

Course Outline of Record

1. Course Code: CIS-054
2.
  - a. Long Course Title: Routing and Switching Essentials
  - b. Short Course Title: ROUTERS & SWITCHES
3.
  - a. Catalog Course Description:
 

This course describes the architecture, components, and operations of routers and switches in a small network. Students learn how to configure a router and a switch for basic functionality. By the end of this course students will be able to configure and troubleshoot routers and switches and resolve common issues with RIPv1, RIPv2, single-area and multi-area OSPF, virtual LANs, and inter-VLAN routing in both IPv4 and IPv6 networks.

This course, along with CIS 053 - Computer Network Fundamentals, should prepare students for the current version of the Cisco Certified Entry-level Network Technician (CCENT) certification exam.
  - b. Class Schedule Course Description:
 

This course, along with CIS 053 - Computer Network Fundamentals, should prepare students for the current version of the Cisco Certified Entry-level Network Technician (CCENT) certification exam.
  - c. Semester Cycle (if applicable): Fall
  - d. Name of Approved Program(s):
    - COMPUTER INFORMATION SYSTEMS AS DEGREE AS Degree for Employment Preparation
    - COMPUTER INFORMATION SYSTEMS AS Degree for Employment Preparation
    - COMPUTER INFORMATION SYSTEMS Certificate of Achievement
    - COMPUTER INFORMATION SYSTEMS\* Certificate of Achievement
4. Total Units: 3.00      Total Semester Hrs: 54.00  
 Lecture Units: 3      Semester Lecture Hrs: 54.00  
 Lab Units: 0      Semester Lab Hrs: 0  
 Class Size Maximum: 32      Allow Audit: No  
 Repeatability 0x  
 Justification 0
5. Prerequisite or Corequisite Courses or Advisories:
 

*Course with requisite(s) and/or advisory is required to complete Content Review Matrix (CCForm1-A)*

 Prerequisite: CIS 053 with a minimum grade of C or equivalent
6. Textbooks, Required Reading or Software: (List in APA or MLA format.)
  - a. Empson, S. (2014). Routing and Switching Essentials Companion Guide (5th/e). Cisco Press.  
 College Level: Yes  
 Flesch-Kincaid reading level: 12
  - b. Empson, S.. Routing and Switching Essentials Lab Manual. Cisco Press , 01-01-2013.
  - c. Lammele, T., Sybex. CCENT Study Guide for exam 100-105 ICND1 v3.0, ed. Cisco Press, 2016
7. Entrance Skills: *Before entering the course students must be able:*
  - a.  
 Show proficiency in IP Addressing, routing fundamentals, and subnets.
    - CIS 053 - Describe the role of protocol layers in data networks.
  - b.  
 Understand the different networking media.
    - CIS 053 - Describe and differentiate the devices and services used to support communications in data networks and the Internet.

# CIS 054-Routing and Switching Essentials

- CIS 053 - Explain fundamental Ethernet concepts such as media, services, and operations.

c.

Show proficiency in networking fundamentals and terminology.

- CIS 053 - Explain fundamental Ethernet concepts such as media, services, and operations.
- CIS 053 - Build a simple Ethernet network using routers and switches.

d.

Demonstrate the principles and structure of IP (Internet Protocol) addressing and the fundamentals of Ethernet.

- CIS 053 - Evaluate the importance of addressing and naming schemes at various layers of data networks in IPv4 and IPv6 environments.

e.

Understand cabling LAN's and WAN's

- CIS 053 - Build a simple Ethernet network using routers and switches.

## 8. Course Content and Scope:

### Lecture:

1. Introduction to Switched Networks
  1. LAN Design
  2. The Switched Environment
2. Basic Switching Concepts and Configuration
  1. Basic Switch configuration
  2. Switch Security Management and Implementation
  3. Configuring Basic Switch Settings
  4. Configuring Switch Security Features
3. VLANs
  1. VLAN Segmentation
  2. VLAN Implementation
  3. VLAN Security and Design
  4. Configuring VLANs and Trunking
  5. Troubleshooting VLAN Configurations
  6. Implementing VLAN Security
4. Routing Concepts
  1. Initial configuration of a Router
  2. Routing Decisions
  3. Router Operation
  4. Mapping the Internet
  5. Configuring Basic Router Settings with IOS CLI
  6. Configuring Basic Router Settings with CCP
5. Inter-VLAN Routing
  1. Inter-VLAN Routing
  2. Troubleshoot Inter-VLAN Routing
  3. Layer 3 Switching
  4. Configuring Per-Interface Inter-VLAN Routing
  5. Configuring 802.1Q Trunk-Based Inter-VLAN Routing
  6. Troubleshooting Inter-VLAN Routing
6. Static Routing
  1. Static Routing Implementation
  2. Configure Static Routing and Default Routes
  3. Review CIDR and VLSM
  4. Configure Summary and Floating Static Routes
  5. Troubleshoot Static and Default Route Issues
  6. Configuring IPv4 Static and Default Routes
  7. Configuring IPv6 Static and Default Routes
  8. Designing and Implementing IPv4 Addressing with VLSM

9. Calculating Summary Routes with IPv4 and IPv6
10. Troubleshooting IPv4 and IPv6 Static Routes
7. Routing Dynamically
  1. Dynamic Routing Protocols
  2. Distance Vector Dynamic Routing
  3. RIP and RIPng Routing
  4. Link-State Dynamic Routing
  5. The Routing Table
  6. Lab - Configuring Basic RIPv2 and RIPng
8. Single-Area OSPF
  1. Characteristics of OSPF
  2. Configuring Single-Area OSPFv2
  3. Configure Single-Area OSPFv3
  4. Configuring Basic Single-Area OSPFv2
  5. Configuring Basic Single-Area OSPFv3
9. Access Control Lists
  1. IP ACL Operations
  2. Standard IPv4 ACLS
  3. Extended IPv4 ACLs
  4. Troubleshoot ACLs
  5. IPv6 ACLs
  6. Configuring and Verifying Standard ACLs
  7. Configuring and Verifying VTY Restrictions
  8. Configuring and Verifying Extended ACLs
  9. Troubleshooting ACL Configuration and Placement
  10. Configuring and Verifying IPv6 ACLs
10. DHCP
  1. Dynamic Host Configuration Protocol v4
  2. Dynamic Host Configuration Protocol v6
  3. Configuring Basic DHCPv4 on a Router
  4. Configuring Basic DHCPv4 on a Switch
  5. Troubleshooting DHCPv4
  6. Configuring Stateless and Stateful DHCPv6
  7. Troubleshooting DHCPv6
11. Network Address Translation for IPv4
  1. NAT Operation
  2. Configuring NAT
  3. Troubleshooting NAT
  4. Configuring Dynamic and Static NAT
  5. Configuring NAT Pool Overload and PAT

Lab: *(if the "Lab Hours" is greater than zero this is required)*

9. Course Student Learning Outcomes:

1.  
Describe and implement basic switching concepts and enhanced switching technologies.
2.  
Assemble, configure, and troubleshoot a small switched network and perform basic routing operations.
3.  
Categorize and describe the purpose, nature, and operations of various network hardware.
4.  
Set up and verify static routing and default routing using basic operations of routers in a small routed network.

10. Course Objectives: *Upon completion of this course, students will be able to:*
- Describe basic switching concepts, how VLANs create logically separate networks and how routing occurs between them, and enhanced switching technologies such as VLANs, VLAN Trunking Protocol (VTP), Rapid Spanning Tree Protocol (RSTP), Per VLAN Spanning Tree Protocol (PVSTP), and 802.1q.
  - Configure and troubleshoot basic operations of a small switched network, VLANs, and inter-VLAN routing.
  - Understand and describe the purpose, nature, and operations of a router, routing tables, and the route lookup process, dynamic routing protocols, distance vector routing protocols, and link-state routing protocols, the purpose and types of access control lists (ACLs), and the operations and benefits of Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS) for IPv4 and IPv6, and Network Address Translation (NAT).
  - Configure and verify static routing and default routing; configure and troubleshoot basic operations of routers in a small routed network including Routing Information Protocol (RIPv1 and RIPv2) and Open Shortest Path First (OSPF) protocol (single-area OSPF); Configure, monitor, and troubleshoot ACLs for IPv4 and IPv6; and configure and troubleshoot NAT operations.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*

- Activity
- Collaborative/Team
- Discussion
- Distance Education
- Lecture
- Participation
- Technology-based instruction

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*

In Class Hours: 54.00

Outside Class Hours: 108.00

- a. In-class Assignments

- Initializing and Reloading a Router and Switch
- Installing the IPv6 Protocol with Windows XP
- Configuring Basic Switch Settings
- Configuring Switch Security Features
- Configuring VLANs and Trunking
- Troubleshooting VLAN Configurations
- Implementing VLAN Security
- Configuring Basic Router Settings with IOS CLI
- Configuring Basic Router Settings with CCP
- Configuring Per-Interface Inter-VLAN Routing
- Configuring 802.1Q Trunk-Based Inter-VLAN Routing
- Troubleshooting Inter-VLAN Routing
- Configuring IPv4 Static and Default Routes
- Configuring IPv6 Static and Default Routes
- Designing and Implementing IPv4 Addressing with VLSM
- Troubleshooting IPv4 and IPv6 Static Routes
- Configuring Basic RIPv2 and RIPv6
- Configuring Basic Single-Area OSPFv2
- Configuring Basic Single-Area OSPFv3
- Configuring and Verifying Standard ACLs
- Configuring and Verifying VTY Restrictions
- Configuring and Verifying Extended ACLs
- Troubleshooting ACL Configuration and Placement
- Configuring and Verifying IPv6 ACLs

- Configuring Basic DHCPv4 on a Router
- Configuring Basic DHCPv4 on a Switch
- Troubleshooting DHCPv4
- Configuring Stateless and Stateful DHCPv6
- Troubleshooting DHCPv6
- Configuring Dynamic and Static NAT
- Configuring NAT Pool Overload and PAT
- Troubleshooting NAT Configurations

b. Out-of-class Assignments

Students are required to read the Cisco Netacad Web site and the CCNA Exploration Routing Protocols and Concepts course booklet.

Utilizing the concepts learned, students will write configurations files and implement Link-State and Distant Vector routing protocols. Students will also write configuration files to implement static routes and analyze the routing tables.

Students will be completing assignments outside of class utilizing Packet Tracer and Netlab. These assignments will consist of preset configuration requirements covering different router and switch networking scenarios.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*

- Self-paced testing  
Computer laboratory assignments/projects designed to clarify students' individual router fluency strengths and areas of improvement.
- Laboratory projects  
Lab projects and oral presentations combing the use of router configurations, static routing, using RIP, using IGRP and basic router troubleshooting.
- Group activity participation/observation  
Collaborative projects designed to demonstrate successful understanding of routing configuration skills and team work skills.
- True/false/multiple choice examinations  
Quizzes/examinations designed to measure students' degree of mastery of routing fundamentals.
- Mid-term and final evaluations  
The 100-105 ICND1 v3.0 exam will be used as the final exam for the course.
- Student preparation  
Exercises/lab projects designed to demonstrate the acquisition of Access Control List and interface placement.

14. Methods of Evaluating: Additional Assessment Information:

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*

PO - Career and Technical Education

Fulfill the requirements for an entry- level position in their field.

Apply critical thinking skills to execute daily duties in their area of employment.

Apply critical thinking skills to research, evaluate, analyze, and synthesize information.

Display the skills and aptitude necessary to pass certification exams in their field.

Exhibit effective written, oral communication and interpersonal skills.

IO - Personal and Professional Development

Demonstrate an understanding of ethical issues to make sound judgments and decisions.

IO - Scientific Inquiry

Collect and analyze data. Skills of data collection include an understanding of the notion of hypothesis testing and specific methods of inquiry such as experimentation and systematic observation.

IO - Critical Thinking and Communication

Apply principles of logic to problem solve and reason with a fair and open mind.

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IO - Global Citizenship - Scientific & Technological Literacy

Synthesize, interpret, and infer, utilizing information, data, and experience to solve problems, innovate, and explore solutions.

IO - Global Citizenship - Ethical Behavior

Apply ethical reasoning to contemporary issues and moral dilemmas.

## 16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year
CSU	CSU San Bernardino	IST 275	Information Networking and Security	2016-2017

## 17. Special Materials and/or Equipment Required of Students:

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18. Materials Fees:  Required Material?

Material or Item	Cost Per Unit	Total Cost
Cost Cisco Examination	\$200	\$200

## 19. Provide Reasons for the Substantial Modifications or New Course:

This course, along with CIS 050 - Computer Network Fundamentals, should prepare students for the current version of the Cisco Certified Entry-level Network Technician (CCENT) certification exam.

20. a. Cross-Listed Course (*Enter Course Code*): *N/A*  
b. Replacement Course (*Enter original Course Code*): *N/A*

21. Grading Method (*choose one*): Letter Grade Only

## 22. MIS Course Data Elements

- a. Course Control Number [CB00]: CCC000579562  
b. T.O.P. Code [CB03]: 70100.00 - Information Technology, G  
c. Credit Status [CB04]: C - Credit - Not Degree Applicable  
d. Course Transfer Status [CB05]: B = Transfer CSU  
e. Basic Skills Status [CB08]: 2N = Not basic skills course  
f. Vocational Status [CB09]: Clearly Occupational  
g. Course Classification [CB11]: Y - Credit Course  
h. Special Class Status [CB13]: N - Not Special  
i. Course CAN Code [CB14]: *N/A*  
j. Course Prior to College Level [CB21]: Y = Not Applicable  
k. Course Noncredit Category [CB22]: Y - Not Applicable  
l. Funding Agency Category [CB23]: Y = Not Applicable  
m. Program Status [CB24]: 1 = Program Applicable

Name of Approved Program (*if program-applicable*): COMPUTER INFORMATION SYSTEMS, COMPUTER INFORMATION SYSTEMS

*Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)*

## 23. Enrollment - Estimate Enrollment

First Year: 12

Third Year: 32

## 24. Resources - Faculty - Discipline and Other Qualifications:

- a. Sufficient Faculty Resources: Yes  
b. If No, list number of FTE needed to offer this course: *N/A*

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25. Additional Equipment and/or Supplies Needed and Source of Funding.

N/A

26. Additional Construction or Modification of Existing Classroom Space Needed. (*Explain:*)

N/A

27. FOR NEW OR SUBSTANTIALLY MODIFIED COURSES

Library and/or Learning Resources Present in the Collection are Sufficient to Meet the Need of the Students Enrolled in the Course: Yes

28. Originator Felix Jose Marhuenda-Donate Origination Date 10/06/16