed and released to the market.

The course covers the trends, industry practices and techniques for the most popular platforms, and by the end of the course, you will have created an engaging user interface prototype. This UI prototype will incorporate the new conceptual and technical skills learned, and can also function as a portfolio piece for future endeavors.

Learning Outcomes

At the conclusion of the course, you should be able to Discuss mobile design and the fundamental principles essential for designing successful mobile apps and incorporating artificial intelligence (AI).

Create AR/VR apps and stay updated on the latest advancements in mobile technology and smart device experiences.

Develop UX for mobile devices like Apple Watch and Android Wear, incorporating gesture-based interfaces to create compelling user experiences.

Explore rapid development of digital products through new UX models, design thinking, and strategic approaches.

Topics Include

Latest iOS and Android Material Design Human Interface Guidelines

Gen AI & Artificial intelligence design patterns (AI)

Figma Design systems and frameworks

Responsive Design and meaningful mobile experiences

Cross Device UX, Lean Mobile UX and design thinking/strategy

Augmented reality (AR), and virtual reality (VR) UX/UI design

Apple Watch and Android Wear UX/UI Design

Car Dashboard UX/UI Design

UX of voice interaction (VUI)

Smart Devices UX/UI Design

## *MySQL and Oracle Database for Developers and Designers | DBDA.X409*

2.0 Units

Oracle and MySQL are both reliable database engines commonly used for storing and serving data as web content. They are popular among developers of open source platforms and projects on the Web. High volume major websites use them. They also have a significant user base in the enterprise database market. This course is intended for DB developers and designers who want to learn MySQL and Oracle technology in depth. The course begins by reviewing the basic SQL queries, DDL and DML operations, data retrieval from multiple tables, and different types of storage engines in databases. It

then introduces the aggregate, the index merge, data manipulation, and stored procedures in MySQL. You will learn to write complex queries and get hands-on experience with advanced features such as creating sub programs, data security, triggers, and dynamic SQL. You will also learn a performance tuning strategy, server configuration, loading techniques and the application architecture for efficient database design. This is a hands-on lab-based course designed to help students master MySQL features and tune for performance.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Perform DDL and DML operations using SQL commands

Develop and manage database stored procedures including best practices

Develop Database Triggers to automate database operations

Understand Database Partitions and create tables with different types of partitions for improving database performance

Perform exception handling and error handling capabilities in both Oracle and MYSQL

Understand different strategies used for improving database performance through Database Indexes, Optimizer, Explain Plan, and database hints

**Topics include**

Review of MYSQL and Oracle database essentials

Understanding MYSQL storage engines, transactions and features of the database and how it differs from Oracle

Performing DDL and DML operations using SQL commands

Retrieving data from multiple tables using JOINS

Writing complex queries using JOINS, SUBQUERIES and nested SUB QURIES

MYSQL functions including single-row, multiple-row, group and aggregate functions

Understanding Oracle and MYSQL optimizer and index merge method

Developing and managing database stored procedures including best practices

Exception handling and error handling capabilities in both Oracle and MYSQL

Utilizing database triggers to automate database operations

Oracle and MYSQL performance enhancements with queries and indexes

Database loading techniques and their effects on performance

**Skills Needed:**

Students should have prior knowledge of the installation and basic operation of MySQL.

## *Natural Language Processing | AISV.X402*

3.0 Units

This advanced course introduces students to many aspects of natural language processing (NLP), a subfield of Artificial Intelligence (AI) focused on human language. The course includes hands-on lab work with popular open source frameworks, such as Pandas, Hugging Face Transformers, and Pytorch and covers a wide breadth of material, ranging from traditional methods, to more recent advancements in NLP, for example ChatGPT. Students will explore natural language understanding (NLU), natural language generation (NLG), and discuss frameworks, algorithms and supervised learning.

The course will cover deep learning (DL), how DL and NLP can be combined, modern NLP architectures and language models in the BERT family. In addition, students will learn about the amazing GPT family of language models, for example GPT, GPT3, Instruct GPT, ChatGPT, and GPT4, as well as other recent advancements in generative Large Language Models (LLMs).

Students will leave the course with a wide-breadth of experience and understanding of the diverse applications of NLP in the modern world, along with the ability to program NLP methodologies in Python.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Create Python code to train a supervised learning algorithm for a variety of NLP tasks

Evaluate the Transformer Architecture

Explain recent innovations in Large Language Models

Analyze how ChatGPT was trained

Create Python code to fine-tune an open source generative Large Language Model

**Skills Needed:** Moderate level of computer programming ability in Python, comfortable with an editor, familiarity with basic command-line operations on a laptop, and a good understanding of Machine Learning models and Deep Learning models.

**Note(s):** Students are required to bring laptops for classroom work. The code samples use Python 3+ and Pytorch, along some Jupyter notebooks in Google Colaboratory (students can optionally pre-register for a free account). Students also have the option of installing the Python 3+ version of Anaconda distribution on their laptops from the following link: https://www.anaconda.com/ on their machines.

## *Neurodivergent Learners | EDTH.X312*

1.0 Units

A growing body of scientific research and evolving cultural awareness have affirmed the value of addressing neurodivergent learners in the classroom and in the workforce.

In this course for educators and professional trainers, we will explore brain differences, reduce cultural prejudice, and identify tools to support the creative potential and abilities of neurodivergent learners. Students will examine the social and cultural dynamics of being neurodivergent and address inequities in the current educational paradigm.

Once we explore difficulties such as overdiagnosis and gaps in educator training, we will examine how the Universal Design for Learning (UDL) can be a strategy for leveling the playing field and put it to use in a new design for the classroom or workplace.

This course is designed for K-12 teachers, college educators, school administrators, home-schoolers, therapists, and HR professionals.

Learning Outcomes

At the conclusion of the course, you should be able to Identify signs of Neurodiversity and the strengths of neurodivergent learners.

Describe Neurodivergence and its short and long-term impacts.

Explain the social and cultural issues related with Neurodivergence.

Discuss strategies to help neurodiverse individuals.

Design a classroom or workspace using Universal Design for Learning and accommodations.

Topics Include

Social Dynamics of Neurodivergence

Social and cultural issues related with Neurodivergence

Empowerment through Education

Neurodivergence in the workplace

Universal Design for Learning

Working knowledge of:

Developing presentations and analyzing research content

## *Next-Gen Sequence Analysis Tools - A Hands-On Approach | BINF.X405*

3.0 Units

There are numerous algorithms available as freeware or by public access in the cloud that make complex biological sequence analyses accessible to everyone. This self-paced, introductory course, aimed at professionals who want to break into the sequencing-related field of bioinformatics, explores important public access tools used for analyzing biological sequence data.

Through hands-on examples and exercises, you will learn how to access public databases for raw sequence data and perform the basic steps in processing next-generation sequence data for RNA, DNA, and ChIP sequencing data to obtain interpretable results.

You will get to explore the analytical parts of next-gen sequencing without having to do wet lab work because we've designed this course for people who are interested in a quick introduction to tools that allow for quick problem-solving without a deep theoretical understanding of how the tools work.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Process raw sequence for DNA and RNA for use in analytical algorithms

Use Galaxy and R programs for performing data analyses

Generate graphical outputs from the analytical results

Annotate analytical results to convey biological meaning about the samples analyzed

**Topics Include**

Public access tools used for analyzing biological sequence data

Additional Information

Most job postings for technicians and scientists in the molecular biology field ask for experience with next-gen sequencing. Having experience with the analytical tools is considered a plus on job applications.

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 30 contact hours

## *NoSQL Databases, Introduction | DBDA.X410*

3.0 Units

NoSQL schema-optional or non-relational databases support Big Data by providing scalability, high availability, clustering, efficient storage and easy access to huge amounts of semi-structured data.

This introductory course gives you a hands-on overview of the two most popular NoSQL databases—MongoDB and Cassandra—as well as an overview of core concepts and other types of open-source NoSQL databases.

We will cover installation, database shell usage, programmatic access, data modeling, scaling/clustering, categories of NoSQL databases (column-based, document-based, key value-based, or graphic-based), the CAP theorem, and BASE semantics.

You will have the opportunity to gain hands-on experience via homework assignments and a course project that involves setting up, populating (with publicly available datasets), and using a NoSQL of your choice (subject to instructor approval).

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the need for NoSQL databases and the types of problems NoSQL databases help solve

Discuss the “foundation concepts” of Mongo DB and Cassandra including semi-structured datasets and wide rows

Explain how Mongo DB and Cassandra databases support horizontal scaling to support Big Data sharding and clustering

Demonstrate how Mongo DB and Cassandra support fault tolerance - replication, clustering

Describe the relationship between cloud computing platforms and the databases we study

Write code to work with Mongo DB and Cassandra database APIs

Apply basic administration of Mongo DB and Cassandra

**Topics Include**

Why use NoSQL databases?

Types of NoSQL databases: Key value, document, column, graph

MongoDB basics

MongoDB data modeling, GeoData

MongoDB sharding, replication, clustering

Cassandra basics

Cassandra data modeling, real-time data with wide rows

Cassandra rings, replication

Other NoSQL databases: Neo4J, DynamoDB

Accessing NoSQL database APIs: Coding

Deploying NoSQL databases in the cloud: Amazon AWS

Using publically available datasets

CAP theorem, BASE

**Skills Needed:**

You will need experience using a programming language such as Python, Ruby, or Java and the ability to set up open-source software, databases, tools, and development environments on personal computers.

## *Object-Oriented Analysis and Design | SEQA.X401*

3.0 Units

Object-oriented design involves transforming the descriptive analysis models into computational models for coding. During an object-oriented requirements analysis, a descriptive model of the problem domain is developed into system specifications. This course which integrates GenAI topics and their applications to Object-Oriented design is intended for software engineers and managers who will be involved in the design of an object-oriented system. The course focuses on case studies and carries them through the design phase. Instruction uses the notation specified by the Unified Modeling Language (UML) developed by Booch, Jacobson and Rumbaugh. Students will learn Agile and Iterative Development methodologies, such as Unified Process and SCRUM, alongside use case and requirements driven design, among other important topics. The course covers the principles of object-oriented design as well as practical applications. Students will have the opportunity to utilize GenAI to analyze requirements and examine generated code for completeness and accuracy.

The course includes a comprehensive final project for students to practice requirements gathering and documenting design using different UML diagrams. Upon successful completion of this course, students should have an understanding of the principles of object-oriented design and system modeling and experience in applying these principles to real-world projects.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe the principles of object-oriented design

Read and design using UML

Complete real-world projects utilizing the principles of object oriented analysis an design

**Skills Needed:**

Programming experience required in an object oriented language. e.g. Java, C++, C#, Python, etc.

## *Organic Chemistry I | CHEM.X002_A*

5.0 Units

This course serves as the foundation for biochemistry, medicinal chemistry, pharmacology, environmental toxicology, and numerous other scientific disciplines. It provides a comprehensive introduction to the structure, properties, and reactivity of organic molecules, equipping students with the essential knowledge needed to understand biological processes, drug development, and chemical interactions in the environment.

Learning Outcomes

At the conclusion of the course, you should be able to

Analyze and represent organic molecules using appropriate structural conventions, including Lewis structures, line-angle drawings, and three-dimensional representations.

Identify and classify organic acids, bases, hydrocarbons, and isomers, and evaluate their physical and chemical properties based on molecular structure.

Predict and compare the mechanisms and outcomes of nucleophilic substitution and elimination reactions (SN1, SN2, E1, E2), applying mechanistic reasoning and structure-reactivity relationships.

Interpret spectroscopic data from NMR, IR, and mass spectrometry to deduce the structure of organic compounds.

Describe and predict the reactivity of key functional groups-including alcohols, phenols, and carbon-carbon pi bonds-in fundamental organic reactions.

Topics Include

Organic Structure and Representation The course introduces molecular representations and foundational concepts from general chemistry to prepare students for analyzing organic molecules.

Acid-Base Chemistry and Hydrocarbons Students explore acid-base behavior in organic systems and study the structure and conformations of alkanes and cycloalkanes.

Stereochemistry and Isomerism Emphasis is placed on recognizing and analyzing isomers, with a focus on stereochemistry and chirality.

Substitution and Elimination Mechanisms Key reaction types-SN1, SN2, E1, and E2-are examined with attention to mechanistic pathways and influencing factors.

Spectroscopy and Structural Analysis Students learn to interpret NMR, IR, and mass spectra to identify and characterize organic compounds.

Functional Group Reactivity The course concludes with reactions involving alcohols, phenols, and carbon-carbon pi bonds, highlighting reactivity and mechanism.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: CHEM.X001_A (General Chemistry I), CHEM.X001_B (General Chemistry II), CHEM.X001_C (General Chemistry III) or equivalent non-UCSC courses.

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## ***Organic Chemistry II | CHEM.X002_B***

5.0 Units

This course introduces organic chemistry with a focus on the reactivity and synthesis of organic compounds. Students will explore molecular structure, functional groups, reaction mechanisms, and key synthesis strategies, gaining a foundation for advanced studies in chemistry and biology.

Learning Outcomes

At the conclusion of the course, you should be able to

Analyze the structure and reactivity of conjugated $\pi$ systems and aromatic compounds, including pericyclic reactions, using molecular orbital concepts.

Predict and explain the behavior of key functional groups—such as aldehydes, ketones, carboxylic acids, and their derivatives—in organic reaction mechanisms.

Apply principles of enolate and enol chemistry to understand α-carbon reactivity and transformations involving amines and nitrogen-containing compounds.

Interpret and compare the chemical properties of biologically relevant molecules, including carbohydrates, amino acids, peptides, proteins, and lipids.

Integrate knowledge of organic mechanisms to evaluate synthetic pathways and biochemical processes involving functionalized molecules.

Topics Include

Conjugation and Aromaticity Students examine the structure and reactivity of conjugated π systems, aromatic compounds, and pericyclic reactions through molecular orbital theory and mechanisms.

Carbonyl and Functional Group Chemistry The course emphasizes the reactivity of aldehydes, ketones, carboxylic acids, and derivatives, including nucleophilic substitution and α-carbon chemistry.

Amines and Nitrogen Compounds Students explore the structure and reactivity of amines and their derivatives, with applications in both synthetic and biological contexts.

Chemistry of Biomolecules Key biomolecules—carbohydrates, amino acids, peptides, proteins, and lipids—are studied for their structure, reactivity, and biochemical relevance.

## *Organic Chemistry II Lab | CHEM.X002_B_L*

2.0 Units

This course introduces students to fundamental techniques in synthetic organic chemistry, with a focus on applications in pharmaceutical and research settings. Students will learn essential methods for the isolation and purification of organic compounds, along with both qualitative and quantitative analysis. These skills are applied to organic reactions, with an emphasis on conducting lab work safely and efficiently. Technical writing is integrated throughout the course through the preparation of lab reports and abstracts.

Learning Outcomes

At the conclusion of the course, you should be able to

Execute key organic laboratory techniques including column chromatography, acid-base extraction, oxidation, and synthesis of pharmaceutical compounds, demonstrating safe and effective laboratory practices.

Utilize spectroscopic methods such as NMR (Nuclear Magnetic Resonance) to analyze and interpret molecular structure and purity of organic compounds.

Systematically document laboratory procedures and observations in a scientific notebook and compose formal lab reports that integrate experimental data with chemical theory.

Apply critical thinking and problem-solving skills to purify, synthesize, and identify organic compounds using multi-step experimental procedures and analytical methods.

Demonstrate a foundational understanding of green chemistry principles and chemical safety, including proper handling, labeling, and disposal of laboratory chemicals and waste.

Expected Effort

At UC schools, 1 credit hour typically requires about 3 hours of student work per week. Actual class meeting times may vary by course.

Course Eligibility and Prerequisites

Prerequisites: CHEM.X002_A (Organic Chemistry I), CHEM.X002_A_L (Organic Chemistry I Lab) and previous or concurrent enrollment of CHEM.X002_B (Organic Chemistry II) or equivalent non-UCSC course(s)

This course is intended for postbaccalaureate students. UCSC undergraduates should follow their major's course requirements.

## *Organic Chemistry I Lab | CHEM.X002_A_L*

2.0 Units

This course introduces students to core techniques in synthetic organic chemistry, with emphasis on applications in pharmaceutical and research industries. The course covers essential methods for isolating and purifying organic compounds, along with qualitative and quantitative analysis. Students apply these skills to carry out organic reactions safely and efficiently. Technical writing is developed through the preparation of lab reports and scientific abstracts.

Learning Outcomes

At the conclusion of the course, you should be able to

Demonstrate proficiency in fundamental organic chemistry laboratory techniques including recrystallization, distillation, extraction, chromatography (TLC and GC), and infrared spectroscopy.

Apply principles of chemical safety, waste management, and proper laboratory etiquette, including the correct use of personal protective equipment (PPE), chemical handling procedures, and lab equipment

maintenance.

Accurately document experimental procedures and results in a formal lab notebook and written reports, demonstrating clear scientific communication and attention to detail.

Analyze and interpret experimental data to draw conclusions about the structure, purity, and identity of organic compounds, using tools such as GC and IR spectroscopy.

Integrate theoretical knowledge with hands-on experience to design, conduct, and troubleshoot multistep organic syntheses and separations.

## *Organizational Development and Change | HRMT.X401*

2.0 Units

Organizational development is needed now more than ever.

The course on Organizational Development and Change aims to equip students with the knowledge and skills necessary to navigate and lead change in an ever-evolving work environment. Students will gain insights into managing successful change initiatives by exploring the historical development of organizational development theories, evaluating different frameworks, and analyzing the impact of organizational culture and employee engagement. The course emphasizes the role of leaders and change agents, the challenges and opportunities associated with change, and the importance of effective communication and feedback.

Through practical application and reflection, students will develop the ability to develop and design change management processes that foster organizational effectiveness and adaptability while addressing cultural and diversity considerations. In this experiential, interactive course, participants engage in group activities and collaborate on a team project, both in and out of class.

Designed for leaders charged with bringing about change, this course builds a valuable foundation for managers, human resource professionals, internal and external consultants, and those interested in pursuing a career in this field. It provides an overview of the field of OD, the nature of change, and the role of the OD and HR practitioner.

Learning Outcomes

At the conclusion of the course, you should be able to

Explain the significance of Organizational Development (OD) in today’s business environment

Evaluate different organizational development frameworks and interventions to effectively manage change

Analyze strategic OD partnerships: HR, middle management, executive team, and/or consultants

Develop strategies and interventions to align business goals and organizational culture with desired change

Design and develop change interventions prioritizing organizational effectiveness, employee

engagement, and adaptability while addressing diversity, culture, neuroscience, and psychology safety

Topics Include

Organization Development (OD) history and overview

Theories and practices of OD, the OD process, and OD models

Strategic partnerships: HR, Middle Management, Executive Team and/or Consultants

Intervention designs that incorporate culture, Diversity, Equity, Inclusion, and Belonging (DEIB), neuroscience, and psychological safety

Aligning OD efforts with HR, management and leadership, and systems of change

Professional Credit

SHRM-CP® or SHRM-SCP® 19.25 PDCs.

## *People Analytics - Delivering Measurable Business Impact | HRMT.X418*

1.5 Units

In People Analytics, students learn the power of using data to drive measurable business outcomes and design data-driven people strategies to catalyze change and transformation in the workforce. You will see how to find and use data, win support for your new people analytics program, diagnose missteps, predict success, and prescribe change based on data rather than intuition. With data as our foundation, we will discuss the four stages of analytics and common pitfalls of people analytics programs. Learn to motivate and inspire leaders to integrate data and analytics with their personal expertise, thus enabling a more effective use of an organization’s most precious resources: people’s time and energy.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe the key elements that make up a People Analytics program and be comfortable with basic statistics and analysis that are used in the field today.

Discuss how an organization might initiate a People Analytics program using existing internal and external data to measure business impact of human resources activities.

Explain how data can be used to measure business outcomes in a way that others in human resources and in the organization can understand and also action for improved business outcomes.

Identify what data is actionable, how that data can be used to understand the underlying impact of business activity, how to use data to predict and prescribe business outcomes in the field of human resources.

Skills Needed Basic mathematics concepts and functions, including square roots and be familiar with the concepts of ratios and proportions. Should possess a grasp of elementary algebra. Also should be able to translate a verbal phrase or sentence into an expression or equation. Be familiar with basic statistical concepts or randomness, likelihood, and correlation.

Professional Credit

SHRM-CP® or SHRM-SCP® 16.5 PDCs.

## *Personal Development Seminar: Concepts in Next-Gen Sequence Analysis | BINF.800*

0.5 CEU's

A brief introduction to bioinformatics and Next-Generation sequencing.

Topics to be discussed include:

Why sequencing is relevant to bioinformatics

How sequence information is generated.

The computational tools used for sequence analysis.

Interpreting sequence analysis results.

Additional Information

This is a good course for students who are wanting to learn more about bioinformatics and Next-Generation Sequencing.

## *Physical Design Flow From Netlist to GDSII | VLSI.X408*

3.0 Units

With shrinking process technologies, physical design is becoming extremely challenging. Physical designers are responsible for producing high quality design tapeout, and an understanding of all aspects of physical design from synthesis to tapeout is critical to success. This course is an introduction to the ASIC physical design flow and tools from netlist (gate level) to GDS-II (fractured data). After an overview of the ASIC physical design flow and synthesis, the course starts with floor planning and block pin assignment. It then covers placement and clock-tree synthesis, followed by routing, and post-route optimization. You will learn RC extraction, static timing analysis, and physical verification. Upon completion of this course, you will possess the essential knowledge and hands-on experience with the backend physical design flows, from a synthesized netlist all the way to layout completion for ASIC chip

tapeout.

For the labs, the instructor will explain the tools used primarily for the placement and route part using IC Compiler (ICC). Other tools such as OpenROAD will be integrated within the flow but are available for students to practice on their own.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Explain the terms and acronyms used in Physical Design

Discuss the concept of Physical Design, ASIC design flow (RTL-to-GDS)

Demonstrate the core features of IC Compiler which is used during the course

Generate a GDS from an RTL design

**Skills Needed:**

Basic knowledge of backend design flow. Hands-on experience with Linux/Unix will be required for lab exercises.

## *Postbacc Lecture Series - Central Coast | PBSV.805_CC*

Through a series of interactive lectures and peer discussions, students gain the knowledge and skills they need to navigate the challenging medical school application process. Speakers in the medical community cover the essentials-from initial preparation to interviews and beyond.

Learning Outcomes

By the end of the course, you will:

Understand primary care specialties, necessary academic preparation, and skills requirements for primary care practitioners.

Demonstrate an understanding of medical school admissions and residency selection processes.

Develop a career plan for a chosen medical profession.

Interpret actionable guidance and advice from active and retired medical professionals and medical students.

Topics Include

Ways to finance your medical training

Medical career arcs: residency, fellowship, practice

Osteopathic vs. allopathic medical education

Writing an effective personal statement

Opportunities to study medicine abroad

Professionalism and leadership in Medicine

Please note: This course is only open to students enrolled in the structured Central Coast cohort of the UCSC Premed Postbaccalaureate Program.

## *Postbacc Lecture Series - Silicon Valley | PBSV.805_SV*

Through a series of interactive lectures and peer discussions, students gain the knowledge and skills they need to navigate the challenging medical school application process. Speakers in the medical community cover the essentials-from initial preparation to interviews and beyond.

Learning Outcomes

By the end of the course, you will:

Understand primary care specialties, necessary academic preparation, and skills requirements for primary care practitioners.

Demonstrate an understanding of medical school admissions and residency selection processes.

Develop a career plan for a chosen medical profession.

Interpret actionable guidance and advice from active and retired medical professionals and medical students.

Topics Include

Ways to finance your medical training

Medical career arcs: residency, fellowship, practice

Osteopathic vs. allopathic medical education

Writing an effective personal statement

Opportunities to study medicine abroad

Professionalism and leadership in Medicine

Please note: This course is only open to students enrolled in the structured Silicon Vallet Cohort of the UCSC Premed Postbaccalaureate Program.

## *Post-Market Regulatory Obligations for Medical Devices | MEDD.X406*

1.5 Units

Once medical devices are on the market, manufacturers are required to follow specific requirements and regulations. This includes investigating complaints, submitting to the FDA's eMDR system for reporting device malfunctions, injuries or deaths; handling recalls, managing post-market surveillance studies requirements under section 522 of the Federal Food, Drug and Cosmetic Act, as well as post-approval studies required at the time of approval of a premarket approval (PMA); and handling advertising and promotional labeling. This course offers the opportunity to apply these post-market regulatory requirements in activities using case studies.

Learning Outcomes

At the conclusion of the course, you should be able to Describe the principal post-market regulatory obligations for medical devices distributed in the United States.

Apply regulations and FDA guidance in order to maintain post-market regulatory compliance.

Document complaint investigations, file MDRs, complete health hazard evaluations, analyze advertisement and promotional content, and manage post-market study reporting needs.

Topics Include

Complaints and Mandatory Reporting Requirements

Recalls, Corrections, and Removals

Post-approval studies & 522 Postmarket Surveillance Studies

PMA Supplements, Annual Reports, 510(k) Modifications, etc.

Additional Information

Please review section notes to view the full schedule.

## *Power of Market Research | MKTG.X401*

2.0 Units

Executives need market research to make informed strategic business decisions on product planning, target markets, customer requirements, communications strategies, pricing, distribution channels and many other factors. From high tech case studies where the feature set of a product and its competitors is the most important thing to research, to high volume internet and consumer businesses where user trends need to be statistically analyzed and forecasted, this course will show the market power you can gain from key knowledge points.

Through lectures, projects, reading, analysis of case studies and class discussions, you will learn to identify the strengths and limitations of market research, as well as the proper ways to gather and present information.

Learning Outcomes

At the conclusion of the course, you should be able to

Select the appropriate types of research to meet a specific business need/question.

Develop a research plan.

Create a survey script to collect primary data to achieve research objectives.

Analyze primary and secondary data to extract pertinent information.

Make recommendations based on data collected.

Topics Include

From basic survey techniques in both primary and secondary research to an understanding of the power of statistical fact-gathering and analysis

Sources of secondary research

Primary research process and costs

Developing a survey for in-person and online usage

Translating, assessing and defining market trends

Customer profiling and typical product persona development

Competitive market segment and customer analysis

Integrating results into business planning

## ***Practical Design and Implementation of VLSI Memory Devices | VLSI.X417***

3.0 Units

This course for new and mid-hires in the custom memory design sector reviews key technologies in VLSI design such as CMOS (complementary metal-oxide-semiconductor), and FinFET (fin field-effect) transistors, NMOS (N-type metal oxide semiconductor) transfer curve and the derivation of MOS (metal-oxide-semiconductor) current across different regions of operation. Students in this course will learn basic memory operation and principles, discuss various tools used for verification of memories, how these tools are used, how practical compiler SRAMs are built in industry, and how they are verified. By focusing on memories and tools related to verification of memories, students go from ground zero to designing and verifying memories on the job.

The class will analyze the 6T bitcell, study of bitcell stability, typical SRAM architecture and move into a detailed discussion on the decoder architecture, sense amplifier architecture and operation, and exploration of IO architectures.

We will dive into the details of the read/write timing waveforms, and timing analysis of memories using Hspice and Nanotime and discuss other verification tools such as ESPCV (logical equivalence), and fanout and noise tools. We will see how analysis corners are derived, and how memories get characterized and analyzed across these corners. Then we will discuss how compiler memories are designed and what factors go into consideration of selecting the number of entries, bits and mux (multiplexer) factors.

We will go into types of bitcells, how multi-ported and multi-banked memories are designed, and what are the pros and cons of each style.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Demonstrate knowledge of 6-T bitcell fundamentals

Explain SRAM read/write operation

Demonstrate knowledge of sense amplifier operation

Demonstrate knowledge of SRAM design

Discuss the tradeoffs made in the design of SRAM compilers

Build a spice deck to measure the read current of the 6T bitcell

Build a spice deck to read and write a simple SRAM

Create a sample Tcl file to run nanotime

Create a sample Tcl file to run ESPCV

**Skills Needed:**

CMOS transistor operation, Hspice, schematic entry with Virtuoso is a plus

## *Practical Design with Xilinx FPGAs | EMBD.X408*

3.0 Units

Field Programmable Gate Arrays (FPGAs) are configurable logic devices with programmable links. They allow you to implement, update, and ship ASICs with low non-recurring engineering costs and are

widely used in system design. This course offers a practical introduction to programmable logic design with Xilinx FPGAs, emphasizing design implementation. The course focuses on improving design methods to advance overall design quality; in essence, to bulletproof a design. Standard logic designs translate automatically and effectively to the world of field programmable logic devices. The course covers common methods based on design constraints used in most design software. You will learn design implementations such as clocking (which creates various clock frequencies from an external reference), including how to handle control and data signals migrating across different clock domains, how to manage clock jitter and debounce input asynchronous signals. You will also learn to manage ground bounce and control power dissipation, while including considerations for safety and security. Practical design examples include discussions of RAM, DSP blocks, basic fabric and A/D converters.

The course places an architectural focus on the Virtex-7, Artix and Kintex families, as well as the Zynq programmable system on a chip. In-class demonstrations and student design projects will feature the Xilinx Vivado Webpack design software. By the end of the course, you should be able to complete practical designs with Xilinx FPGAs and understand design and timing reports. The course includes a student project with design tools; real device implementation or programming is optional.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Implement a practical design on Xilinx hardware

Debug a design on Xilinx hardware

Use the Xilinx Vivado tool

Explain common Xilinx FPGA features and how to use them in the software tool

Demonstrate a broader view of FPGA applications and an understanding of programmable products in the market

**Note(s):** Students are required to purchase a Zynq-based board for their project (approximately $100, not included in the tuition). Detailed board information and instruction will be provided on the first night of class.

**Skills Needed:**

Experience with logic design of digital systems or equivalent knowledge.

## *Practical DFT Concepts for ASICs, SoC and SiP | VLSI.X409*

3.0 Units

Formerly "Practical DFT Concepts for ASICs: Nanometer Test Enhancements"

Testing application-specific integrated circuits (ASICs), system on chips (SOCs) and system in packages (SIP) is becoming very challenging in today's advanced process technologies/nodes. The

dense spacing of lines on silicon, gigahertz clock rates, newly-emerging fault classes—these factors make it difficult to reach even 98% coverage. This course is ideal for integrated circuit (IC) designers seeking a deeper understanding of test issues, or test engineers wanting to stay current with emerging trends and tools. This course is filled with engineering insights. It first builds a solid foundation in scan-based design —a necessary skill for understanding more recent techniques like delay-fault testing, scan compression, and built-in self test (BIST). Students will gain hands-on experience in building scan chains and generating test patterns, using Synopsys DFT Compiler (DFTC) and TetraMAX ATPG. You will learn advanced topics such as inserting multiple scan chains, employing sequential ATPG to handle non-scan flops, optimizing DFT logic, understanding LBIST and MBIST, and following nanometer trends in testing.

The systematic hands-on labs reinforce techniques introduced in lecture, and are packed with useful information and practical guidelines. By the conclusion of the course, you will be able to hand off a full-scan design and generate a high-coverage test program for nanometer ASIC.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Use Design for Test Compiler (DFTC) to perform test-smart synthesis and insert scan chains

Explain in detail how full-scan design enables ATPG to generate a pattern for particular testable fault in fault universe

Hand off a full-scan design from DFTC to TetraMAX, and make use of all key features of the ATPG tool to generate a high-coverage test program. Employ sequential ATPG to handle non-scan flops

Explain how on-chip BIST replaces external ATE, generating patterns and compacting the response

Discuss nanometer trends in testing, such as detecting delay and bridging faults, adaptive scan, strategies for IP cores, testing low-power designs, and supporting testing of on-chip analog content

**Skills Needed:**

A working knowledge of digital logic design is recommended.

## *Preparing for FDA Inspections and Conducting Sponsor Audits-GxP | CTDM.X414*

1.5 Units

In the regulated pharmaceutical and biotech medical device industries, inspections by government agencies are often a prerequisite for new product-marketing approvals. Knowing what to expect and how to prepare for and respond to such inspections is as critical as conducting sound clinical research. As the FDA and other regulatory authorities increase the frequency of inspections, it is imperative that everyone involved in the development of new therapies be familiar with government inspection processes and their role during these inspections. This course helps participants prepare for FDA inspections and conduct sponsor audits considering GxP guidance.

Learning Outcomes

At the conclusion of the course, you should be able to Describe current sponsor and FDA practices expected during inspections.

Discuss how regulations and guidance are applied to improve inspection readiness.

Explain the differences between audits and inspections, sponsor responsibilities in relation to the FDA.

Identify risks in clinical trials that will be issues during a sponsor audit or FDA inspection

Topics Include

Investigator and sponsor/monitor inspections

How and when inspections occur

FDA inspection procedures and practices

Conducting sponsor audits and inspections

Interacting professionally with inspectors

Responding effectively to inspectors' observations

Additional Information

This course benefits professionals involved in all aspects of clinical research including sponsor clinical development personnel, quality assurance and compliance, investigators, monitors, regulatory affairs personnel, data managers, and safety surveillance personnel

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 15 contact hours

## ***Principle Based Leadership for Project Managers | PPMT.X422***

1.5 Units

The landscape for project management is changing, requiring an iterative, value-based, model to remain competitive in a dynamic, changing market. To align with organizational goals and customer value, project managers need to create a set of actionable outcomes to execute projects based on values and principles.

In this course, you will assess values and principles, including Waterfall, hybrid, and agile models and frameworks. You will learn how to make value-added decisions for the benefit of project stakeholders that are in alignment with the goals of an organization.

Learning Outcomes

At the conclusion of the course, you should be able to

Review and understand principles from Waterfall, hybrid, and Agile project management frameworks

Create a strategic objective from an assigned case study

Design a strategic plan that maps values to principles to outcomes

Create a strategic work breakdown structure (WBS) that maps principles to tactical execution items

Topics Include

Compare and contrast agile frameworks—Scrum, Agile Manifesto, Modern Agile, Disciplined Agile, Scaled Agile

Compare and contrast project management frameworks

Discuss the strategic values of a company case study

Introduction to Generative AI and its use in modern project leadership

## ***Principles of Business Analysis | BUSM.X400***

3.0 Units

This course provides a sound foundation in business analysis concepts and lays the groundwork for advanced studies. You'll learn the techniques to define value including the project management skills needed to plan, manage, and communicate; requirements management approaches needed to elicit, analyze, solicit, and verify requirements; and enterprise architecture techniques to promote knowledge retention, reduction of complexity, and reuse. Learn to control your current business processes and derive business requirements for process and automation projects that add value to your organization. The course includes group and individual exercises, a threaded case study, and tactics for on-the-job (OTJ) implementation.

Learning Outcomes

At the conclusion of the course, you should be able to

Discuss fundamental business analysis concepts

Distinguish between the roles of a business analyst and project manager

Identify the key business analyst responsibilities and deliverables in each of the knowledge areas

Identify stakeholders and select appropriate techniques for eliciting their requirements

Understand business analysis tasks necessary to complete a business analysis effort

Describe how a business analyst works with stakeholders to identify and comprehend their needs

Understand how a business analyst manages issues and changes to maintain agreement on solution scope

Decide which business analysis activities are most appropriate to identify needs

Clarify needs and solutions with various stakeholder groups

Define business analysis tasks that progressively elaborate stakeholder and solution requirements

Determine business analysis tasks that progressively elaborate stakeholder and solution requirements when gaps are identified

## ***Principles of Drug Discovery and Development | CTDM.X417***

The discovery and development of a new drug is a complex, lengthy, and expensive process. Given that regulatory approval to market a drug is required before a company can generate revenue, it is one of the riskiest endeavors that a company can undertake.

In this course, you will examine this process—from the discovery of small synthetic and generation of large, biologic drug molecules through the preclinical efforts to evaluate and enhance the pharmacologic properties of a potential drug for safety and efficacy. We'll discuss the objectives, the overall mechanics, and ethics of testing investigational drugs in clinical studies with human volunteers. Lastly, we'll take a look at how the U.S. Food and Drug Administration (FDA) reviews the marketing application for a new drug, and the post-approval requirements it imposes on biopharmaceutical sponsors.

During the course, you'll get a sense of what makes the biopharmaceutical industry a fascinating area for study. You'll see the science and government regulations underlying the development of drugs, as well as the politics often associated with bringing a new drug to the marketplace. Course discussion is infused with real-world examples that demonstrate the challenges that people in the biopharmaceutical industry routinely face as they try to advance a potential new drug through the developmental pathway to FDA approval.

The course provides an important foundation in drug development for professionals from all disciplines

who are currently working in or are considering a move to the biopharmaceutical industry.

**Learning Outcomes**

At the conclusion of the course, students should be able to:

**Appreciate what is involved in bringing a new drug to market, including understanding:**

* How biopharma companies make decisions to advance investigational drugs from discovery through the nonclinical and clinical stages of drug development.

* The different phases and processes of clinical evaluation of investigational drugs in humans, including clinical trial objectives, trial structure, and the kinds of data generated from these studies.

* The oversight role of the U.S. Food and Drug Administration and the impact of its regulations on the evaluation of investigational drugs in humans (which comprises pharmaceutical law, compliance, Good Clinical Practice, ICH Guidances, and the bioethics underlying the conduct of clinical trials).

**Obtain a sense of the science and state-of-the-art technologies underlying the discovery and development of drugs.**

**Develop and use critical thinking skills to consider the challenges that biopharmaceutical companies face when developing a new drug.**

* Ask questions about preconceived notions related to biopharma. Be able to assess the benefit that the biopharmaceutical industry brings to society, and offer informed criticism based on understanding their business model. **Major topics discussed during the course include:**

An overview of the key technologies employed to discover small synthetic and large biologic-based drug molecules such as. monoclonal antibodies

Drug targets and their validation

Key concepts related to the therapeutic use of drugs—drug safety, efficacy, risk/ benefit ratio, drug specificity, pharmacokinetics, drug metabolism— and pharmacodynamics

Clinical trial design and associated ethical considerations, trial objectives, types of trial data generated, and how these data are used to advance drugs to the marketplace

Selected drugs and their pharmacologic mechanisms of action (especially drugs related to treatment of cancer and infectious diseases such as , COVID-19, AIDS

The mechanics of conducting a clinical trial from start to finish

Oversight role of the FDA in the clinical development stage of testing drugs, drug patents and applicable pharmaceutical regulations, and FDA inspections of pharmaceutical sponsors and clinical trial sites

Job opportunities and career pathways in the biotech and pharmaceutical industry

Additional Information

Please make sure computers have audio and video capabilities to support online Zoom sessions

## ***Principles of Educational Therapy | EDTH.X300***

3.0 Units

This course provides an interactive overview of the educational therapist's role, including discussions of ethical practices, state and federal laws related to professional responsibilities and limitations. The responsibilities of the educational therapist, including case management, information gathering, assessment practices, goal setting and intervention strategies are also examined.

Learning Outcomes

At the conclusion of the course, you should be able to Define the profession of educational therapy and its relationship with other allied professions

Identify the common qualities of educational therapists

Describe the history of the profession

Discuss the variations across different forms of educational therapy practice with particular attention to individual practice

List the components of educational therapy practice

Identify common ethical issues

Determine one's eligibility for meeting educational therapy standards of practice

Topics Include

Qualities of an Educational Therapist

Code of Ethics

Components of Clinical Practice

## *Principles of Marketing | MKTG.X400*

2.0 Units

Marketing is the convergence point for issues involving the customer, the competition, and corporate capabilities. It is the constantly evolving field of exchange relationships.

In this course, students explore the fundamental principles of marketing in context of corporate, economic, and societal influences. We take a deep dive into the strategies and best practices in today's marketing world, focusing on the practical knowledge that managers need to be effective in both product- and service-based industries.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe what marketing and strategy are;

Conduct market and industry analyses; and

Apply different strategies to build a customer-driven strategy and mix.

Topics Include

The role of marketing in shaping and developing new ideas;

Factors that affect pricing;

Channels through which products and services are distributed;

Elements of wholesaling and retailing; and

The strategies, mechanisms and techniques behind advertising, direct sales, and other forms of promotion.

We will also analyze the impacts of changing lifestyles and international market forces on American buying patterns, as well as consumer and organizational buying behaviors. Students will get an overview of the world's leading markets and businesses and learn methods and resources for researching and segmenting. Group discussions will include the career opportunities in marketing and marketing management.

## *Printed Circuit Board Design for Signal Integrity and EMC Compliance | EMBD.X409*

1.5 Units

This course presents simplified design techniques for the design and layout of printed circuit boards to achieve both signal integrity and electromagnetic compatibility (EMC). Signal integrity is a primary concern for system functionality while EMC compliance allows a product to be legally sold. This course was developed for both experienced and entry level engineers who are responsible for printed circuit board designs and system level products. Upon completion, students should be able to create a high-density, high technology printed circuit board that meets or exceeds test and system level requirements easily. In an informal tutorial format, design and layout techniques are introduced in a simple to follow step-by-step presentation that allows plenty of opportunities to address specific questions. Major instructional emphasis is placed on real-life examples that demonstrate good layout practices that can be incorporated immediately. Simulation results will be presented to demonstrate basic principles. This course is taught at the fundamental level, not tied to any PCB tool. Rigorous mathematical analysis and theory will not be presented. Multi-layer, high-density designs is the focus of the course, however, single- and double-sided designs are examined based upon fundamental concepts for multi-layer boards.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Explain simplified electromagnetic theory and physics using a visualization approach

Design printed circuit boards and systems to achieve both signal integrity and EMC compliance quickly and at low cost

Employ techniques to solve signal and power integrity issues in PCB

**Topics Include**

Fundamental concepts of signal integrity and EMC

Material science related to construction of a printed circuit board

Suppression and grounding

Layer stackup assignments

Power distribution networks (bypassing/decoupling)

Transmission lines requiring impedance control and routing

Transmission line termination

Interconnects and I/O

Backplanes and large busses

Miscellaneous design techniques and concepts

**Skills Needed:**

Prior experience with printed circuit board and system level design and testing is highly desired. A solid foundation in basic electrical engineering principles helps one understand fundamental design concepts. This course targets the spectrum of designers, from entry-level to senior engineer, including EMC engineers.

### *Product Marketing and Management | MKTG.X406*

2.0 Units

This in-depth introduction to product management, product marketing and product marketing engineering covers everything from core concepts and terminology to process management. The course is designed to meet the needs of product managers, product marketing managers and product marketing engineers who are charged with driving products to market but who may be new to the disciplines and processes involved. Participants learn to manage the process of shaping final products and taking them into the marketplace all from the perspective of the customer advocate.

Learning Outcomes

At the conclusion of the course, you should be able to

Provide hands-on experience taking a concept through the product life cycle.

Give students access to product management industry leaders to provide feedback and exposure.

The objective is to teach real world business and product management skills. We are focused on practical skills and how this works in real life over theoretical frameworks

Equip students who wish to pursue a PM career with the skills and knowledge they need to succeed.

Teach students need-finding skills and general problem-solving skills.

Topics Broadly Include

Concept of the 'whole' product and product lifecycle

Product planning, scoping markets, pricing and margins, forecasting

Product management, MRD and PRD, roadmaps, metrics

Product packaging, costing, production

Product positioning, persona, promotion, launch planning

Product support for sales, channels, merchandising

End of life (EOL) planning

Analyzing customer needs

Researching and sizing markets

Evaluating competition

Developing product requirements

Assessing ROI

Managing product lifecycles

Working with engineering, marketing and sales

Working with sales channels

Skills Needed

Familiarity with basic concepts in business, marketing, would be relevant. Besides that, there are no prerequisite skills needed for this course.

## *Project and Program Management Certificate Completion Fee | O-CE0165*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Project Leadership and Communication | PPMT.X415*

3.0 Units

This course is designed to equip students with the "soft skills" needed for managing projects, including leadership, communications, team organization and development, conflict management, quality management, and negotiating. Using case studies and exercises, students explore vital aspects of project leadership such as the use of participative management to build commitment, leadership styles, organizational cultures and configurations, interpersonal skill development, project staffing, and working with distance-separated teams. Students also learn to establish clear project goals, overcome communication problems, write performance reports, and manage agreement.

Learning Outcomes

At the conclusion of the course, you should be able to

Describe and apply various leadership styles

Recognize various organizational structures and operate efficiently within them

Demonstrate several motivational and influencing skills

Assess one’s own leadership strengths and weaknesses and create a development plan

Describe how and why we filter “reality” – in other words, perception

Demonstrate methods for gaining commitment to projects

Establish open and honest communications within a project

Acquire, organize, motivate and reward teams

Describe and Demonstrate techniques for leading both co-located and virtual teams

Delegate efficiently

Manage conflict and negotiate effective agreements

Topics Include

Project leadership versus project management

Improving project communications

Building commitment to the project

Successfully managing conflict

Using the Johari Window to assess your interpersonal skills

## ***Project Management Fundamentals | PPMT.X425***

3.0 Units

Please note: Previously offered as the Role of the Project Manager Course: PPMT.X400 for 1.5 units. If you have already completed Course: PPMT.X400, you do not need to retake this course.

Delivering on time and on budget is not enough. Projects must generate value for stakeholders. This foundational course goes beyond the nuts and bolts of project management, exploring the strategic value that projects deliver to customers and sponsoring organizations. In this course, students focus on traditional waterfall project management as defined by the Project Management Institute (PMI) while learning how it differs from Agile project management methodology.

Learning Outcomes

At the conclusion of the course, you should be able to

Explain the strategic role of project management in achieving organizational goals, with emphasis on stakeholder satisfaction and benefits realization.

Differentiate between traditional and agile project management methodologies, identifying when each is

best applied. Define core project management concepts, including the Triple Constraints, project management process groups, and the 10 knowledge areas.

Apply principles of project management to define scope, develop schedules and budgets, and manage project risk, quality, and communication, as well as stakeholder, resource, and change management.

Demonstrate proficiency in project delivery by generating accurate status reports, addressing variances from the project plan, performing root cause analysis, and implementing project change control.

Topics Include

Tools and practices to define scope, create schedules and budgets, and manage project risk and quality.

Effective stakeholder management, how to align projects with organizational strategy, and guide organizations through organizational change.

Explore the strengths and weaknesses of traditional project management with Agile, a collaborative and iterative approach to project management that focuses on adaptability and collaboration. Note, for a detailed course on Agile, please consider Agile Project Management Fundamentals, a required course in the certificate program.

## *Project Risk Management | PPMT.X406*

1.5 Units

Project risk management is the application of tools, techniques, and practices to both increase the likelihood of positive project outcomes and reduce the likelihood of negative ones. It requires constant vigilance from the earliest stages of a project through planning and execution and even beyond its completion.

Students in this course will learn risk management practices as they apply to traditional (waterfall) projects and Agile projects, and ultimately to the realization of a project's intended benefits.

The course reviews basic risk management concepts for waterfall projects and introduces techniques for quantitative risk analysis, incorporating analysis insights into project plans, developing effective risk response plans, and creating project reserves. It also examines Agile practices such as backlog management, sprint planning, and quality management to reduce project risk.

Additionally, the course includes two key risk management topics – root cause analysis and organizational risk management. Root cause analysis helps teams identify potential risks during planning and how to manage them after they occur. Organizational change management assures a higher rate of adoption of project deliverables and realization of benefits to project stakeholders.

Coursework includes in-class team assignments, take-home assignments, and a final project, providing students with practical experience in applying risk management principles.

Learning Outcomes

At the conclusion of the course, you should be able to

Apply tools and techniques to identify, analyze, and manage project risks

Use advanced statistical analysis techniques to analyze risk likelihood and impact

Manage product backlogs, sprint planning, and quality management in relation to risk management in Agile projects

Utilize root cause analysis during planning and execution

Apply organizational change management techniques to optimize the adoption of project deliverables and assure benefits realization to project stakeholders

Topics Include

Traditional project risk management The risk management life cycle – identification, analysis, response planning, monitoring

Quantitative risk analysis and advanced data analysis techniques

Incorporating risk management into project management plans

Risk response planning

Creating project reserves

Risk monitoring processes

Agile risk management Managing project scope

Managing project time

Managing project quality

Root cause analysis

Organizational change management and project risk management

Skills Needed

Basic level training or experience in waterfall project management and agile.

## *Psychology of Human Learning | EDTH.X308*

3.0 Units

The principles of cognitive, developmental and social psychology, as they apply to the exceptional learner, are examined in this course. Current research is reviewed as it relates to individual differences, the learning process, and theories and problems of learning, including the impact of motivation and intelligence on the special learner. The fundamentals of physical, motor, social and emotional development at critical stages are examined. This course covers the key human learning theories, including classical, social, Piagetian, and information-processing perspectives.

Learning Outcomes

At the conclusion of the course, you should be able to Understand cognitive, social, and linguistic development

Learn theorists and theories of learning (past and present)

Understand and apply core concepts of learning differences, assessment, and memory

Topics Include

Teaching and Educational Psychology

Learning, Cognition, and Memory

Instructional Strategies

Creating a Productive Learning Environment

Summarizing Students' Achievement and Abilities

## *Public and Analyst Relations | MKTG.X402*

2.0 Units

In today’s world, the concept of mindshare is crucial to building successful public relations and analyst relations campaigns. Because customers have access to more information about a company, there is an increasing amount of public discussion about its activities, products and services. Without mindshare, marketing efforts can become misguided, superior technology fails to be adopted, and even the most promising companies fail to blossom. Yet winning the mindshare battle is more challenging than meets the eye.

Today's public relations or analyst relations practitioner needs to be an integrated media person who can build trust and credibility by gaining exposure and creating an ongoing dialogue with customers and the analysts that they rely on to mitigate risk. By leveraging a variety of readings, exercises, case studies and guest speakers, this course explores the power of public/analyst relations to build credibility, trust, goodwill and reputation. The course is a good fit for professionals at various stages of

their careers who want a strong foundation in PR/AR basics and are interested in building comprehensive PR or AR strategies.

Learning Outcomes

At the conclusion of the course, you should be able to

Define public relations

Define analyst relations

Describe a comprehensive view of public relations strategy

Describe a comprehensive view of analyst relations strategy

Apply some of the tools of public relations

Identify a career path in media and analyst relations, using diverse skills such as writing and editing, rich media, social media, communications planning, positioning and messaging, executive communications, or measurement and analysis

Topics include

Communications channels

Trade shows and event management

Photography

Wire services

Search-optimized press releases

Editorial calendar management

Press conferences and press tours

Product reviews

Ongoing public relations management

Budgets for international PR

Spokesperson training

Crisis communications

In-house vs. agency PR

## *Python for Data Analysis | DBDA.X420*

3.0 Units

With data now being created at the rate of 2.5 quintillion bytes a day, there is a tremendous demand for people who can explore vast amounts of data. In this lab-based course, you will learn how to glean empirical truth from data using Python with Pandas, how to make the right decisions, and how to bring order from chaos.

Experience Python's straight-forward syntax, built-in data types, and object-oriented programming (OOP) and make your own data types. Learn how Python's brilliant architecture allows you to jump into any of more than 300,000 libraries provided for Python. In this course you work with the Pandas, NumPy, and Matplotlib libraries to inspect data, manipulate data, calculate statistics, and provide informative and beautiful visual representations for data sets via interactive Jupyter Notebooks.

**Learning Outcomes**

At the conclusion of the course, you should be able to:

Describe Python's underlying object model, operators, and syntax

Employ Pandas, NumPy, and Matplotlib through Python and Jupyter Notebooks

Clean, manipulate, analyze, and graph data

Create Python functions to customize the behavior of data transformations

Grasp and emulate the online Python/Pandas/Matplotlib data analysis examples

**Topics Include**

Pandas, DataFrames and Series for data sets:

* Cleaning

* Collating

* Extrapolating

* Analyzing

* Dealing with timed data

* Discovering cycles

Matplotlib for presenting graphs

Python for using the data libraries effectively

**Skills Needed**

Helpful, but not required, are a basic experience in any programming language and a rudimentary knowledge of statistics.

## *Python for Machine Learning | DBDA.X427*

3.0 Units

This course introduces students to the Python programming language essential for data manipulation, statistical analysis, and predictive modeling techniques required for machine learning and artificial intelligence.

We will explore the wonderfully concise and expressive use of Python's advanced module features and apply it in probability, statistical analysis, training models, and various other applications. Students will explore mathematical operations with array data structures, optimization, probability density function, interpolation, visualization, and other high-performance benefits of core scientific packages such as NumPy, Pandas, scikit-learn, and Matplotlib.

Additionally, students will learn modern machine learning concepts and techniques, including supervised, unsupervised, and semi-supervised learning, to develop predictive models using Python libraries. The course concludes with a real-world, end-to-end machine learning project, providing students with practical experience in solving challenging problems.

**Learning Outcomes**

At the conclusion of the course, the student should be able to

Develop complex functions and scripts to perform complicated calculations to solve engineering, financial, mathematical and scientific problems and visualize the results of these calculations.

Install, configure Python and essential Python development tools and write programs to perform data analysis, statistical analysis, learning and AI techniques.

Manage and manipulate data, perform data type conversions, merge datasets, deal with missing values, and extract, delete, or transform subsets of data based on logical criteria.

Manage a complete machine learning workflow, from data preparation, dimensionality reduction and feature engineering to model selection, training, prediction, evaluation and optimization through a real-world machine learning project.

Attain deeper understanding of the mathematical toolkit provided by powerful core packages and acquire hands-on experience.

**Topics Include**

Training models

Random forests

Dimensionality reduction

Clustering methods

**Skills Needed:**

Basic Programming Knowledge as can be acquired in Python Programming for Beginners (CMPR.X415) and a knowledge of Fundamentals of Statistics

## *Python for Programmers | CMPR.X416*

3.0 Units

Python language is gaining popularity because its use enhances program correctness and increases programmer efficiency. Because of its clear and elegant syntax, dynamic typing, automatic memory management, and straight-forward module architecture, Python is simple to learn and fun to use. Its code is easy to read, write, extend and modify. This lab-based course offers proficiency in the core concepts of Python, and the skills and knowledge for building applications using any of the hundreds of thousands of task-specific Python libraries.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Learn and practice writing Pythonic code: efficient, accurate, easy to read/write

Describe the Python environment and code introspection

Express Python Syntax: flow control, function protocols, exception handling and functional programming

Use Built-in data types: strings, tuples, lists, dictionaries and sets

Apply Object-oriented features: classes, inheritance and overriding

Build applications, packages, and libraries

Create iterators, generators, decorators, and context managers

**Topics include**

The Python environment: interpretation, integrated development environment, code introspection

Syntax: flow control, f-string formatting, function protocols, exception handling, functional programming

Built-in data types: strings, tuples, lists, sets, dictionaries

Sequence manipulations: slicing, accessing, packing, unpacking, sorting by an arbitrary sort key

Object-oriented features: classes and inheritance

Building applications, modules, packages, and libraries

Popular libraries: os, sys, copy, unittest, cProfile, optparse, unittest, shutil, tempfile, subprocess, and more

Pythonic thinking: namespaces, internationalization, iterators, generators, decorators, dynamic coding, context managers

PandasAI

**Note(s):** The Python interpreter is free software and runs on all popular platforms. Students are required to have Python 3.7 or higher installed.

**Skills Needed:** Significant experience in any programming language.

## *Python: Object-Oriented Programming | CMPR.X420*

2.0 Units

Demand for Python programmers who understand the latest skills in today's fastest growing computer language, grows every day. Object-oriented programming (OOP) has become a must-have technique in today's high-tech software development jobs.

In this intermediate course, students will use Python to explore OOP techniques including: encapsulation, polymorphism, and inheritance. The material is introduced and explained through the development of graphical user interface elements and, in a fun way, by building highly approachable, simple computer games. The Python language, because of its simple syntax, makes the implementation of OOP very clear. To build interactivity, we will use the well-known Pygame extension to introduce event-driven programs. Along the way, you will gain an intermediate level of understanding of the Python language. After this course, you should be able to translate the underlying concepts to other OOP languages with ease.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Implement event-driven programs

Describe the elements that make up an object (class, instance, instance variable, method, class variable)

Explain how objects allow data and code to work together as a cohesive unit (as opposed to simple functions)

Describe the three main tenets of object-oriented programming: encapsulation, polymorphism, and inheritance

Make informed decisions about when it is appropriate to use encapsulation, polymorphism, and inheritance in practice

Take a complicated programming problem and break it down into a set of manageable, potentially re-usable classes

Incorporate graphical user interface (GUI) elements in programs, and describe how the underlying GUI code works

**Topics include**

Object-Oriented Programming: Encapsulation, Polymorphism, Inheritance

Intermediate Python

Event-driven systems

Building graphical user interface elements

Simple games

**Skills Needed:**

Basic programming experience with Python.

## *Python Programming for Beginners | CMPR.X415*

1.5 Units

This hands-on, lab-based course is intended for newcomers to programming. Python is favored by first-time programmers because it presents engineering concepts in a straightforward, clear language,

while quietly and behind-the-scenes, it takes care of the difficult, tedious, and error-prone details that present the major obstacles to writing a program in older languages. Python is an open-sourced language with rich features and is used extensively in many industries.

The course covers the important concepts and programming mechanisms that exist in all programming languages: reading and writing to standard IO, using operators, controlling the flow of execution, using functions, reading and writing files, and basic object-oriented programming concepts. It also includes Python-specific facilities such as code introspection, re-use, built-in sequence types, and iteration.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Develop programs using a basic integrated development environment (IDE)

Develop small-to-medium size programs that demonstrate a solid understanding of software development in Python

Write Python programs using the core elements of variables and flow control structures

Write Python functions to facilitate code reuse

Work with the Python standard library

Write Python programs following a specific style guide

Explore Python's object-oriented features

**Note(s):** The pace of this course may be slow for people who are familiar with a programming language. If you have a basic understanding of Python, you may want to consider the intermediate level "Python: Object-Oriented Programming" (CMPR.X420). More experienced programmers should take "Python for Programmers" (CMPR.X416).

*This course includes a module on "Introducing Generative AI Assisted Programming."

## *Quality Management for Enterprises, Products, and Programs | PPMT.X421*

2.0 Units

Quality management (QM)—planning, assurance, and control—is a critical skill in today’s fast-paced business environment. In Quality Management for Enterprises, Products, and Programs, you will learn the widely adopted methodologies, such as Lean, Six-Sigma, and Continuous Improvement, which build successful outcomes. These are the techniques that produce organizational, product, and service excellence in corporations around the world.

You’ll have the opportunity to work with typical framework, analytical techniques, and underlying principles and receive guidance with quality standards setting, root-cause analysis, and tactical decision making.

Learning Outcomes

After successful completion of the course, students will

Gain understanding of the importance of QM for products or services and its relation to customers / stakeholders' satisfaction

Strengthen their knowledge of the essential components of a QM plan, and experience the process of identify quality standards and criteria, and how to ensure or inspect for them

Distinguish among the main Quality Improvement methodologies and choose the most appropriate for the given situation

Utilize the most common Quality Assurance and Controls tools, understand analytical techniques, and synthetize information to prompt action or resolution

Gain exposure to upcoming trends in data analytics and prescriptive Process Control

## *Quality Management Systems for Medical Devices: ISO 13485 and FDA Requirements | MEDD.X407*

2.5 Units

Through a series of lectures, interactive discussions and case studies, this course provides in-depth exposure to the fundamental concepts and major issues central to regulatory compliance in the medical device sector. The course emphasizes using the principles of the medical device quality system (QS) regulations and ISO 13485 as tools to take a process-oriented, risk-based approach to compliance, while achieving strategic business objectives in today's dynamic regulatory environment. You will learn about key processes in the quality system medical device regulation (21 CFR 820) and ISO 13485, while learning how to address noncompliance challenges from a practical standpoint. The instructor provides insight into implementing an effective CAPA system and using it as an improvement tool. The course also discusses current industry trends, FDA initiatives, best practices for interacting with regulatory agencies, and a brief overview of the FDA Quality System Inspection Technique (QSIT) and Medical Device Single Audit (MDSAP) programs.

Learning Outcomes

At the conclusion of the course, you should be able to Demonstrate how the "GXPs" interrelate with each other throughout the product life-cycle.

Understand the underlying concepts and principles of the FDA QSR and ISO 13485:2016

Update on how global initiatives are impacting the regulatory environment

Understand how the MDSAP (Medical Device Single Audit Program) is impacting global regulatory inspections

Identify and discuss non-compliances to the FDA QSR and ISO 13485:2016 through case studies

Conduct a critical analysis of a “real life” company and present findings to the class

Learn how to use the quality system as a tool to achieve strategic business objectives

Topics Include

"GXPs" and how they relate to each other

The FDA QS Regulation vs. ISO 13485, including updates to ISO 13485:2016

Regulatory intelligence resources

How to use principles of the FDA Quality System Regulation to critically analyze a real-world company

How to prepare and host regulatory inspections and use the quality system as a tool to achieve strategic business objectives

Additional Information

This course was formerly titled "Medical Device Quality Systems" & "Quality Systems for Medical Devices: FDA QSR and ISO 13485"

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 25 contact hours

Approved for 15 RAC recertification credits

## *Real-Time Embedded Systems Programming, Introduction | EMBD.X410*

3.0 Units

A real-time embedded system is designed to monitor and respond to external environments within a time deadline. A wide variety of devices that you see on the market today fall into this category - personal health and fitness trackers, smart thermostats, home security systems, and smart video cameras, to name a few. These systems interact with the environment using a variety of hardware and software interfaces. The embedded software manages these interfaces and makes sure that the tasks are accomplished within tight timing constraints. The Real Time Operating System (RTOS) on these devices is responsible for scheduling independent tasks and managing processes. This introductory course provides a foundation in the features and programming models of real-time embedded systems with hands-on learning. The course introduces the fundamentals of real-time scheduling and resource management protocols that are essential in designing and building commercial products and covers the use of RTOS to effectively design tasks and device drivers to meet real-time requirements. You'll learn

about important topics in real-time systems, such as priority-based real time scheduling, interrupt handling, using timers, and detecting and preventing deadlocks. The course will also discuss multi-threading, cooperative versus preemptive multi-tasking and inter-process communications, focusing on programming in FreeRTOS and understanding internals such as schedulers and idle tasks.

You'll design and code a real-time embedded systems project in C language on an open source FreeRTOS emulator. Upon completion of the course, you'll understand real-time embedded systems programming and the interactions of hardware, software, and the OS in such systems.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Explain the fundamental concepts of real-time embedded systems including various scheduling and resource management protocols

Explain the software architecture of a real time embedded application, the hardware/software interfaces, the RTOS foundation, and the multitasking based design needed to meet real time requirements of the system

Use the hardware interfaces that embedded applications typically need to work with

Explain the RTOS kernel, scheduling mechanisms, task management, interrupt management as well as IPC mechanisms

Design and program an embedded system application using a RTOS simulator

Compare and contrast existing commercial RTOS for performance and applicability

**Skills Needed:**

A strong background in C programming and an understanding of embedded system architecture.

## *Regulation of in vitro Diagnostics in Europe and the US | MEDD.X408*

2.5 Units

This course offers a comprehensive overview of the current European and U.S. Regulatory and Quality Affairs for in vitro diagnostic (IVD) products. You will gain a perspective on the critical elements of the regulatory requirements for obtaining IVD marketing approval. This course will take an extensive look into specific in vitro diagnostics topics and learn about the new and emerging regulatory requirements surrounding them. Learn about the impending transition for IVDs from the current European Directives (IVDD) to new substantially different European Regulations (IVDR), which will bring a majority of currently self-declared IVDs to require Notified Body involvement. Skills needed: "Quality Systems for Medical Devices: FDA QSR and ISO 13485" or working knowledge/experience in Quality Systems is needed. Learning Outcomes

At the conclusion of the course, you should be able to Discuss the current EU and US in vitro diagnostic device submission requirements

Explain the EU list based and risk-based method for classification of devices in the US and new EU IVDR

Understand how to create strategies to gain access to the current EU market

Define actions that can be taken at this time to prepare and facilitate transitions in conformity with the forthcoming European Regulations (IVDR)

Understand how to create strategies to gain access to the US markets

Discuss the critical elements and core principles for IVD device development

FDA’s jurisdiction in the design, testing, marketing and post-marketing of medical devices; risk assessment

Explain the regulatory requirements for in vitro diagnostics manufactured in European healthcare institutions

Explain the regulatory requirements for US laboratory developed tests (LDTs) and device manufacturer requirements for clinical laboratories

Describe the diagnostic tests and test systems requirements to be issued a CLIA certificate of waiver

Discuss the effects of regulation of IVD diagnostics in US clinical laboratories and EU healthcare institutions and its effect on the IVD device manufacturing industry

Topics Include

Intro to IVDs

IVD Submissions

IVD Product Development

Special Categories of IVDs

Current Topics in IVD Regulatory

Current Events in IVD Regulation - US and EU

Additional Information

This course will provide students with an understanding of the core elements in the in vitro diagnostic device industry. Topics will include a review of the European and US FDA regulatory frameworks, device classification system, routes to market, pre-market submissions, and post-market surveillance and change requirements. The regulatory approach will address the current requirements, future impending changes and what actions can be taken now to facilitate transitions. Application of quality system requirements as pertinent to IVD devices will also be covered. The course will be interactive,

with student participation required, and will consist of lectures and case studies/examples, with three exams and a brief paper with references on a relevant topic of the student's choice (approved in advance by the instructor).

## *Regulatory Affairs Certificate Completion Fee | O-CE0364*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the "Certificate Completion Fee" to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Regulatory Submissions: Devices and Diagnostics | REGL.X405*

2.5 Units

This course is designed to provide individuals with pragmatic knowledge of how to craft medical device submissions for approval by the FDA. Students should already have a foundation in medical device terminology, classification, and regulations prior to taking this course. Through lectures, case studies, and hands-on exercises, new and experienced regulatory professionals learn how to work with the regulations, guidance documents, and style guides to write portions of key medical device submissions that both comply with the requirements and are clear to the reviewers. Students explore the content and process of medical device submissions, as well as gain insight into timelines, important strategic considerations and business impacts.

Learning Outcomes

At the conclusion of the course, you should be able to Find the required regulations and guidance documents for device and diagnostic submissions

Use regulations and guidance documents to outline and construct a variety of device submissions

Appreciate the role that regulatory strategy play in the submissions process, for US device submissions

Topics Include

510(k)s: Traditional, special, abbreviated

PMA

Panel and Pre-submission preparation

Software, Artificial Intelligence, and Digital Health Submissions

Warning letter responses

eSTAR and ecopy submissions

Additional Information

In order to obtain maximal benefit, this hands-on course requires substantial out-of-class work on a submission project, where you will be crafting a 510K. Please plan your course schedules accordingly.

## *Relational Database Design and SQL Programming | DBDA.X415*

3.0 Units

Most business and technical data consists of multiple tables with interlocking relationships. Such databases must provide reliable storage, transaction management, access security and multi-user support. In this course, you will learn the concepts and design for a Relational Database Management System (RDBMS) and focus on the Structured Query Language (SQL) to define and manipulate data. The course covers how to create conceptual, logical and physical designs of relational databases in response to a set of user requirements. Instructions will be provided through the use of several case studies. You will learn design methodology, entity-relationship diagrams (ERD) and normalization principles. You will use an Oracle database to design the ERD and implement a working database. SQL is the query language used to access, maintain and share data with the relational database. You will learn methods for producing readable output, creating and manipulating tables and creating and managing constraints using SQL.

The concepts and SQL language learned here apply to all major RDBMS. You will gain understanding of the relational DB and have hands-on experience in creating database and working with data. The instructor recommends MySQL as an example database.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe a business or other activity in terms suitable for defining a relational database for that activity

Discuss and communicate database design and implementation with other practitioners

Compile the SQL code needed to create a database, as well as to insert, access and update the information in the database

Identify some of the key bottlenecks and deal with them

**Topics Include**

Relational database concepts

Entity-relationship model

Normalization

SQL basics

SQL functions and operators

Restriction and formatting

Sorting and aggregating data

Transaction management and stored procedures

Combining queries with set operators

Managing tables and database performance

**Skills Needed:**

Familiarity with general database concepts and ability to install software or databases on a personal computer.

## *Risk Management for Regulated Industries | MEDD.X409*

3.0 Units

This course discusses how risk management is applied in the medical device, biotechnology, pharmaceutical and in vitro diagnostic (IVD) industries. Lectures and workshops delve into risk management concepts and tools, including hazard identification, hazard analysis, fault tree analysis, failure modes and effects analysis (FMEA), Hazard Analysis and Critical Control Point (HACCP), mitigation application, regulatory requirements, the creation of risk management plans, reports and files, how to conduct Risk Management Reviews, and what might be audited in your Risk Management System. By the end of the course, you'll be able to conduct risk management for a variety of products, processes and services within the biomedical industries and beyond.

Learning Outcomes

At the conclusion of the course, you should be able to Develop an understanding of Risk Management as part of the product and process development cycle by defining a hazard, levels of risk, types of harm, and to rank risk mitigation activity

Prepare a Hazard Analysis including hazards, hazardous situations, harms, and understand risk estimation

Perform a HACCP (Hazard and Critical Control Points) analysis as a qualitative process hazard analysis for process risk management for any process

Assess the application and results that critical tools of quality such as a Failure Modes and Effects

Analysis and Fault Tree Analysis can provide

Compose and document mitigations to risk in a suitable regulatory format

Enumerate the fundamental documentation requirements of ISO 14971 (Medical Devices – application of risk management to medical devices)

Prepare a Risk Management Plan in a device, a pharmaceutical product, a diagnostic product, or a process, which describes the tasks involved in successfully leading an ISO Quality System implementation project from start-up through Registration

Apply structured qualitative and quantitative risk management concepts and tools leading to a documented Risk Management Plan and Risk Management File that can be used in any due diligence for reducing risk in product, process or service development

Topics Include

Risk Management

Annex A Characteristics

Hazard Analysis

Additional Information

Prerequisite(s): Students need to possess reasonable experience, background, and/or theoretical knowledge of medical devices, diagnostics or pharma. "Quality Systems for Medical Devices FDA QSR and ISO 13485" formerly titled "Medical Device Quality Systems" and "Introduction to Medical Device Regulation," or "Regulation of Medical Devices and Diagnostics," or "Medical Devices: Regulatory Strategies and Marketing Pathways," or equivalent experience.

## *Rust Programming Fundamentals | CMPR.X426*

3.0 Units

This comprehensive course provides an introduction to Rust programming, covering its core features and practical applications.

Students interested in writing efficient, concurrent, and interoperable code, will learn to set up the development environment, write and run programs, and explore built-in data types, operators, and control flow constructs. They will gain a deep understanding of memory safety, ownership, borrowing, error handling, and standard libraries.

Advanced topics such as thread programming, generics, and FFI will be explored. We'll compare Rust to other programming languages to understand its unique features and advantages.

Learning Outcomes

At the conclusion of the course, you should be able to

Analyze features and compare benefits of Rust and other programming languages to make informed decisions on language selection for specific use cases.

Create well-structured Rust programs, using built-in data types, operators, and control flow constructs

to solve programming problems.

Apply principles of memory safety, ownership, and borrowing to write code that is secure and efficiently minimizes potential memory-related issues.

Evaluate and use advanced Rust concept-thread programming, generics, and FFI-to develop concurrent and interoperable code for handling complex programming scenarios.

Employ error handling mechanisms, including Rust's robust features, to ensure proper program control, fault tolerance, and graceful error recovery.

Skills Needed

Programming experience in C/C++

## *Science of Clinical Trials Design | CTDM.X415*

2.5 Units

This course reviews the science that forms the basis of effective clinical trial design. You'll learn to classify and describe trial design by stage in drug and device development. The course covers the purposes of clinical trials, including types of trial designs. You'll learn to define hypotheses and study objectives and determine population and sample size.

Learning Outcomes

At the conclusion of the course, you should be able to List and describe the drug and device clinical trial phases

Describe various types of clinical trial designs and their application

Explain how goals and objectives of a clinical trial are established

Understand the basic statistical considerations in the design of clinical trials

Identify whether various scientifically sound trial designs can be effectively put into practice and potential pitfalls

Topics Include

Local standards of practice affecting clinical trials

Pharmacoeconomics

Working with marketing to identify unmet medical needs

Ethical considerations in clinical trial design

Additional Information

You'll gain hands-on experience designing clinical trials synopses and Phase 2 development strategies.

Professional Credit

CA BRN/LVN Credit - Provider #CEP13114

## *Science Play: Inquiry-Based Learning Made Easy | ECED.X317*

1.0 Units

Young children ask a lot of questions. They are naturally curious about the world around them. Through playful science activities, teachers of young children can leverage that curiosity to create inquiry-based learning investigations. This course explores how easy it is to design an inquiry-based investigation using hands-on experiments, games, puppet shows, story books, and more. Lesson plans, mathematics connections, and California learning foundations in science will be discussed in the broader context of early childhood education. Science Play will inspire you to expand your comfort with science education and feel confident teaching science while keeping it developmentally appropriate and highly engaging.

Educators will learn to design hands-on lessons and units that connect to general curricular topics incorporating circle time activities, puppet shows, literature connections, and ideas for extending investigations. You will also learn inquiry-based and emergent science curriculum development, including methods for teaching children to document their own experiments and observations, and ways to document and communicate classroom science learning for parents and colleagues. Grades are based on reflections, lesson plans, and class participation.

As a foundation for understanding science principles appropriate for the early childhood classroom, the course examines the California Preschool Learning Foundations in science, as well as science position statements from the National Science Teachers Association and the National Association for the Education of Young Children.

**Learning Outcomes:**

At the end of the course, students should be able to

Describe how young children engage in science practices

Discuss how adults can leverage children’s play in creating science investigations

Explain developmentally appropriate ways a child might demonstrate scientific understanding

Identify the California Science Learning Foundations for Preschool

## *Search Engine Marketing | MKTG.X410*

2.0 Units

Your web site is your marketing window to the world. But how will the world find you and will they stay once they arrive? How can you score better with search engines by having an active organic search (SEO) program? When does it pay to advertise online and use SEM/PPC campaigns? What are the options? How do I track spending and results? How do I use Social Media to improve my search engine rankings and what tools are available? Find answers to these questions and learn to create a complete and effective Web-marketing program.

This interactive, hands-on course employs live case studies and projects to explore the uses of blogs, micro-blogs, animation, videos and online competitions. Bring your own interactive marketing needs to class and learn first hand how to cut through the noise and promote your company and products online.

Search Engine Optimization: Gain as much as exposure as possible through organic search

Search Engine Marketing: Get results from pay-per-click and other ad programs

Using Social Media to help build your search marketing programs

Beyond Google and Bing: The other ways to win online

Measurement and analytics: Major tools and statistics

Lead tracking and conversion

Tie-ins with other marketing communication programs including integrating email, display and print

Learning Outcomes

At the conclusion of the course, you should be able to

Understand the underlying approach that search engines use to return search results

Be able to communicate with development team to accomplish best practices in organic search engine optimization

Understand the basics of the Google Ads advertising environment

Create and optimize your first Google Ads campaign

## *Semiconductor Design and Innovation Workshop Series: High-Precision GHz Op Amp Design | VLSI.800_W3*

0.3 CEU's

Welcome to our immersive Semiconductor Design and Innovation workshop series. During these sessions you will be introduced to new and established tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications.

Learning Outcomes

At the conclusion of the workshop, you should be able to

Describe and discuss the evolution of op amp design and its limitations.

Explain the new amplifier topology and its high-precision feedback.

Demonstrate an ability to properly and effectively analyze its impact on modern lab instruments.

Topics Include

Evolution of Operational Amplifier Design (uA 741 and beyond)

Limitations of Traditional Op Amp Architectures and Incremental Improvements

Advances in Semiconductor Processing and Frequency Response Limitations

Introduction of the New Amplifier Topology (Early 2000s)

High-Precision Feedback and GHz-Range Performance

Disruptive Impact on the Instrumentation Industry (Tektronix, Keysight, and Market Shifts)

Applications of the New Topology in Modern Low-Cost Lab Instruments

## *Semiconductor Design and Innovation Workshop Series: RISC-V: Understanding Computer Architecture | VLSI.800_W2*

0.3 CEU's

Welcome to our immersive Semiconductor Design and Innovation workshop series. During these sessions you will be introduced to new and established tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the workshop, you should be able to

Describe and discuss the architecture of RISC-V processors, their fundamental components, and how they compare to other instruction set architectures in modern computing systems.

Identify critical hardware and software components within a RISC-V system-on-chip design, including memory interfaces, peripherals, and the toolchain required for development.

Demonstrate an ability to properly and effectively design, implement, and debug custom RISC-V-based systems and understanding of the RISC-V industry trend.

**Topics Include**

The nature, history, and ongoing practices of RISC-V as a technology, and about RISC-V international organization

RISC-V Architecture and Components

Analyzing and modifying the RISC-V-core and memory hierarchy

As an open-source, extensible ISA, RISC-V is shaping the future of computing. The workshop introduces a commercial RISC-V system, covering theory, architecture, and technical aspects of the RISC-V ISA.

**Students are required to bring laptops for class exercises**

## *Semiconductor Design and Innovation Workshop Series: Timing Constraint Management for Modern System On Chip | VLSI.800_W1*

0.3 CEU's

Welcome to our immersive Semiconductor Design and Innovation workshop series. During these sessions you will be introduced to new and established EDA tools that will help you create and manipulate content in new and powerful ways. Each session is led by an industry expert who will guide you through the material and share its real-world implications. **Learning Outcomes**

At the conclusion of the course, you should be able to

Describe and discuss timing constraints and why this is critical knowledge as the industry works on the integration of millions of gates onto a single die. for instructors

Identify use cases where the burden on RTL, Physical Design, and timing engineer can be alleviated through an automated, correct-by-construction approach.

Demonstrate an ability to properly and effectively use the Timing Constraint Management tool to reduce time-to-market and improve design efficiency

**Students are required to bring laptops for class exercises**

## *Silicon Chip Design & Semiconductor Engineering Certificate Completion Fee | O-CE0186*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Software Engineering and Quality Certificate Completion Fee | O-CE0383*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *Software Quality Assurance and Testing | SEQA.X403*

2.0 Units

The requirements for high-quality, reliable, predictable software becomes increasingly necessary as its use continues to grow—both generally and in mission- or life-critical environments, as well as in the latest AI technology. As the software industry evolves, the need for qualified engineers trained in the principles, methodologies, techniques and tools of software quality assurance, software ethics, and data model accuracy for AI has also grown. This course presents the specifics of software quality assurance and software testing. The course also describes how these processes fit into the software development process, how ethics apply to software engineering and how software models are developed for AI. **Learning Outcomes**

At the conclusion of the course, you should be able to

Identify critical processes that instill quality assurance in the SW development life-cycle

Focus on Verification activities within software development

Explain various validation methodologies

Describe concepts of ethics related to AI and SW Engineering

Understand test tools

Understand SW Test terminology

Write a successful Systems Test Plan

Develop a Traceability matrix

### *Specialization for Administrative Professionals Completion Fee | O-CE0507*

Once all of the specialization requirements have been met and your final grades are posted, please access your Student Portal to enroll in the "Specialization for Administrative Professionals Completion Fee" to begin the review process. Please allow four to six weeks to receive your credential.

### *Specialization in AI Business Practices Completion Fee | O-CE0531*

Once all the requirements have been met and your final grades are posted, please enroll in the "Specialization in AI Business Practices Completion Fee" to begin the review process and pay the fee. Please allow four to six weeks to receive your Specialization certificate.

### *Specialization in AI Strategies, Productivity and Practices Completion Fee | O-CE0531*

Once all the requirements have been met and your final grades are posted, please enroll in the "Specialization in AI Strategies, Productivity and Practices Completion Fee" to begin the review process and pay the fee. Please allow four to six weeks to receive your Specialization certificate.

### *Specialization in Data Engineering Completion Fee | O-CE0530*

Once all the requirements have been met and your final grades are posted, please enroll in the "Specialization in Data Engineering Completion Fee" to begin the review process and pay the fee. Please allow four to six weeks to receive your Specialization certificate.

### *Specialization in Data Science Completion Fee | O-CE0529*

Once all the requirements have been met and your final grades are posted, please enroll in the "Specialization in Data Science Completion Fee" to begin the review process and pay the fee. Please allow four to six weeks to receive your Specialization certificate.

### *Specialization in DevOps and Virtualization Completion Fee | O-CE0518*

Once all the requirements have been met and your final grades are posted, please sign into your student portal to enroll in the "Specialization in DevOps and Virtualization Completion Fee" to begin the review process. Please allow four to six weeks to receive your credential.

### *Specialization in Java Development Completion Fee | O-CE0528*

Once all the requirements have been met and your final grades are posted, please enroll in the "Specialization in Java Development Completion Fee" to begin the review process and pay the fee. Please allow four to six weeks to receive your Specialization certificate.

### *Specialization in Lean-Agile Project Management Completion Fee | O-CE0508*

Once all of the specialization requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Specialization in Lean-Agile Project Management Completion Fee” to begin the review process. Please allow four to six weeks to receive your credential.

### *Specialization in Linux Development Completion Fee | O-CE0532*

Once all the requirements have been met and your final grades are posted, please enroll in the "Specialization in Linux Development Completion Fee” to begin the review process and pay the fee. Please allow four to six weeks to receive your Specialization certificate.

### *Specialization in Machine Learning with Python Completion Fee | O-CE0533*

Once all the requirements have been met and your final grades are posted, please enroll in the "Specialization in Machine Learning with Python” to begin the review process and pay the fee. Please allow four to six weeks to receive your Specialization certificate.

### *Specialization in Mobile Application Development Completion Fee | O-CE0500*

Once all the requirements have been met and your final grades are posted, please access your student portal to enroll in the 'Specialization in Mobile Application Development Completion Fee' to begin the review process. Please allow four to six weeks to receive your credential.

### *Specialization in Python Completion Fee | O-CE0509*

Once all the requirements have been met and your final grades are posted, please sign into your student portal to enroll in the “Python Specialization Completion Fee” to begin the review process. Please allow four to six weeks to receive your credential.

### *Statistics | BUSM.X406*

3.0 Units

This course explores the fundamentals of statistical methods and reasoning. Topics include descriptive methods, data gathering, probability, interval estimation, significance tests, one- and two-sample problems, categorical data analysis, correlation and regression. The instructor will demonstrate how to use spreadsheets and statistical software to analyze and interpret data. Real-world examples are drawn from a variety of fields including biology, business and marketing. While not too mathematically rigorous for the novice, the course provides some mathematical detail to illustrate basic concepts. No prior background in calculus or statistics is required.

Learning Outcomes

At the conclusion of the course, you should be able to

Create and interpret basic graphs to display sample data, such as histograms and bar charts.

Calculate key statistics (like averages, range, and spread) to summarize and understand data.

Analyze and interpret data using percentiles to understand how individual data points compare to the overall data set.

Solve problems involving common data patterns, including how to deal with data that follows a normal distribution.

Explain how to test data for important patterns, including how to use methods like hypothesis testing and regression to make predictions and draw conclusions.

Identify differences and relationships in data by using methods to compare groups and analyze data tables.

Topics Include

Orientation

Descriptive Statistics

Probability

Hypothesis Testing

Estimation

Inference about Two Populations

Correlation

The Chi Squared Distribution

ANOVA

Additional Information

This course is not calculus based and only a beginning to intermediate algebra level of mathematical ability is required.

## ***Strategies for Learning Differences in Mathematics | EDTH.X302***

3.0 Units

This course deals with two key areas of math learning: computation and problem solving. You will learn the background of “mathematics differences” and strategies for dealing with math anxiety, risk factors, and the importance of developing “number sense.” Important elements of mathematical reasoning will also be addressed, including the role of attention, memory, and language in math. You’ll learn the use of multisensory math and gain strategies for improving long-term and working memory capacity through case studies of students with math learning differences.

Learning Outcomes

At the conclusion of the course, you should be able to Identify risk factors for developing difficulties with math

Recognize specific behaviors presented by students who have difficulties with learning mathematics by using a numeracy screener

Researching and understanding a math topic in depth before teaching it

Preparing a series of math lessons on a topic of choice

Topics Include

Students with learning differences and math

Working Memory and Math

The Teaching of Operations

How Math Anxiety affects Learning

Notes

Students will need a student level membership for the Association of Educational Therapists to access the webinars recommended for viewing in the modules. A.E.T. Student Membership.

## ***Supply Chain Operations Management | BUSM.X419***

3.0 Units

Operations management involves designing, managing, and improving the set of activities that create products and services and deliver them to customers. The activities, along with the people, technology, knowledge, and procedures that dictate how work is organized, collectively form the operating system.

This course covers operations from a supply chain network perspective, helping students understand key processes and process thinking that manage the flow of products, services, and information.

In Supply Chain Operations Management, you will learn how supply chain partners and functional groups interact with each other as a supply chain network. We’ll cover inventory models, optimization using MS Excel's linear programming add-in, forecasting, aggregate planning, and quality tools. You will also learn the planning activities required to manage operations across the supply chain from the supplier to the customer and end user.

Learning Outcomes

Define supply management and its role in an organizational setting

Establish clear performance objectives and process measures by acknowledging the importance of quality management (QM) and the use of QM tools

Compare various process technologies applied to production and service operations

Discriminate between the requirements of push and pull manufacturing processes

Define the roles of aggregate planning, inventory models, MPS, MRP, ERP and scheduling

Topics include

Inventory management

Optimization using linear programming

Forecasting methods

Quality tools for improvement

Managing processes and capabilities—Six Sigma methodology

Planning and scheduling

Managing projects activities

Risk analysis and managing risk

Note

Course SCMT.X406 Supply Chain Operations Management and BUSM.X419 Supply Chain Operations Management is the same course. You only need to complete either SCMT.X406 OR BUSM.X419 to meet the requirement for the Business Administration Certificate.

## *System and Functional Verification Using UVM (Universal Verification Methodology) | VLSI.X410*

3.0 Units

Universal Verification Methodology (UVM) is the industry standard for functional verification methodology developed by key EDA vendors and industry leaders. It uses a SystemVerilog-based, OOP-centric approach to improve interoperability and code reusability. In this course, you will use the

OOP testbench knowledge learned earlier to create a full-fledged, flexible verification environment for solving today's increasingly complex functional verification challenges. You will also gain real-world, hands-on experience developing an industrial-strength UVM-based testbench that is layered, interoperable, constrained-random, and coverage-driven. The course introduces the UVM architecture; its core set of base-classes and utility methods, and associated factory automation techniques. This framework forms the basic building blocks that facilitate the development of layered, modular, scalable, and reusable verification environments in SystemVerilog. You will be immersed in the practical application and deployment of UVM base-classes, understand their role in the verification environment to reduce design time and risks, as well as increasing quality and efficiency. The main base-classes covered are the UVM test classes, sequence classes, component classes, messaging and reporting mechanism, factory, configuration database, transaction-level modeling (TLM), scoreboarding, coverage and phasing mechanism. You will learn the power of UVM for successfully designing complex constraint-random coverage driven verification projects.

Concepts introduced in class are reinforced in the lab. In addition to in-class hands-on labs and weekly take-home assignments, you'll work on a project to build an advanced UVM verification environment for a selected application with transaction-level and layered architecture. You will form a project team, create a test plan, develop a UVM-based verification environment, perform functional coverage, and submit a complete project report.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Understand the UVM hierarchies and various components needed to build a comprehensive UVM Testbench

Design and implement various testbench components, such as driver, monitor, sequencer, agent, environment, scoreboard, coverage, and environment

Understand the configuration databases, factory override, Transaction Level Modeling (TLM)

Understand virtual sequences and virtual sequencers

Build a framework for UVM Testbench

**Skills Needed:**

Students should have experience with object-oriented programming, C/C++, or have taken "Advanced Verification with SystemVerilog OOP Testbench" course. Prerequisite topics will not be repeated here. Hardware verification experience is helpful.

## *SystemVerilog Assertions and Formal Verification | VLSI.X411*

3.0 Units

Technologies like machine learning, autonomous driving, IoT, and cloud computing are ushering a new era of chip design with innovative architectures and advanced process nodes. With billions of dollars at

stake, the race to be first-to-market is putting new challenges on the chip design and verification community.

In this course, you will be introduced to SystemVerilog (1800-2017 IEEE standard), a unified hardware design, specification and verification language that is being rapidly adopted by chip designers and verification teams to boost productivity and ensure first-pass silicon success. While it's based on Verilog and some extensions, the SystemVerilog language improvements include enhanced scheduling semantics, rich data types, interfaces with emphasis on assertions, and formal verification—all covered in this course.

You will also be introduced to SystemVerilog Assertion (SVA) concepts and syntax, using small examples and realistic design protocols. You will learn about immediate and concurrent assertions, their differences and use cases, and how to write assertions for formal verification. In the second part of the course covering formal verification theory, students will run the formal tool, debug a counter-example, and learn the refinement process.

This is a lab-based course giving you the opportunity to dive into key topics in detail—from language constructs to assertion coding guidelines that include practical examples of how to use assertions in verification. Students will also learn methodology choices and assertions in a formal context. The course provides hands-on exercises using assertions in simulation (VCS) and formal verification (VC-Formal).

**Learning Outcomes**

At the conclusion of the course, you should be able to

Understand SystemVerilog data types, interfaces and their use cases

Understand the role of Assertions in the verification process

Identify functional blocks appropriate for verifying using SystemVerilog assertions

Create an Assertion test plan based on specifications

Write assertions for the given design specs and run them in simulation

Run SystemVerilog assertions using formal verification tool and analyze results

Be familiar with Formal verification Apps use models and applications

## *System Virtualization Fundamentals | LINX.X417*

2.5 Units

Virtualization is a fundamental technology underlying most modern computer systems and networks, yet little understood by many in industry. Virtualization products are now being applied at the network level, in storage infrastructure, and for virtualized operating systems. They are helping to meet critical IT goals such as cost reduction, productivity, scalability, and cloud computing. This course builds the foundation skills that IT and engineering professionals need to make use of this important technology. The course covers virtualization at various levels. For computer systems, it includes hardware

virtualization and support for Hypervisors. For network virtualization, it addresses virtual LANs, virtual SANs, WAN acceleration, network access control, server load balancing and firewall virtualization. In the area of storage virtualization, discussions cover basic concepts and deployment at the device block level, file system level, and more. Licensing issues arising from virtualization are also covered. You will learn the basic concepts of virtualization and how it is applied to CPUs and operating systems, networks, and storage systems.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe general virtualization concepts and their applications to various areas of computing

Discuss the working principles of several commercial virtualization products in the area of storage, networking, and licensing

Explain the principles of software and hardware hypervisors

Explain how virtualization has been applied to networking and the storage fields

Explain how virtualization affects other areas like licensing, backups, and disaster recovery

Identify the advantages and disadvantages of virtualization at various levels and in different areas

**Topics Include**

History of virtualization

Software virtualization

Hardware virtualization: Hypervisors and CPU support for hypervisors

Network virtualization: Load balancing, WAN acceleration, Firewalls, Network access control

Storage virtualization: File system level, Data block level

Other topics of interest: Licensing and virtualization, Data de-duplication and backups, Disaster recovery

**Skills Needed:**

A basic understanding of storage systems and networking concepts.

## *Techniques of Educational Therapy: Affective, Cognitive and Perceptual Elements | EDTH.X305*

3.0 Units

This course explores the fundamental cognitive processes that are necessary for learning to occur at maximum capacity. These include motor, auditory, visual, visual motor integration and verbal processing areas. The course will also include how to increase the functionality of these areas as well as attending skills. The "affect" of learning or how the student feels about himself in terms of academic performance will also be addressed. We review possible scenarios of client experiences and how to support their learning.

Learning Outcomes

At the conclusion of the course, you should be able to Understand the importance of – and how to use – current research to use and develop techniques of skill remediation as an educational therapist

Review and demonstrate a general understanding of theoretical learning theories and how they relate to different types of learning conditions

Demonstrate general understanding of how emotions can be a significant factor to the remediation of skills, skill performance, and academic esteem.

Understand how beliefs, emotions, and sensitivity can affect clients, parents, and institutions.

Review other conditions that affect the development of academic skills and performance

Identify the important components of a multi-sensory remediation program involving academic affect and cognitive processing remediation.

Understand the variations and adaptability of a variety of current programs in academic affect and educational therapy

Apply appropriate materials and strategies for remediation of processing and affect areas

Possess a basic understanding of the kinds and justifications of accommodations, modifications, & strategies that can be useful for processing and affect issues

Analyze data gathered by Scholastic testing, psychoeducational assessment, parent and teacher questionnaire forms, and review of history to generate an educational therapy remediation program that will meet the specific needs of the client. Topics Include

Developing an Educational Therapy Plan

Techniques for Developing Academic Affect

Modifications for the Classroom and the Home Environment

Additional Information

It is highly recommended that students find partners outside of class to work with to develop the activities based on concepts that are discussed in class. Reading will be assigned at first class. During this course, many objectives will be covered. Due to this large amount of information, concentration of certain topics may be altered to fit time constraints.

## *Technology in Schools, Introduction (SB 2042 Standard 11) | EDUC.XSC209*

2.0 Units

This course introduces K-12 teacher candidates to current technologies that enhance the classroom and learning experience. You will learn to leverage new modalities to communicate with students, parents, colleagues, and administration; design technology-integrated instructional activities; gain insight into related legal and ethical issues; and practice with various technologies for instruction and assessment. By the end of the course, you'll have a toolkit of technology resources and strategies to benefit your classroom. This course meets the SB 2042 Level 1 technology requirement (Standard 11) for teacher preparation.

The goal of this course is to lay a foundation of educational technology pedagogy. In order to increase knowledge around available educational technology resources. This course aims to make learning practical and applicable- starting with your classroom reality and personal comfort level with technology. The course objectives also satisfy the state technology requirement for your credential.

EDUC.XSC209 is worth 2 CEUs, which equals 20 hours of “in-class instruction” and participation, not including homework time. The course workload has been calibrated to meet, but not exceed these parameters. The instructor reserves the right to make slight adjustments to the course schedule to best meet the needs of the students.

Learning Outcomes

At the conclusion of the course, you should be able to Use computer-based technology appropriately to facilitate the teaching and learning process in a school setting. (TPEs 1, 2, 3, 4, 5, & 6)

Gain technology competence as defined in "Standards 1:4, 3:6, 4:4, 4:8, 5:4 and 6:6 -- California Commission on Teacher Credentialing (CCTC) 2018.

Demonstrate knowledge of current basic computer hardware, software and terminology, and the use of digital tools and learning technologies across learning environments. (TPE 4:4 & 6:6)

Select and evaluate a wide array of technologies for effective use in relation to an established curriculum. (TPEs 3:6, 3:7, 4:4 & 5:4)

Demonstrate knowledge and understanding of the appropriate use of computer-based technology for information collection, analysis, and management in the instructional setting. (TPEs: 3:6, 3:7, 4:4, 5:4 & 6:6)

Demonstrate knowledge and understanding of some of the legal and ethical issues concerned with the use of technology. (TPE 3:7 & 6:6)

Topics Include

EdTech Pedagogy and Selecting Technology in the Classroom

Technology Tools for 21st Century Teaching and Learning

Digital Citizenship and Literacy

Technology to Differentiate Instruction

Preparing Technology Enhanced Lessons in The Classroom

Additional Information

This course is delivered online via Canvas. The course is designed to be completed asynchronously and can be self-paced and accelerated based on student proficiency levels. By keeping pace with the course outline, students can ensure that they will complete all deliverables on a timely basis with minimal procrastination and stress. Students will also be able to contribute and collaborate more fully with our community of learners.

Assignments are completed over 6-weeks. This course moves fast and it is imperative that you keep up with your assignments.

Please note that there are a variety of assignments and it is important to pay careful attention to each assignment due date as they may vary. No matter the date, all assignments are due by 11:59 pm Pacific Standard Time.

Students are expected to login to Canvas and check their email daily. Students are expected to communicate with their professor and peers with respect at all times.

Participants will also need to have a (free) google account. A significant number of the activities will be using the Google Suite for Education apps, since that is what is freely available in the majority of schools, and a google account is needed for access.

## ***The Business of AI | AISV.800***

1.5 CEU's

The demand for artificial intelligence (AI) technologies in industry has grown 270 percent in just four years creating huge job opportunities for the people who understand the technology as well as the developing business impact of such disruption. This course is not just for software engineers. In a hands-on, workshop-style environment, students will explore the future of AI and its potential on organizational levels.

You will focus on:

Understanding the business and managerial implications of AI

Becoming better at using AI technologies

Learning to successfully integrate AI into your organization.

We will start by demystifying AI with an introduction to the technology, including an overview of machine learning (ML), deep learning (DL), neuro-linguistic programming (NLP), and autonomous systems. We will review definitions and buzzwords; the hype vs. reality; and the evolution of key AI technologies.

A survey of how enterprises are using AI will help you identify opportunities in your own companies. You will gain exposure to AI applications across functional areas, including:

The workflow of an AI project-from proof of concept to production

The importance of data

The skills needed for AI

A map of AI tools, infrastructure, and frameworks

Learning Outcomes

At the conclusion of the course, you should be able to

Distinguish AI hype from reality in industry and diverse markets

Leverage AI in business strategy to unlock new opportunities, differentiate and innovate

Identify opportunities to apply AI in your own business or a use-case to deliver tangible business value and outcomes

Navigate ethical and societal implications of AI and enterprise AI governance

Describe successful AI delivery organizations with business stakeholders

Summarize the AI project implementation lifecycle

Create an enterprise AI program end-to-end implementation to gain an operational view of an AI project

Topics

Topics also include the economics of AI technologies and business models, as well as risks and regulatory compliance. You will explore an AI transformation playbook and learn how AI can be integrated into business functions through rich case studies and an AI-first strategy. Ethical, legal, and economic implications will be covered for business strategy and society as well as AI's impact on work and trends in the labor market.

Finally, the future of work will be discussed, its changing nature, the balance between people and

machines and the training, reskilling, and retention of needed talent.

By the end of this course, you will be able to create a business roadmap for implementation of AI in your specific domain areas.

## *The Internet of Things: Big Data Processing and Analytics | EMBD.X412*

3.0 Units

How are you harnessing the immense amount of data embedded inside The Internet of Things (IoT)? This phenomenon promises many new technological innovations and business benefits. The prospect of connecting potentially millions or even billions of embedded devices, sensors, appliances and other data-collecting gear to the cloud is daunting yet exciting. It requires new processes and tools for collecting and processing IoT big data and analyzing the device information to glean insights embedded within vast amounts of data. Discover how to transform this data deluge into actionable insights by using state-of-the-art AI and machine learning techniques, and by utilizing modern big data processing tools. The course first defines IoT and why IoT data processing is very different from typical big data analytics, with its unique requirements for data security, device identity, huge data volume, and real-time processing. The course reviews the challenges and current architectures of IoT data collection to the cloud. Using a hands-on approach in Amazon Web Services (AWS) with simulated data, you will learn to build a messaging and data streaming system with Apache Spark and Kafka. You will explore current IoT architectures and learn how to build robust data pipelines that can handle the scale and complexity of IoT data.

You will work with simulated and real IoT device data, designing and implementing your own data flows to extract valuable business intelligence. The course provides a deep dive into industrial practices of IoT big data processing and analytics, with a focus on practical application of tools and frameworks.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe characteristics and requirements of IoT specific data

Demonstrate how to build a data flow to connect an IoT system or device data to the cloud in specific formats

Explain how to use big data tools to process IoT data in distributed computing

Employ algorithms (including Kafka data stream processing and machine learning) to analyze IoT data patterns and extract intelligence

**Skills Needed:**

Software installation and some programming experience in C, Java or Python (one of the three) is required.

## *Timing Closure in Silicon IC Design | VLSI.X414*

3.0 Units

As transistor technology becomes increasingly complex in the sub-nanometer process, the timing signoff of designs such as ASIC, FPGA, GPU, and SoC becomes more challenging.

In this course, you will learn industry-standard timing methodologies and techniques used during design implementation to achieve targeted clock frequency and ensure manufacturing yield of successful silicon.

The course begins with foundational concepts, including transistor topology, delay modeling through digital gates, and setup and hold characterization. You will gain hands-on exposure to clock constraints, exceptions, and what-if analysis, and learn how to address timing violations in ECO (Engineering Change Order) mode.

Advanced topics include signal integrity (SI) analysis and prevention, process variations, hierarchical and flat analysis, and STA (Static Timing Analysis) margin. The instructor will share practical examples of block-level and full-chip timing closure, budgeting, and debugging skills. Students will also explore EDA tools and practice with small test cases.

By the end of the course, design engineers will be able to perform static timing analysis using PrimeTime, Genus, OpenROAD, or any other STA tool during multiple phases of design implementation.

**Learning Outcomes**

At the conclusion of the course, you should be able to:

Analyze and characterize delays in combinational & sequential circuits

Discuss in-depth knowledge of static timing analysis

Write and debug constraints

Drive timing closure for block or chip

Write ECOs

Explain how to fix critical timing paths

Define terms such as PVTs, OCV, CRPR, crosstalk, CDC, etc.

**Skills Needed:**

Linux/Unix skills are required for lab exercises.

## *Understanding Learning Differences | EDTH.X309*

3.0 Units

This course helps professional educators, counselors, educational therapists, and parents understand learning differences. Current theories on neurological processing, attention and memory are presented. Through case studies, discussion, video and lecture, participants learn to identify the signs of autism, Asperger's Syndrome, nonverbal learning disorder, learning disability and attention deficit disorder, as they relate to learning tasks.

Learning Outcomes

At the conclusion of the course, you should be able to Identify characteristics and symptoms of various learning differences with emphasis on Dyslexia, ADHD, Mathematics learning difficulties, and the Autism Spectrum.

Learn about common Processing Disorders such as Visual and Auditory Perception among others.

Describe the essential components of Special Education Law as it relates to Accommodations and Modifications in the classroom.

Identify Evaluation and Assessment tools used for providing Resource services.

Topics Include

Neuroplasticity

Introduction to Learning Differences

Processing Differences, ADHD and Executive Functioning

Reading, Math, and Dyslexia

Autism Spectrum and Social Cognition

Learning Differences and Social Justice

## *User Experience and Web Design Certificate Completion Fee | O-CE0613*

Once all of the certificate requirements have been met and your final grades are posted, please access your Student Portal to enroll in the “Certificate Completion Fee” to begin the review process. Please allow 4-6 weeks to receive your certificate.

## *User Experience Design, Advanced | UEWD.X415*

3.0 Units

This follow-up to “User Experience Design Fundamentals” covers new design methods and offers

hands-on practice. In addition to understanding the UX design principles and processes at a greater depth, advanced practitioners also have to engage users for research, use tools to communicate design, as well as carry out the design in a collaborative product development environment. If you want to take your design skills to the next level and practice advanced techniques in user experience design, this is the course for you. The course focuses on application of the design methodologies and design strategies, from concept development to prototyping, including user research and design presentations. The goal of this course is to get you ready to take real-world UX design challenges and master industry practices in interaction design, visual design and information design, including DOs and DON'Ts. You will also learn how to apply human cognitive principles in design. The course will expose you to design & prototyping tools to create effective and pleasing user experiences. The course includes techniques for team collaboration, UX design presentation, documentation, and effective codification, as commonly practiced with clients and in corporations.

You will work on individual and team projects while sharpening your UX design skills and knowledge, while receiving feedback from the class. Projects may include websites, software applications, or product interfaces. The course will also provide guidance in establishing a UX design portfolio.

Learning Outcomes

At the conclusion of the course, you should be able to Select and use design tools appropriately

Practice appropriate research techniques Apply learnings from cognitive psychology Select and use design methods effectively Collaborate as designers in a team Apply global design principles across domains Present and share their work with others Clearly codify and document their design ideas and solutions Topics Include

Design Thinking

Design Methods and Strategies

Applying Design Principles

Research Methods

Working knowledge of:

An image processing and/or drawing application (e.g. Adobe Illustrator, Google Drawings, OmniGraffle, Sketch, or a similar program) is required. The drawing is to communicate product design in high fidelity graphics.

Additional Information

Students should have completed the prerequisite course, or have at least two years of work experience in the field.

Participants will also be exposed to a deep library of resources and tools for later reference and use.

## *User Experience Design Fundamentals | UEWD.X414*

3.0 Units

User experience design is a major factor in creating winning industry products. Design-driven businesses and products have a higher chance of succeeding in the marketplace. This course focuses on using user-centered design strategies and methods to create highly effective, pleasurable, and usable products while meeting business goals and objectives. The knowledge gained in this course directly applies to creating great user experiences for Web sites, Web applications, software as well as user-interfaces of many other products. The course will also expose you to the multidisciplinary nature of the user experience design process, design thinking, and the steps you can take to succeed. The course covers methods and strategies of six overlapping phases: problem identification, information collection, idea generation, prototyping, evaluation/testing, and implementation.

You will practice with assignments and through team discussions. Some assignments require high-fidelity design of Web applications.

Learning Outcomes

At the conclusion of the course, you should be able to Apply the User Centered Design process with respect to creating web sites and applications

Develop a reasonable library of design methods and strategies including a design "vocabulary".

Analyze the business needs of a website

Develop a design that will enable users to accomplish their goals at the website

Topics Include

Knowing the User, Intelligence Gathering

Idea Generation Methods and Strategies in Design

Application of Design Principles

Evaluating Prototypes, Iterations, User-Research

Working knowledge of:

Drawing applications (e.g. Adobe Illustrator, Fireworks, Google Drawings, OmiGraffle, Sketch, or a similar program). You will need access and some experience using.

Image processing applications such as Adobe Photoshop and ability to draw flowcharts and basic visual elements are highly recommended. The drawing is to communicate product design in high fidelity graphics.

## *User Research and Analysis | UEWD.X424*

2.0 Units

This course provides an in-depth understanding of user research and analysis techniques essential for designing user-centered products and services. Students will learn various user research methods with emphasis placed on real-world applications and developing actionable insights for iterative product design. **Learning Outcomes**

At the conclusion of the course, you should be able to

Explain the principles and importance of user research.

Design and conduct user research studies using various methods.

Analyze and interpret user data to inform design decisions.

Communicate research findings effectively to stakeholders for enhancement of user experience across all phases of the product development lifecycle.

**Topics Include**

Role of user research in the UX design process

Research project planning and scoping

User interviews and usability testing

Persona development and journey mapping

Stakeholder communication and reporting

## *Validating Software for Medical Devices and Emerging Technologies | MEDD.X410*

2.0 Units

With the increasing number of medical devices running on software, there is an enormous demand for quality assurance and regulatory affairs professionals who can address the validation, documentation, compliance and submission requirements unique to software-controlled devices. This how-to course covers the requirements for validation for all types of software, including Class II and III embedded medical device software, digital health apps, software as a medical device, medical device data systems, manufacturing software, automated test software, process software, quality system software, and spreadsheets. Students engage in interactive classroom discussions and an in-depth survey of the regulations, guidance documents and standards specific to medical device software and validation.

You will work on a project designed to help you determine software level of concern, define a software validation strategy, write a software validation plan, create software validation test procedures and test cases, and write a software validation report. Overall, you will learn how to create these types of documents and activities while also learning the regulatory requirements and expectations for software used in the medical device industry.

Learning Outcomes

At the conclusion of the course, you should be able to Identify the different types of software regulated by the FDA and interpret the latest FDA regulations, guidelines and International standards applicable to medical device software

Discuss software level of concern and use it to focus validation activities and develop an appropriate validation strategy

Explain the different requirements for validation of device, manufacturing & quality system software and discuss how to differentiate between verification and validation in software testing

Create a software validation plan, test procedure and software validation report that documents software validation activities and complies with regulatory requirements

Topics Include

FDA Regulated Software, Regulations, Guidance Documents and International Standards

Detailed look at IEC 62304

Software Validation Planning and Strategy

Digital Health

Additional Information

Most required tools and materials are available on the FDA website for free.

## *Value-Added Quality Audits | REGL.X407*

1.5 Units

In today's dynamic business environment, every aspect of an organization needs to perform value-added activities that have a positive impact on the bottom line. Regulatory and quality units in more and more biomedical industry corporations are relying on quality audits as a means to improve operations. By auditing domestic and international quality system regulations (GXP, QSR and ISO), these organizations are assessing and improving the effectiveness of their internal systems and those of their suppliers and corporate partners. This hands-on course introduces participants to fundamental auditing principles and techniques including planning, conducting, analyzing, and communicating audit results in terms that are meaningful to senior managers. By understanding the psychology of audits and practicing questioning techniques, participants will take their organization's quality audit program to another level. Learning Outcomes

At the conclusion of the course, you should be able to Explain how audits can help an organization achieve its strategic business objectives

Provide a brief overview of the audit process

Understand the psychology of audits

Learn different ways of using questioning techniques to make the audits “value added”

Understand, communicate and present non-conformances to 21 CFR 820 in a simulated audit setting

Understand the MDSAP audit model

Topics Include

Anatomy of the Audit Process

Attributes of a Good Auditor

Auditor Strategies

The Communication Process

Additional Information

Most of the class materials provided via Canvas

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 15 contact hours

## *Viruses, Vaccines and Antiviral Therapy | BTEC.X413*

2.0 Units

Not since the great Spanish flu pandemic at the end of World War I, estimated to have taken the lives of 50–100 million people, have humans experienced an infectious disease threat like the current coronavirus pandemic. In the last decade we have seen outbreaks of Zika and Ebola viruses, as well as an increased frequency in other dangerous viral infections.

In this comprehensive virology course, designed to prepare people for career advancement in both clinical and biopharmaceutical roles, students will have the opportunity to study coronavirus biology and learn about the status of drugs and vaccines being developed to target SARS-CoV-2. We will learn about past viral pandemics, such as influenza, smallpox, and polio and examine how viruses replicate in human hosts, spread in human populations, and alter human history.

Learning Outcomes

At the conclusion of the course, you should be able to Appreciate viruses as a part of our natural environment.

Obtain a sense of the complex dynamics between viruses and their hosts.

Recognize how viruses employ different strategies to multiply and spread from human to human.

Understand the impact of viral diseases on human health and society (i.e., how viral disease has impacted human history).

Learn what can be done to prevent and treat common viral infections and understand the benefits and risks associated with virus vaccines and antiviral drugs.

Have sufficient knowledge to contribute to current discussions about viruses affecting human populations today (e.g., COVID-19, Ebola, West Nile, Dengue, and Chikungunya viruses).

Topics Include

Recent developments in molecular biology and genetics that have been instrumental in developing viral vaccines and antiviral drugs.

How viruses cause disease (pathogenesis).

The relationship between viruses and cancer.

Host defense mechanisms.

The influence of climate change on emerging viral diseases.

The role viruses play in gene therapy and gene editing as well as treating cancer and bacterial infection.

The problem of antiviral drug resistance.

How to effectively use antiviral drugs to treat viral disease.

Emerging viruses.

The risks and benefits of viral vaccines.

The polio eradication campaign.

The epidemiology of influenza virus.

The challenges of developing an HIV-1 vaccine.

Working knowledge of:

Molecular biology or the desire to appreciate the significance of viruses in real-world settings is sufficient for this course

Additional Information

Course evaluation consists of a take home exam and an independent writing assignment. Some

knowledge of molecular biology is useful, although a desire to appreciate the significance of viruses in real-world events is sufficient. This course will benefit individuals preparing for career advancement in both clinical and industry roles.

Professional Credit

UCSC EXTENSION Approved by the California Board of Registered Nursing, Provider Number 13114, for 20 contact hours

## *Web and Mobile Analytics | MKTG.X412*

2.0 Units

With the explosive growth of online business transactions, Web and mobile analytics play an important role in understanding and optimizing customer reach and growth. Unlike off-line business models, to compete in the digital global economy, organizations need to employ agile digital marketing techniques that can continuously adapt to customer needs. This is a hands-on class full of real-life examples to work through.

Learning Outcomes

At the conclusion of the course, you should be able to

Define metrics that help capture customer experience in Web and mobile environments

Learn how to work with big customer profiling data using cutting edge machine learning turn-key solutions (R packages, Python libraries - no programming needed)

Use tools such as Google Analytics, Tableau, Gephi, and others to derive patterns and predict possible outcomes

Create reports and infographics that help understand micro and macro levers that can be used to iteratively improve your marketing campaign

## *Web Applications Testing, Comprehensive | SEQA.X405*

3.0 Units

With the complexity of distributed architectures, dynamic environments and diverse user bases, testing web applications requires specialized skills. This course offers essential knowledge for testing Web apps and services, focusing on client-side testing for quality assurance across platforms and browsers.

The course begins with an introduction to the basic structure and components of modern Web applications. It covers key architectural patterns (like client-server, microservices, and serverless architecture) and the flow of data within web apps. Using an example of a feature in a large Web application, you will learn to develop a test plan and test cases that can be executed automatically. The course covers three aspects of Web testing: UI, Web services, and load/performance. You will use the Selenium tool to interact with browsers and to automate UI testing. The course also covers setting up test environments, and using open source tools to test Web application performance, along with an introduction to behavior driven testing. The course concludes with continuous integration, continuous

development concepts, and security testing.

The course employs open source and free tools to practice the various aspects of Web testing. Students are required to bring laptops to class and install tools on their own computers.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe how the web works and what are the challenges in testing web based software

Develop test plans for a feature or entire web site

Use selenium webdriver to develop automated tests

Explain and test REST based web services

Implement performance and load testing for web sites

Explain the basics of continuous testing, security testing

**Skills Needed:** Experience working with Python and HTML. JavaScript and Networking protocols such as TCP/IP required.

## *Wireless Infrastructure: from Antenna Design to 5G, Fundamentals | EMBD.X419*

3.0 Units

This course has a fundamentals based approach, designed to give students the knowledge and skills they need in a competitive job market covering wireless communications and standards, in particular 5G, as well as antenna and transceiver design principles and practices for mobile devices.

The course briefly reviews amplitude modulation (AM) and frequency modulation (FM), which are essential in understanding IQ modulation used in virtually all modern radios (WiFi, OFDM, CDMA, TDMA, 4g, 5g, etc.). Building on these fundamentals, the course examines the industry's digital wireless standards, including but not limited to IS-136, IS-95, Bluetooth, 4G, 5G, 802.11(a, g, n), and long term evolution (LTE).

It is equally important to understand antenna design and here you will learn about antenna trade-off considerations for cellphones, Bluetooth, and WiFi, including antenna size versus range on various configurations, dipoles, dish, beams, phase arrays, and slotted antennas. The course will analyze the practical designs used in the Apple iPhone and Samsung Galaxy. Instruction emphasizes an intuitive understanding of the fundamentals, rather than complex mathematics, and industry insights from an experienced professional.

**Learning Outcomes**

At the conclusion of the course, you should be able to

Describe legacy receiver and transmitter architectures

Explain the fundamentals of AM and FM modulation both from a receiver and transmitter

Discuss contemporary digital modulation techniques such as QAM, TDMA, CDMA, GSM, and OFDM as used in 5G

Demonstrate Phase Lock Loops: how they work and how they are used in today’s radios

Describe in detail modern antennas used in cell phones, wifi etc. design of multi band single feed antennas

Evaluate transmission standards

**Skills Needed:**

A general background in electrical engineering and networking.

## *Workplace Conflict Resolution and Mediation | HRMT.X419*

1.5 Units

In today's dynamic and diverse professional landscape, effective conflict resolution skills are essential for fostering a harmonious and productive work environment. Within this introductory course, designed specifically for working professionals, you'll gain insights into handling employee's interpersonal conflicts. You'll also learn techniques to support your staff to effectively resolve workplace and group conflicts.

We will explore conflict resolution and mediation approaches to identify the most effective interventions to facilitate employee conflict resolution. Through a combination of engaging lectures, interactive discussions and practical exercises, you’ll acquire essential skills to effectively manage conflicts.

This course is ideal for managers, team leaders, human resource professionals, project managers, and anyone interested in fostering a healthier, more collaborative work environment.

Learning Outcomes

Identify and understand different perspectives and approaches to the study of workplace conflict

Understand the role conflict management techniques and how mediation plays in the resolution of disputes

Identify and implement strategies for preventing or defusing rising conflict

Recognize how mediator and party biases and cultural differences can affect the resolution process

Understand the mediation process when participating in a EEOC mediation

Topics Include

Core concepts of workplace conflict

De-escalation mediation techniques

The role of confidentiality in the process

How to prepare to conduct conflict resolution meetings with parties involved in workplace conflict

Professional Credit

SHRM-CP® or SHRM-SCP® 16.5 PDCs.