I. INTRODUCTION

A. This course describes the architecture, components, and operations of routers and switches in larger and more complex networks. Participants learn how to configure routers and switches for advanced functionality. By the end of this course, participants will be able to configure and troubleshoot routers and switches and resolve common issues with OSPF, EIGRP, and STP in both IPv4 and IPv6 networks.

B. This course serves as a required or elective course on various degree plans. Curriculum plans for degrees and certificates, are listed in the current Central Texas College Catalog.

C. The delivery method of this course may be traditional lecture/lab, blended lecture/lab, or online.

D. Prerequisites: ITCC 1440, or CCENT certification.

II. LEARNING OUTCOMES

Upon successful completion of this course, CCNA 3: Scaling networks, the student will be able to:

A. Configure advanced routing and switching protocols on multi-area networks. (C1, C5, C6, C7, C8, C12, C15, C17, C18, C20, F1, F7, F8, F9, F12)

B. Resolve common issues with OSPF, EIGRP, and STP in both IPv4 and IPv6 networks. (C1, C5, C6, C7, C8, C12, C15, C17, C18, C20, F1, F7, F8, F9, F12, F16)

C. Implement a WLAN in a small-to-medium network. (C1, C5, C6, C7, C8, C12, C15, C17, C18, C20, F1, F7, F8, F9, F12)
III. INSTRUCTIONAL MATERIALS

A. The instructional materials identified for this course are viewable through www.ctcd.edu/books

B. Lecture classes also require at least one USB storage device. Online students may use cloud based storage.

IV. COURSE REQUIREMENTS

A. Attend both lecture and lab or in the case of online delivery, be actively engaged in Blackboard and maintain constant progress.

B. Be prepared to participate in discussion, team projects/assignments and take unannounced assessments relating to the lecture materials.

C. Complete all exams/assessments.

D. Submit all assignments on time.

V. ASSESSMENTS

A. Student content mastery will be evaluated in the following areas:
   - Assessments (midterm exam, quizzes, projects, etc.)
   - Final Assessment (final exam and/or semester project, participation)

B. Scheduled and unscheduled assessments will be given at the discretion of the instructor.

C. Exams/assessments may be composed of both subjective and objective questions plus computer output.

D. A student must take all exams/assessments. No make-up exams/assessments will be given. Both online and on campus students who know in advance that they will be absent due to school sponsored trips, military duty or orders, or any other valid reason, must arrange to take an early exam/assessment. Unexpected absences due to illness or other extenuating circumstances will require the student to see the instructor about make-up work in lieu of the missed exam/assessment.

E. Students with unexcused absences will be given a zero for each missed assignment.
VI. SEMESTER GRADE COMPUTATIONS

<table>
<thead>
<tr>
<th>Course Requirements</th>
<th>Points</th>
<th>Points</th>
<th>Grade</th>
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<td>Assignments</td>
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<td>A-Superior</td>
<td>4</td>
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<tr>
<td>Assessments</td>
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<td>800-899</td>
<td>B-Above Average</td>
<td>3</td>
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<td>Final Assessment</td>
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<td>700-799</td>
<td>C-Average</td>
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<td></td>
<td></td>
<td>600 - 699</td>
<td>D – Passing but Unsatisfactory</td>
<td>1</td>
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<td></td>
<td></td>
<td>0 -599</td>
<td>F-Failure</td>
<td>0</td>
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<td>0 - 599</td>
<td>F-Failure</td>
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</tr>
</tbody>
</table>

VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE INSTRUCTOR

A. Course Withdrawal: It is the student’s responsibility to officially withdraw from a course if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file a Central Texas College Application for Withdrawal (CTC Form 59). The student must sign the withdrawal form.

CTC Form 59 will be accepted at any time prior to Friday of the 12th week of classes during the 16-week fall and spring semesters. The deadline for sessions of other lengths is:
- 10-week session Friday of the 8th week
- 8-week session Friday of the 6th week
- 5-week session Friday of the 4th week

The equivalent date (75% of the semester) will be used for sessions of other lengths. The specific last day to withdraw is published each semester in the Schedule Bulletin.

For non-GoArmyEd active military students, the effective date of withdrawal is the filing date with the Education Center. For all other students, the effective date of withdrawal is the date that the withdrawal application is received by the Central Texas College representative.

Students who used financial aid, military tuition assistance, VA benefits, or other non-personal funds may be required to repay tuition and fees to the funding agency. For specific repayment requirements, contact the Office of Student Financial Aid or Veterans Services Office before withdrawing. Military tuition assistance students should visit their military Education Center or Navy College Office.

A student who officially withdraws will be awarded the grade of “W” provided the student’s attendance and academic performance are satisfactory at the time of official withdrawal. Students must file a withdrawal application with the College before they may be considered for withdrawal.
A student may not withdraw from a class for which the instructor has previously issued a grade of “F,” “FI,” “FN,” “IP,” or “XN.”

B. Instructor Initiated Withdrawals: Faculty are authorized to withdraw students who are not making satisfactory course progress to include failure to meet College attendance requirements as outlined in the section of the Catalog entitled “Satisfactory Progress Standards.” The instructor will assign the appropriate grade on CTC Form 59 for submission to the registrar.

Students enrolled in distance learning courses are expected to maintain constant progress throughout the course. Failure to do so may result in the student being administratively withdrawn by the instructor.

Students who have not attended class by the 12th class day of a 16-week course or the 6th class day of an 8-week term may be administratively withdrawn by the instructor with a grade of "W." Students may be administratively withdrawn from any class when their absences reach a total equal to 12.5% of the class hours for the course; and in the opinion of the instructor, the student cannot satisfactorily complete the course. An example: Students attending a 48-hour class during an 8-week period normally meet 180 minutes each session for 16 sessions. Those students accumulating two (2) unexcused absences are subject to Administrative Withdrawal since the total unexcused absences equal 12.5% of class hours for the course. Those students attending a 48-hour class during a 16-week period normally meet 90 minutes each session for 32 sessions. Those students accumulating four (4) unexcused absences are subject to Administrative Withdrawal since the total unexcused absences equals 12.5% of class hours for the course. In a distance learning course the last date of attendance is the last activity by the student in the course.

C. Administrative Withdrawal: A student may be administratively withdrawn by a designated member of the administrative staff of the College when the student has been placed on Academic Suspension or Disciplinary Suspension; the student has an outstanding financial obligation owed to the college; or the student registered for a course without the required prerequisite or departmental permission.

The College is under no obligation to refund tuition and fees, or other costs associated with an administrative or instructor initiated withdrawal.

D. Incomplete Grade: The College catalog states, “An incomplete grade may be given in those cases where the student has completed the majority of the coursework but, because of personal illness, death in the immediate family, or military orders, the student is unable to complete the requirements for a course...” Prior approval from the instructor is required before the grade of “IP” for Incomplete is recorded.
E. **Cell Phones and Pagers:** Students will silence cell phones and mobile devices while in the classroom or lab.

F. **Americans with Disabilities Act (ADA):** Disability Support Services provide services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Review the website at [www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support) for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

G. **Instructor Discretion:** The instructor reserves the right of final decision in course requirements and may make changes to the course outline and/or assignments as needed.

H. **Civility:** Individuals are expected to be aware of what a constructive educational experience is and be respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.

I. **Degree Progression:** Students who receive a grade of “D” are advised not to enroll in the next course for which this course was a prerequisite.

J. **Failing Grade:** The grade of “F” or “FN” will be given for academic failure, non-attendance or scholastic dishonesty.

K. **Scholastic Honesty:** All students are expected to maintain the highest standards of scholastic honesty in the preparation of all course work and during examinations. The college policy on scholastic honesty, including definitions on plagiarism, collusion, and cheating can be found at the following URL: [http://online.ctcd.edu/plagiarism.cfm](http://online.ctcd.edu/plagiarism.cfm)
VIII. COURSE OUTLINE

A. Lesson One: Introduction to Scaling Networks

1. Learning Outcomes: Upon successful completion of this lesson the student will be able to:
   a. Describe the use of the hierarchical network for a small business.
   b. Describe recommendations for designing a network that is scalable.
   c. Configure basic settings on a Cisco IOS device.

2. Learning Activities:
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (C7, C8, C9, C15, C18, F1, F9, F10, F13)
   b. Perform skills and functions in the section (C1, C5, C7, C8, C9, C16, C18, F1, F9, F10, F13)

3. Unit Outline:
   a. Implementing a Network Design
   b. Selecting Network Devices

B. Lesson Two: LAN Redundancy

1. Learning Outcomes: Upon successful completion of this lesson the student will be able to:
   a. Describe the issues with implementation a redundant network.
   b. Explain STP, PVST+ and Rapid PVST+ operation in a switched LAN environment.
   c. Identify common STP configuration issues.
   d. Use Cisco IOS commands to verify HSRP and GLBP implementations.

2. Learning Activities:
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (C7, C8, C9, C15, C18, F1, F9, F10, F13)
   b. Perform skills and functions in the section (C1, C5, C7, C8, C9, C16, C18, F1, F9, F10, F13)

3. Unit Outline:
   a. Spanning Tree Concepts
   b. Varieties of Spanning Tree Protocols
   c. Spanning Tree Configuration
   d. First-Hop Redundancy Protocols
C. Lesson Three: Link Aggregation

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
   a. Describe Link Aggregation.
   b. Describe EtherChannel technology.
   c. Configure Link Aggregation with EtherChannel.
   d. Troubleshoot Link Aggregation with EtherChannel.

2. Learning Activities:
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (C7, C8, C9, C15, C18, F1, F9, F10, F13)
   b. Perform skills and functions in the section (C1, C5, C7, C8, C9, C16, C18, F1, F9, F10, F13)

3. Unit Outline:
   a. Link Aggregation Concepts
   b. Link Aggregation Configuration

D. Lesson Four: Wireless LANs

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
   a. Describe wireless LAN technology and standards.
   b. Describe wireless topologies.
   c. Explain channel management within a wireless LAN.
   d. Describe security threats to wireless LANs and explain mitigating security measures.
   e. Configure a wireless router and the associated wireless clients.

2. Learning Activities:
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (C7, C8, C9, C15, C18, F1, F9, F10, F13)
   b. Perform skills and functions in the section (C1, C5, C7, C8, C9, C16, C18, F1, F9, F10, F13)

3. Unit Outline:
   a. Wireless LAN Concepts
   b. Wireless LAN Operation
   c. Wireless LAN Security
   d. Wireless LAN Configuration
E. Lesson Five: Adjust and Troubleshoot Single-Area OSPF

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
   a. Modify OSPF interface priority to influence the DR/BDR election.
   b. Configure a router to propagate a default route in an OSPF network.
   c. Explain the process and tools used to troubleshoot a single-area OSPF network.
   d. Troubleshoot missing route entries in a single-area OSPFv2 or OSPFv3 route table.

2. Learning Activities:
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (C7, C8, C9, C15, C18, F1, F9, F10, F13)
   b. Perform skills and functions in the section (C1, C5, C7, C8, C9, C16, C18, F1, F9, F10, F13)

3. Unit Outline:
   a. Advanced Single-Area OSPF Configurations
   b. Troubleshooting Single-Area OSPF Implementations

F. Lesson Six: Multiarea OSPF

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
   a. Explain why multiarea OSPF is used.
   b. Explain the use of neighbor adjacencies and LSA’s in maintaining and constructing a routing table.
   c. Configure and verify multiarea OSPF in a routed network.

2. Learning Activities:
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (C7, C8, C9, C15, C18, F1, F9, F10, F13)
   b. Perform skills and functions in the section (C1, C5, C7, C8, C9, C16, C18, F1, F9, F10, F13)

3. Unit Outline:
   a. Multiarea OSPF Operation
   b. Configuring Multiarea OSPF

G. Lesson Seven: EIGRP

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
a. Describe the basic features of EIGRP.
b. Describe the packet features and protocols used to establish EIGRP adjacencies and routing tables.
c. Configure and verify EIGRP for IPv4 in a small routed network.
d. Configure and verify EIGRP for IPv6 in a small routed network.
e. Compare characteristics and operation of EIGRP for IPv4 vs EIGRP for IPv6.

2. Learning Activities:
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (C7, C8, C9, C15, C18, F1, F9, F10, F13)
   b. Perform skills and functions in the section (C1, C5, C7, C8, C9, C16, C18, F1, F9, F10, F13)

3. Unit Outline:
   a. Characteristics of EIGRP
   b. Configuring EIGRP for IPv4
   c. Operation of EIGRP
   d. Configuring EIGRP for IPv6

H. Lesson Eight: EIGRP Advanced Configurations and Troubleshooting

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
   b. Configure and modify EIGRP to improve network performance and ensure secure routing updates.
   c. Troubleshoot adjacency issues and missing route entries for an EIGRP network.

2. Learning Activities:
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (C7, C8, C9, C15, C18, F1, F9, F10, F13)
   b. Perform skills and functions in the section (C1, C5, C7, C8, C9, C16, C18, F1, F9, F10, F13)

3. Unit Outline:
   a. Advanced EIGRP Configurations
   b. Troubleshoot EIGRP

I. Lesson Nine: IOS Images and Licensing

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
a. Explain the IOS image naming conventions implemented by Cisco.
b. Manage Cisco IOS system files to support network requirements.
c. Explain the licensing process for Cisco IOS software.
d. Configure a router to install a Cisco IOS software image license.

2. Learning Activities:
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (C7, C8, C9, C15, C18, F1, F9, F10, F13)
   b. Perform skills and functions in the section (C1, C5, C7, C8, C9, C16, C18, F1, F9, F10, F13)

3. Unit Outline:
   a. Managing IOS System Files
   b. IOS Licensing