

# COMPUTER INFORMATION SYSTEMS

DIVISION: Business and Applied Technology

The Computer Information Systems discipline offers a great way for you to change your career or to start a new one in a technology related field. Our programs will teach you how to practically implement technology and technology solutions in businesses and online.

In our Certificate of Achievement and AS Degree programs, you will learn the foundational skills needed to find employment in fields of computer information systems, with the opportunity to specialize in programming, IT support, and Microsoft Enterprise System Administration. We are a Cisco Networking Academy Certified program. Additionally, we offer several different Occupational Skills Certificates where you can develop skills unique to particular jobs in IT. Our courses also prepare you to test for industry credentials that are widely respected in the field.

- CCNP Routing & Switching Preparation – Occupational Skills Certificate (<https://curriculum.pasadena.edu/academic-programs/computer-information-systems/ccnp-routing-switching-preparation-occupational-skills-cert/>)
- CISCO Enterprise Network Associate – Occupational Skills Certificate (<https://curriculum.pasadena.edu/academic-programs/computer-information-systems/cisco-enterprise-network-associate-occupational-skills-cert/>)
- Computer Information Systems - Help Desk/User Support - Associate in Science Degree, Certificate of Achievement (<https://curriculum.pasadena.edu/academic-programs/computer-information-systems/computer-information-systems-help-deskuser-support-as-cert-achievement/>)
- Computer Information Systems – Computer Retail Sales & Support – Associate in Science Degree, Certificate of Achievement (<https://curriculum.pasadena.edu/academic-programs/computer-information-systems/computer-information-systems-computer-retail-sales-support-as-cert-achievement/>)
- Computer Information Systems – Cybersecurity – Associate in Science Degree, Certificate of Achievement (<https://curriculum.pasadena.edu/academic-programs/computer-information-systems/computer-information-systems-cybersecurity-as-cert-achievement/>)
- Computer Information Systems – Full Stack Web Development – Associate in Science Degree, Certificate of Achievement (<https://curriculum.pasadena.edu/academic-programs/computer-information-systems/computer-information-systems-full-stack-web-development-as-cert-achievement/>)
- Computer Information Systems – Software Development – Associate in Science Degree, Certificate of Achievement (<https://curriculum.pasadena.edu/academic-programs/computer-information-systems/computer-information-systems-software-development-as-cert-achievement/>)
- Computer Information Systems – System and Network Administration – Associate in Science Degree, Certificate of Achievement (<https://curriculum.pasadena.edu/academic-programs/computer-information-systems/computer-information-systems-system-network-administration-as-cert-achievement/>)

## Courses

### CIS 001 INTRODUCTION TO COMPUTERS

**3 unit**

*Transfer Credit: CSU; UC*

Computer information systems with focus on hardware, software, operating systems, file management, local area networks, the Internet, digital data representation, and digital media. Hands-on experience with word processing, presentation, spreadsheet, and database software. No credit if taken after CIS 010. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade

### CIS 010 INTRODUCTION TO INFORMATION SYSTEMS

**3 unit**

*Transfer Credit: CSU; UC*

*C-ID: ITIS 120*

Examination of information systems and their role in business. Focus on information systems, database management systems, system development, networking, Internet and web, e-commerce, security, application development languages and tools, computer systems hardware and software components. Application of these concepts and methods through hands-on projects developing computer-based solutions to business problems. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade

### CIS 011 INFORMATION AND COMMUNICATION TECHNOLOGY ESSENTIALS

**4 unit**

*Transfer Credit: CSU*

*C-ID: ITIS 110*

Introduction to the computer hardware and software skills needed to help meet the growing demand for entry-level Information and Communication Technology (ICT) professionals. Topics covered are mobile devices, Linux, macOS, virtualization and cloud computing, as well as expanded information about Microsoft Windows operating systems, security, networking, troubleshooting, and the responsibilities of an IT professional. Preparation for the CompTIA A+ certification exams. Total of 54 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade

### CIS 012 INTRODUCTION TO PROGRAMMING USING PYTHON

**3 unit**

*Transfer Credit: CSU; UC*

Fundamental concepts and models of application development using Python programming language. Coverage of structured and object-oriented programming principles and techniques. Topics include the basic concepts of program design, variables, declarations, statements, expressions, basic I/O (input and output), flow control structures, functions and modules, lists (arrays), tuples, dictionaries, file access, classes and objects, class attributes and methods, inheritance, abstraction, encapsulation, and polymorphism. Preparation for the Microsoft Technology Associate (MTA): Introduction to Programming using Python, Python Institute Certified Entry-Level Python Programmer (PCEP), and Python Institute Certified Associate in Python Programming (PCAP) exams. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade

**CIS 014 C++ PROGRAMMING****3 unit***Transfer Credit: CSU; UC***Prerequisite(s):** CIS 012 or equivalent

Application development using C++ programming language. Coverage of object-oriented programming principles and techniques. Topics include C++ basics, control structures, functions, arrays, pointers, classes, overloading, data abstraction, encapsulation, inheritance, polymorphism, virtual functions, file processing, templates, exceptions, and STL (Standard Template Library). Preparation for the C++ Institute's C++ Certified Associate Programmer (CPA) and C++ Certified Professional Programmer (CPP) exams. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 016 JAVA PROGRAMMING****3 unit***Transfer Credit: CSU; UC***Prerequisite(s):** CIS 012 or equivalent

Application development using Java programming language. Coverage of object-oriented programming principles and techniques. Topics include Java basics, control structures, arrays, classes, methods, overloading, encapsulation, inheritance, polymorphism, collections, Lambda expressions, exceptions, Java I/O, Java API, and database applications. Preparation for the Oracle Certified Associate (OCA) – Java SE Programmer and Oracle Certified Professional (OCP) – Java SE Programmer exams. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 022 INTRODUCTION TO THE INTERNET****3 unit***Transfer Credit: CSU***Prerequisite(s):** CIS 010

General overview of computer systems, networking, and the Internet. World Wide Web, email, telnet, ftp, newsgroups, finding information on the Internet, and basic Web page creation. Legal, ethical, privacy and security issues on the Internet. Total of 90 hours lecture.

**Grade Mode:** Audit, Letter Grade**CIS 031 INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS****3 unit***Transfer Credit: CSU; UC***Recommended Preparation:** CIS 011

Introduction to concepts in data and information management centered around the core skills of identifying organizational information requirements, conceptual data modeling techniques, conversion of conceptual data models into relational data models, verification of structural characteristics with normalization techniques, and implementation of a relational database using an industrial-strength database management system. Overview of data quality and data security tasks, database application development, and data and information management technologies that provide decision support capabilities under the broad business intelligence umbrella. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 040 UNIX/LINUX ADMINISTRATION****3 unit***Transfer Credit: CSU***Prerequisite(s):** CIS 011 or valid CompTIA A+ certification or equivalent

Installation, configuration, and troubleshooting of Unix/Linux operating systems in a small or enterprise environment: types of installation, device drivers, kernel, process management, scripting, packages, networking services, system services, storage, cloud computing, remote management, updates, monitoring, system and data recovery, authorization and authentication, and advanced management tools. Preparation for the CompTIA Linux+, LPIC-1: Certified Linux Administrator, and LPIC-2: Certified Linux Engineer certification exams. Total of 36 hours lecture and 72 hours laboratory.

**Grade Mode:** Letter Grade**CIS 041 CCNA: INTRODUCTION TO NETWORKS****3 unit***Transfer Credit: CSU***Recommended Preparation:** CIS 011 and MATH 003

Architecture, structure, functions, components, and models of the Internet and other computer networks. Principles and structure of IP (Internet Protocol) addressing and the fundamentals of Ethernet concepts, media, and operations are introduced to provide a foundation for further study of computer networks. Use of the OSI (Open Systems Interconnection) and TCP/IP (Transmission Control Protocol / Internet Protocol) layered models to examine the nature and roles of protocols and services at the application, network, data link, and physical layers. Preparation for the CompTIA Network+, Cisco CCT Routing & Switching, and Cisco CCNA certification exams. No credit if taken after CIS 161. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 042 CCNA: ROUTING, SWITCHING, AND WIRELESS ESSENTIALS****3 unit***Transfer Credit: CSU***Prerequisite(s):** CIS 041

Configuring and troubleshooting enterprise networks. Topics include: static routing, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Virtual LANs (VLANs), Inter-VLAN routing, Spanning Tree Protocol (STP), EtherChannel, Dynamic Host Configuration Protocol (DHCP), First-Hop Redundancy Protocol (FHRP), Access Control Lists (ACLs), Network Address Translation (NAT), and Wireless LAN (WLAN). Preparation for the CompTIA Network+, Cisco CCT Routing & Switching, and Cisco CCNA certification exams. No credit if taken after CIS 162. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade

**CIS 045 MCP: MICROSOFT WINDOWS SYSTEM ADMINISTRATION****4 unit***Transfer Credit: CSU***Prerequisite(s):** CIS 011 or valid CompTIA A+ certification or equivalent; and CIS 042 or equivalent

Deploy, configure, maintain, troubleshoot, and support server hardware and server software technologies in a small to enterprise environment, including a cloud computing environment with an emphasis on the administration of Microsoft Windows Server operating systems infrastructure. Topics include storage solutions, server virtualization using Hyper-V, Microsoft Azure cloud services, ADDS, ADCS, DNS, DHCP, WDS, WSUS, DirectAccess, VPNs, IPv6 transition technologies, failover clustering, and disaster recovery. Preparation for the CompTIA Server+ and Microsoft MCP Windows System Administration certification exams. Total of 54 hours lecture and 72 hours laboratory.

**Grade Mode:** Letter Grade**CIS 061 INTRODUCTION TO INFORMATION SYSTEMS SECURITY****3 unit***Transfer Credit: CSU***Prerequisite(s):** CIS 011 or valid CompTIA A+ certification or equivalent, and CIS 042 or equivalent

Principles of information systems security related to providing, managing, and maintaining secure systems at various organizational levels. Administration of network protocols, analysis of hardware/software processes, communications, applications, policies, and procedures. Principles of cybersecurity, risk management/assessments, reporting, dealing with social challenges and demands, legal and ethical issues, security planning, physical security, and technology. Preparation for the CompTIA Security+, Cisco Certified CyberOps Associate, and Cisco Network Security certification exams. Total of 36 hours lecture and 72 hours laboratory.

**Grade Mode:** Letter Grade**CIS 062 INTRODUCTION TO SYSTEMS ANALYSIS****3 unit***Transfer Credit: CSU***Prerequisite(s):** CIS 010

Information systems and the discipline of systems analysis to analyze solutions to a variety of realistic IT problems. Develops skills in applying the tools, techniques, and concepts of systems analysis to information systems development in order to identify and apply constraints to determine feasibility. Apply criteria to select the best information technology solution from alternatives. Total of 54 hours lecture.

**Grade Mode:** Letter Grade, Pass/No-Pass**CIS 063 INTRODUCTION TO CYBERSECURITY: ETHICAL HACKING****3 unit***Transfer Credit: CSU***Prerequisite(s):** CIS 061 or equivalent, and CIS 012 or equivalent

Concepts, principles, and techniques for attacking and disabling a network within the context of properly securing a network. Emphasis on network attack methodologies and appropriate defenses and countermeasures. Preparation for the EC Council's Certified Ethical Hacking certification exam. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 065 DIGITAL FORENSICS FUNDAMENTALS****3 unit***Transfer Credit: CSU***Prerequisite(s):** CIS 061 or equivalent

Methods used to properly conduct a computer forensics investigation based on objectives of the International Association of Computer Investigative Specialists (IACIS) certification. Topics covered include an overview of computer forensics as a profession, the computer investigation process, ethics, operating systems boot processes and disk structures, data acquisition and analysis; technical writing, and computer forensics tools. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 070A WORK EXPERIENCE IN INFORMATION TECHNOLOGY (PAID)****0.5-8 unit***Transfer Credit: CSU***Prerequisite(s):** Completion of one semester at Pasadena City College and completion of one course in major**Enrollment Limitation:** Instructor approval

Provides students on-the-job learning in a paid position in the field of information technology. Development of effective work habits, attitudes, and career awareness so as to enable students to become productive employees. Credit may be accrued at the rate of 0.5 to 8 units per semester. One unit of credit for each 75 hours of paid work experience.

**Grade Mode:** Letter Grade, Pass/No-Pass**CIS 070B WORK EXPERIENCE IN INFORMATION TECHNOLOGY (UNPAID)****0.5-8 unit***Transfer Credit: CSU***Prerequisite(s):** Completion of one semester at Pasadena City College and completion of one course in major**Enrollment Limitation:** Instructor approval

Provides students on-the-job learning in an unpaid position in the field of information technology. Development of effective work habits, attitudes, and career awareness so as to enable students to become productive employees. Credit may be accrued at the rate of 0.5 to 8 units per semester. One unit of credit for each 60 hours of unpaid work experience.

**Grade Mode:** Letter Grade, Pass/No-Pass**CIS 112 ADVANCED PROGRAMMING USING PYTHON****3 unit****Prerequisite(s):** CIS 012

Application development using advanced Python programming techniques. Topics include the advanced Object-Oriented programming, advanced functions and modules, packages, process management, network programming, web programming, GUI (Graphical User Interface) programming, and testing principles and techniques. Preparation for the Python Institute Certified Associate in Python Programming (PCAP) and Python Institute Certified Professional in Python Programming (PCPP) exams Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade

**CIS 112D DATA STRUCTURES AND ALGORITHMS****3 unit****Prerequisite(s):** CIS 014, CIS 016, or CIS 112

Emphasizes the choice and application of data structures and efficient algorithms in implementing applications, covering the most commonly used data structures such as linked lists, stacks and queues, search trees, maps, hashing, priority queues, sorting, and graphs. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 137 MCSA: MICROSOFT WINDOWS CLIENT OPERATING SYSTEMS****3 unit****Prerequisite(s):** CIS 011 or valid CompTIA A+ certification or equivalent

Installation, configuration, and troubleshooting of Microsoft Windows client operating systems in a small or enterprise environment: different types of installation, device drivers, networking services, storage, apps, remote management, updates, monitoring, system and data recovery, authorization and authentication, and advanced management tools. Preparation for the Microsoft Certified Solutions Associate (MCSA): Windows client operating systems certification exam. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 141 MCSA: MICROSOFT EXCHANGE SERVER ADMINISTRATION****4 unit****Prerequisite(s):** CIS 146

Install, configure and manage Microsoft Exchange Server in a Windows Active Directory environment. Configure Microsoft Exchange Server roles. Manage users, mailboxes, security, and database. Configure connectors, antivirus and anti-spam systems, transport rules and message compliance, archiving, policies, client connectivity, public folders, and high availability. Backup and restore Exchange Server. Total of 54 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 146 MCSA: MICROSOFT WINDOWS SYSTEM ADMINISTRATION 2****4 unit****Prerequisite(s):** CIS 045

Implementation and administration of Active Directory Domain Services (AD DS), distributed AD DS, AD DS sites and replication, users and groups, Group Policy Objects (GPOs), Active Directory Certificate Services (AD CS), Active Directory Rights Management Services (AD RMS), Active Directory Federation Services (AD FS), and Microsoft Azure services. Preparation for the Microsoft MCSA Windows Server certification exam. Total of 54 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 151 VCP-DCV: VMWARE VSPHERE ADMINISTRATION****3 unit****Prerequisite(s):** CIS 011 or valid CompTIA A+ certification or equivalent

Installation, configuration and management of VMware vSphere which includes VMware ESXi hosts and VMware vCenter server. Topics include cloud computing architecture, vSphere virtual infrastructure, vCenter Server architecture, virtual machines, virtual networks, virtual storage, resource management and monitoring, high availability, fault tolerance, distributed resource scheduler, and update manager. Preparation for the VMware Certified Professional – Data Center Virtualization (VCP-DCV) certification exam. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 163 CCNA R&S: SCALING NETWORKS****3 unit****Prerequisite(s):** CIS 042

Installation, configuration and management of scaling networks. Topics include: VLAN Trunking Protocol (VTP), Extended VLANs, Dynamic Trunking Protocol (DTP), Spanning Tree Protocols (STP), Link Aggregation, Hot Standby Router Protocol (HSRP), Enhanced Interior Gateway Routing Protocol (EIGRP), and Multi-area Open Shortest Path First (OSPF). Preparation for the CCNA Routing & Switching certification exam. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 164 CCNA: ENTERPRISE NETWORKING, SECURITY, AND AUTOMATION****3 unit****Prerequisite(s):** CIS 042

Configuring and troubleshooting enterprise networks. Topics include: Point-to-Point Protocol (PPP), PPP over Ethernet (PPPoE), Virtual Private Networks (VPNs), Generic Routing Encapsulation (GRE), advanced Open Shortest Path First (OSPF) configurations, advanced Access Control Lists (ACLs) configurations, advanced Network Address Translation (NAT) configurations, network security, network management, network design, network troubleshooting, network virtualization, and network automation. Preparation for the Cisco CCNA certification exam. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 165 CCNP R&S ROUTE: IMPLEMENTING IP ROUTING****4 unit****Prerequisite(s):** CIS 164 or valid CCNA RS certification or equivalent

Authorized Cisco Networking Academy CCNP R&S ROUTE course with lecture and hands-on lab. Advanced topics in Cisco routing including how to design, configure, maintain and scale routed networks that are growing in size and complexity, using Cisco routers connected in LANs and WANs typically found at medium to large network sites. Emphasis toward preparing for the Cisco Certified Network Professional (CCNP R&S ROUTE) examination. Total of 54 hours lecture and 72 hours laboratory.

**Grade Mode:** Letter Grade



**CIS 167 CCNP R&S SWITCH: IMPLEMENTING CISCO IP SWITCHED NETWORKS****4 unit****Prerequisite(s):** CIS 165

Build and manage enterprise networks using multilayer switching technologies. Covers enterprise network design, VLANs, Spanning-Tree Protocol (STP), inter-VLAN routing, Multilayer Switching (MLS), Cisco Express Forwarding (CEF), and Hot Standby Router Protocol (HSRP). Securing the switched network model, including setting passwords, local and remote login, modifying default privilege levels, and applying Layer 3 traffic management techniques to the enterprise network. Very detailed information regarding the role of switches in multicasting. Emphasis toward preparing for the Cisco Certified Network Professional (CCNP R&S SWITCH) examination. Total of 54 hours lecture and 72 hours laboratory.

**Grade Mode:** Letter Grade**CIS 168 CCNP R&S TSHOOT: TROUBLESHOOTING AND MAINTAINING IP NETWORKS****4 unit****Prerequisite(s):** CIS 167

Diagnose, isolate, and correct network failures and performance problems. Identify troubleshooting targets and use appropriate troubleshooting tools to manage network. Emphasis toward preparing for the Cisco Certified Network Professional, Troubleshooting (CCNP R&S TSHOOT) examination. Total of 54 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 169A CCNA SECURITY****4 unit****Prerequisite(s):** CIS 164 or valid CCNA RS certification or equivalent

Installation, configuration, troubleshooting and monitoring of Cisco network devices to maintain integrity, confidentiality, and availability of data and devices. Topics include security concepts, secure network infrastructure, managing secure access, AAA, VPN encryption, firewalls, intrusion prevention, web and email content security, and endpoint security. Preparation for the CCNA Security certification exam. Total of 54 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 169B CCNP SECURITY: IMPLEMENTING CISCO EDGE NETWORK SECURITY SOLUTIONS****4 unit****Prerequisite(s):** CIS 169A

Focuses on the overall security process in a network including security policy design and management, security technologies, products, and solutions. Firewall and secure router design, installation, configuration, and maintenance along with intrusion prevention system implementation using routers and firewall will be covered. VPN implementation using routers and firewalls will be covered. A part of Cisco Networking Academy Program preparing students for CCSP (Cisco Certified Security Professional) certificate. Total of 72 hours of lecture and 54 hours of laboratory.

**Grade Mode:** Letter Grade**CIS 170 CISCO IP TELEPHONY ADMINISTRATION****4 unit****Prerequisite(s):** CIS 164 or valid CCNA RS certification or equivalent

Install, configure, and troubleshoot Cisco Unified Communications (UC) solutions. Administration of end-user interfaces, telephony and mobility features, dial plan, Cisco IOS gateways, and Cisco UC solutions maintenance. Preparation for the Cisco CCNA Collaboration exam. Total of 54 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 192 INTRODUCTION TO WEB DEVELOPMENT****3 unit****Recommended Preparation:** CIS 012

The essentials of HTML5, CSS3, and JavaScript including their functionalities, syntax, and advanced techniques to create web content and designs that can be adapt to various device form factors. Coverage includes HTML5 elements and APIs, CSS3 syntax and advanced techniques, code validation, form creation, mobile design for browsers and apps, and JavaScript and its application. Preparation for the CIW Advanced HTML5 and CSS3 Specialist certification. No credit if taken after GRFX 192. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 193 CLIENT-SIDE WEB DEVELOPMENT USING JAVASCRIPT****3 unit****Prerequisite(s):** CIS 012 and CIS 192

Client-side web application programming using JavaScript. Topics include JavaScript basics, control structures, arrays, object-oriented programming, functions, methods, expressions, Document Object Model (DOM), forms, debugging, event handling, cookie creation, security, web API (Application Programming Interface), libraries and frameworks, and AJAX. Preparation for the CIW JavaScript Specialist Certification. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 194 CLIENT-SIDE WEB DEVELOPMENT USING JAVASCRIPT LIBRARIES****3 unit****Prerequisite(s):** CIS 193

Client-side web application programming using JavaScript libraries. Focuses on React's declarative user interfaces, testing Redux, React router, React Redux, JSX, data flow, usage with React, async actions, async flow, and React middleware to create effective client-side web applications on the latest web stacks and techniques. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade**CIS 197 SERVER-SIDE WEB DEVELOPMENT****3 unit****Prerequisite(s):** CIS 031 and CIS 194

Server-side web application programming using various server-side technologies. Coverage of Server-side web development principles and techniques. Utilization of PHP and Node.js to building database-driven web sites that incorporate lightweight, efficient, and secure web services and applications. Preparation for the Zend Certified PHP Engineer and OpenJS Node.js Application Developer exams. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** Letter Grade

**CIS 199 WEB DEVELOPMENT USING RUBY ON RAILS**

**3 unit**

**Prerequisite(s):** *CIS 012*

Introduction to Web Applications Development using the Ruby on Rails framework. Topics include Ruby fundamentals, Rails basics, Rails installation, Model-View-Controller (MVC) architecture, ActiveRecord, Controllers, Views, test-driven development, application security, and deployment and scaling. Total of 36 hours lecture and 54 hours laboratory.

**Grade Mode:** *Letter Grade*