I. INTRODUCTION

A. This course discusses the WAN technologies and network services required by converged applications in a complex network. The course enables students to understand the selection criteria of network devices and WAN technologies to meet network requirements.

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 2412.

II. LEARNING OUTCOMES

Upon successful completion of this course, CCNA 4: Connecting Networks, the student will be able to:

A. Configure and troubleshoot network devices. (C1, C5, C6, C7, C8, C12, C15, C17, C18, C20, F1, F7, F8, F9, F12)

B. Resolve common issues with data link protocols. (C1, C5, C6, C7, C8, C12, C15, C17, C18, C20, F1, F7, F8, F9, F12, F16)

C. 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)

D. Implement virtual private network (VPN) operations in a complex network. (C1, C5, C6, C7, C8, C12, C15, C17, C18, C20, F1, F7, F8, F9, F12)

E. Implement security best practices. (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](http://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>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>300</td>
</tr>
<tr>
<td>Assessments</td>
<td>300</td>
</tr>
<tr>
<td>Final Assessment</td>
<td>400</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1000</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Points</th>
<th>Grade</th>
<th>Quality Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>900-1000</td>
<td>A-Superior</td>
<td>4</td>
</tr>
<tr>
<td>800-899</td>
<td>B-Above Average</td>
<td>3</td>
</tr>
<tr>
<td>700-799</td>
<td>C-Average</td>
<td>2</td>
</tr>
<tr>
<td>600 - 699</td>
<td>D - Passing but Unsatisfactory</td>
<td>1</td>
</tr>
<tr>
<td>0 - 599</td>
<td>F-Failure</td>
<td>0</td>
</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: Hierarchical Network Design

1. Learning Outcomes: Upon successful completion of this lesson the student will be able to:
   a. Describe the three layers of a hierarchical network and how they are used in network design.
   b. Describe the Cisco Enterprise Model.
   c. Discuss the need for business network architectures that are designed to address emerging trends in IT.
   d. Discuss three business network architectures: borderless network architecture, collaboration network architecture and the data center/virtualization network architecture.

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. Hierarchical Network Design Overview
   b. Cisco Enterprise Architecture
   c. Evolving Network Architectures

B. Lesson Two: Connecting to the WAN

1. Learning Outcomes: Upon successful completion of this lesson the student will be able to:
   a. Describe the purpose and operation of a WAN.
   b. Compare various private and public WAN technologies.
   c. Select the appropriate WAN protocol and service for a specific network requirement.

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. WAN Technologies Overview
   b. Selecting a WAN Technology
C. Lesson Three: Point-Point Connections

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
   a. Explain the fundamentals of point-point serial communication over a WAN.
   b. Configure HDLC encapsulation.
   c. Describe the benefits of using PPP over HDLC in a WAN.
   d. Configure PPP encapsulation and authentication on a point-point serial link.

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. Serial Point-Point Overview.
   b. PPP Operation.
   c. Configure PPP.
   d. Troubleshoot WAN Connectivity

D. Lesson Four: Frame Relay

1. Learning Outcomes: Upon successful completion of this lesson, the student will be able to:
   a. Explain the benefits and operation of Frame Relay.
   b. Describe the bandwidth control mechanism in Frame Relay.
   c. Configure Frame Relay PVC on a router serial interface.
   d. Configure point-point subinterfaces.

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. Introduction to Frame Relay
   b. Configure Frame Relay
   c. Troubleshoot Connectivity
E. **Lesson Five: Network Address Translation (NAT) for IPv4**

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   a. Describe the benefits, characteristics and drawbacks of NAT.
   b. Configure static and dynamic NAT using CLI.
   c. Configure PAT and port forwarding using the CLI.
   d. Describe NAT64.

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. NAT Operation
   b. Configuring NAT
   c. Troubleshooting NAT

F. **Lesson Six: Broadband Solutions**

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   a. Describe the benefits of teleworking solutions.
   b. Describe cable, DSL and broadband wireless access.
   c. Select an appropriate broadband solution for a given network requirement.
   d. Describe the operation of PPPoE.
   e. Configure basic PPP over Ethernet on a client router.

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. Teleworking
   b. Comparing Broadband Solutions
   c. Configuring xDSL Connectivity

G. **Lesson Seven: Securing Site-Site Connectivity**
1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   a. Describe the benefits of VPN technology.
   b. Describe the purpose and benefits of GRE tunnels.
   c. Discuss the characteristics of IPSec.
   d. Explain IPsec implementation using the IPsec protocol framework.
   e. Compare IPSec and SSL remote access VPNs.

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. VPNs
   b. Site-Site GRE Tunnels
   c. Introducing IPSec
   d. Remote Access

H. **Lesson Eight:** Monitoring the Network

1. **Learning Outcomes:** Upon successful completion of this lesson, the student will be able to:
   a. Explain syslog and SNMP operation.
   b. Configure syslog and SNMP to compile messages.
   c. Describe NetFlow operation.
   d. Configure Netflow to monitor traffic.
   e. Explain how NetFlow data is used to examine traffic patterns

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. Syslog
   b. SNMP
   c. Netflow

I. **Lesson Nine:** Troubleshooting the Network

1. **Learning Outcomes:** Upon successful completion of this lesson, the student
will be able to:

a. Explain how network documentation is developed and used to troubleshoot network issues.
b. Describe the general troubleshooting process.
c. Compare troubleshooting methods in a systematic, layered approach.
d. Describe common network troubleshooting tools.
e. Determine the symptoms and causes of network problems, using a layered model.
f. Troubleshoot network discrepancies.

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. Troubleshooting with a Systematic Approach
   b. Network Troubleshooting