
Intermediate Networking

School of Advanced Technology

Course Number:
NET2000

Contribution to Program:
Core

Educator(s):
Michael Anderson

Applicable Program(s):
Bachelor of Information
Technology – Network Technology

AAL:
03

Approved For:
Fall 2022

Course Hours:
5 contact hours per week

Prerequisites:
NET1006

Approved By:



Corequisites:
None

John Dallas
Academic Chair, ICT-SSN Dept

Approved for Academic Year:
2022-2023

COURSE DESCRIPTION

Architecture, components and operations of routers and switches in Enterprise networks. Topics include configuration and troubleshooting of OSPF, including Multi-area, redundancy, NAT and troubleshooting techniques. (Includes: Experiential Learning Activity)

COURSE CURRICULUM

I. Course Learning Requirements/Embedded Knowledge and Skills

Essential Course Learning Requirements	Knowledge and Skills
<p>To earn credit for this course, you must reliably demonstrate your ability to:</p> <ul style="list-style-type: none"> ○ Explain basic principles of hierarchical network design and architecture ○ Explain the need for, and basic principles of, dynamic routing protocols ○ Understand principles for troubleshooting enterprise-scale networks 	<ul style="list-style-type: none"> – Correctly interpret and understand network documentation. – Correctly use, and fully understand and interpret the network diagnostic tools ICMP and Traceroute, including as an aid for documentation. – Demonstrating the ability to use appropriate procedures for efficient troubleshooting of enterprise-scale networks is an essential requirement.
<ul style="list-style-type: none"> ○ Understand, explain, implement, and troubleshoot IPv6 addressing in an enterprise environment, including dynamic addressing with SLAAC, DHCPv6, and ICMPv6. 	<ul style="list-style-type: none"> – Configuration of IPv6 addressing schemes, including SLAAC and DHCPv6 for dynamic addressing. – Demonstrating practical lab skill at consistently and accurately deploying IPv6 configuration(s) on actual equipment is an essential requirement.
<ul style="list-style-type: none"> ○ Understand, explain, and implement single area OSPF for IPv4 (OSPFv2) and IPv6 (OSPFv3) ○ Understand, explain, and implement multi-area OSPF for IPv4 (OSPFv2) and IPv6 (OSPFv3) ○ Understand, explain, and implement troubleshooting methods for OSPF 	<ul style="list-style-type: none"> – Configuration of single and multi-area OSPFv2 routing. – Configuration of single and multi-area OSPFv3 routing. – Demonstrating practical lab skill at consistently and accurately deploying the multitude of OSPF configurations on actual equipment is an essential requirement.
<ul style="list-style-type: none"> ○ Understand, explain, and implement Access Control Lists: including their concepts, purpose, operation, and role in Network security. ○ Understand and explain the principles for troubleshooting ACLs. 	<ul style="list-style-type: none"> – Configure standard and extended ACLs on Cisco equipment for both IPv4 and IPv6. – Demonstrating practical lab skill at consistently and accurately deploying ACLs on actual equipment is an essential requirement.
<ul style="list-style-type: none"> ○ Understand, explain, and implement Network Address Translation: including the purposes, types (including static, dynamic, PAT), advantages, and disadvantages. ○ Understand and explain troubleshooting principles for NAT. 	<ul style="list-style-type: none"> – Configure NAT (dynamic, static, and PAT) – Demonstrating practical lab skill at consistently and accurately deploying NAT configuration(s) on actual equipment is an essential requirement.
<ul style="list-style-type: none"> ○ Understand and explain the requirement and function of WAN technology and protocols, including IPsec and VPNs. 	<ul style="list-style-type: none"> – Configure GRE as a universal tunnel suitable for a multitude of VPN technologies. – Demonstrating practical lab skill at consistently and accurately deploying GRE on actual equipment is an essential requirement.

II. Learning Resources

Required Textbooks:

1. CCNA v7 Enterprise Networking, Security and Automation (ENSA) course (NetAcad online course)
2. CCNA v7: Enterprise Networking, Security, and Automation (Companion Guide) by Cisco Networking Academy; Cisco Press, Jul 16, 2020; ISBN-13: 978-0-13-663432-4

Suggested Reference Books:

The following books are suggested to enhance your learning, but are NOT required texts.

- CCNA 200-301 Official Cert Guide Library, Wendell Odom; Cisco press, Dec 31, 2019; ISBN-13: 978-1-58714-714-2

Lab Notebook:

During lab periods, you will be expected to have and maintain a separate lab notebook to manually record anything you may need to repeat or recall in the future. Some lab exercises may instruct you to record information in your lab notebook for future reference in follow-on labs. If you are involved in a troubleshooting exercise, the lab book will be particularly valuable for recording any issues, your diagnostic and corrective actions and the ensuing results. Proper documentation is a critical aspect of an effective problem solving methodology.

Functioning IT Account:

You need a functioning Algonquin IT account to do work required for this course, sometimes while in the lab. **Make sure you have a functioning IT account!**

Required Equipment:

Each student will require:

- a USB memory stick. Students will need to backup and/or save results of their lab work, and will need a USB stick to do so.

Course activities are predicated on the use of the “Required Equipment” as stipulated, using the college-supplied software image, within the scheduled lab. Students attempting to use other hardware, platforms, etc. do so at their own risk

III. Teaching/Learning Methods

The course consists of 5 contact hours per week in a mixture of lectures and hands-on lab sessions. It is anticipated that you will need to spend at least an additional 3 - 6 hours per week, outside of that for readings, assignments and further study/research.

During this course you are likely to experience:

Classroom Lectures:

The classroom lectures will cover the core relevant material in each chapter of the required textbook, expanding on some of the topics presented while reviewing in more detail other important concepts.

It is important to follow the theory sessions closely as they carry & expand the “knowledge” thread for the course, and are structured in a way to ensure intuitive and durable learning.

Certain topic areas will be briefly presented in “big picture terms” in the earlier lectures and then revisited in more depth later on in subsequent lectures or semesters.

Lectures will present the majority of the theoretical material of the course. Students are expected to attend all of the lectures. Students are encouraged to ask questions during lectures and to consult with the professors on topics, which they do not clearly understand. Professors will inform students, at the beginning of the course, of suitable times for consultations.

Online Cisco curriculum:

The online Cisco educational material is available to you through Cisco Net Academy. Students will be expected to have read from each relevant chapter of the curriculum PRIOR to attending lectures. The online curriculum also contains helpful links to relevant web sites, practice quizzes to help test your knowledge, and other useful tools.

Cisco textbook(s):

The textbook is closely related to the online curriculum, and helps to fill in some of the knowledge gaps and to present a depth of information that is not given with the online curriculum. As such, it acts as a good reading & study guide for the course curriculum.

Labs:

The labs are the hands-on component of the course, allowing students to apply relevant portions of the theoretical material in a more concrete way.

It is also important to follow the lab sessions closely as they are not necessarily synchronized to the theory lectures at all times during the semester. The lab sessions are structured as independent stand-alone learning opportunities that *complement* the theory portion of the course.

Students are expected to perform initial analysis, design, and possibly some configuration **before** their scheduled lab, in order to take advantage of the limited lab time. Laboratory assignments will be integrated with the theory material. Experience has shown that students' ability to successfully complete the assigned exercises directly correlates with their level of success on tests and the final exam(s).

While the text references and lectures constitute major sources of information for this course, additional information such as pdf format course notes posted on the course website, Internet references, exercises, lab worksheets and other material will be provided as required.

This course requires you to learn material in the following broad areas listed below, and the organization of the theory and lab portions of the course will reflect this division of learning.

- A. Concepts related to "how it works", "why it's necessary", "where/when it's used".
- B. Standards & practices related to applying the knowledge & technologies to achieve certain results.
- C. Recognizing relevant and valid applications of the technology, and knowing what to expect from them.
- D. Ways and means of dealing with malfunctioning networks.
- E. Evolutions and trends related to all the above.
- F. The acronyms and technical jargon associated with all of the above.

IV. Learning Activities

Samples of learning activities may include:

- Lectures in-class and possibly online
- Self-directed reading and research (textbooks and online materials)
- In-class quizzes
- Assigned laboratory work, individually or in groups
- Using Algonquin's NetLab, a remote-access networking facility
- Individual homework assignments
- In-class exercises, individually or in groups

V. Course Content

It is anticipated that course topics will be covered according to the following week-by-week schedule, though the professor reserves the right to make adjustments as deemed necessary. This schedule has been designed keeping in mind the transition from a purely virtual learning environment (due to Covid-19) to a fully in-person environment with real equipment.

Week	Topic	Lab work
1	Welcome / orientation; review of NET1002/NET1006 highlights	Intro to Lab; subnetting postlab
2	Intro to Enterprise networks: hierarchical design, large number of devices, dynamic protocols, IPv6 (Ch 11, SRWE Ch 8)	Basic device cabling, config including IPv4 static routes
3	Dynamic Routing Principles & Single area OSPFv2 – theory of operation (Ch 1)	IPv6, including static routes and DHCPv6 (SRWE Ch 8)
4	OSPFv2 Single area configuration (Ch 2)	OSPFv2 – single area
5	OSPFv2 Multi-area: theory of operation & configuration (Extra)	OSPFv2 – multi-area
6	OSPF optimization and Troubleshooting (Extra notes)	ICMP+Traceroute (Extra notes)
7	OSPFv3 Single/Multi-area (Extra notes)	OSPF – optimization
	Break week Oct 24-28	
8	Network Security concepts and ACLs (Ch 3, 4)	OSPFv3
9	IPv4 ACLs (extended) (Ch 4, 5)	ACLs – config & verification
10	IPv6 ACLs (Extra notes)	ACLs – extended, IPv6
11	NAT principles of operation (Ch 6)	NAT
12	WAN, VPN & IPsec concepts (Ch 7, 8)	GRE (+ possibly VPN)
13	Complete all topics; course review	SBA Practice lab
Exam period	Lab Exam: Skills Based Assessment Final theory Exam	

VI. Evaluation/Earning Credit:

The following will provide evidence of your learning achievement:

Assessment of student learning will be done by means of in-class and online tests, final theory exam and laboratory activity that include a "practical" lab exam.

Laboratory attendance is compulsory, and absence from **three or more laboratory sessions** without the prior consent of the professor will result in a **final grade of “F”**. Students are responsible for keeping a record of the number of laboratory sessions they have missed. The Professor(s) is not responsible for informing students of an impending failure because of missed laboratory sessions. **Note: this policy may be modified if necessary due to a resurgence of Covid-19, but please start by assuming that attendance at ALL labs is mandatory.**

The ICT Department requires that all course assignments (homework exercises, laboratory work, projects, etc) be submitted by students using a standard which could be specific to one or more courses. Professors will advise students in writing of the exact details of the assignment's submission requirements. Student submissions that do not meet the course submission standards may not be marked, and may incur a penalty of up to 100% of the submission mark.

All laboratory assignments must be successfully completed in order to obtain course credit. Late assignments will be penalized and receive a mark of zero, but must still be completed. Any evaluation aspects missed will result in a grade of “0” for that item. In the case of a documented emergency or prior arrangement, the professor, in consultation with the Chair, will determine how the marks will be made up and/or final grade adjusted.

All students are required to write the final Theory Exam. If, as a result of being off-track in your program, you note that there is a scheduling conflict in your exam schedule, it is your responsibility to alert your course professor no later than one week before the start of the final exam period, to allow for any special arrangements. For any other situations resulting in a student not writing their Theory Exam, the normal Carleton University rules for missed final exams will apply. See the following link for details:

<http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/examinations/#deferred-final-exams>

All students are required to write the Lab Exam. It is specifically an assessment of speed and accuracy in performing the essential duties and requirements of network configuration and management, and is the means by which students demonstrate mastery of core aspects of the course curriculum: correctly and reliably completing this work is a vital, indispensable part of both this course and network engineering. Certain practical lab skills are designated as an essential requirement and duty (as defined by section 17(1) of the Ontario Human Rights Code R.S.O. 1990) and derives from the fact that functional network access, and restoring that access should it ever fail, is now widely understood as a time-sensitive, mission critical resource. Accordingly, only under exceptional circumstances will requests for extended time on the Lab Exam be considered, and all such requests must be made well in advance of the test date. Please see details of both Carleton's and Algonquin's regulations for exact deadlines.

Students registered with PMC or CAL are reminded that they should review the relevant legislation and policies so that they are fully aware of the rights, responsibilities, and obligations of all parties. Examples of the legislation include *Guidelines on accessible education*, Ontario Human Rights Commission, ISBN: 0-7794-7191-1. All requests for retroactive accommodation will be meaningfully considered as they arise.

The factors determining the final grade are:

1. Tests, Quiz & Final Examination	65%
Formative Assessments	30%
– Midterm Test:	20% (provisionally set for Oct 31) Scheduled for Wed Nov 2nd
– In-class Quizzes & Exercises:	5% (approximately)
– Chapter tests:	5% (approximately)
Final Theory Examination	35% (Exam week: Dec 10-22)
 2. Practical Evaluation	 35%
Lab Exercises	10%
- Pre-lab, in-lab, and post-lab exercises (Weekly)	
Lab Exam	25% (Exam week: Dec 10-22)

In order to obtain a credit for this course, students **must**:

- **achieve ½ the marks from Evaluation Item #1** (i.e. theoretical portion of the course)
- **achieve ½ the marks from Evaluation Item #2** (i.e. practical portion of the course)

Lab Evaluation Details

Lab evaluation is conducted by the lab professor, and contributes significantly to your final grade. For this course, the following criteria must be satisfied in order to obtain a non-zero lab mark:

1. Satisfactory attendance and participation in the lab.
2. Satisfactory workmanship and behaviour in the lab.
3. Satisfactory adherence to rules prescribed for the lab facility.
4. Being prepared and equipped for lab work while in the lab.

5. Satisfactory completion of the work required within the lab period.
6. Satisfactory completion of any exercises and projects outside of lab hours.

Where there is a requirement for group work and/or sharing of hardware within a group, the lab professor reserves the right to reorganize/stipulate group memberships.

VII. Related Information

Retention of course material. It is your responsibility to retain copies of all assignments, labs and mid-term tests (returned from the professor), and any other evaluations and pertinent records (except for final exams, which are not returned) in case you become involved in an appeal hearing at a later date.

It is also your responsibility to retain course outlines for possible future use to support applications for transfer of credit to other educational institutions.

College email account. Algonquin College provides all full-time students with an email account. This is the address that will be used when the College, your professors, or your fellow students communicate important information about your program or course events. It is your responsibility to ensure that you know how to send and receive email using your Algonquin College account, and to check it regularly.

Harassment/Discrimination/Violence will not be tolerated. Any form of harassment (sexual, racial, gender or disability-related), discrimination (direct or indirect), or violence, whether involving a professor and a student or amongst students, will not be tolerated on the college premises.

Harassment means one or a series of vexatious comment(s) (whether done verbally or through electronic means), or conduct related to one or more of the prohibited grounds that is known, or ought reasonably to be known, to be unwelcome/unwanted, offensive, intimidating, derogatory or hostile.

This may include, but is not limited to: gestures, remarks, jokes, taunting, innuendo, display of offensive materials, offensive graffiti, threats, verbal or physical assault, stalking, slurs, shunning or exclusion related to the prohibited grounds.

Bachelor of Information Technology students are bound by the Carleton's regulations on Academic Integrity and proper conduct, as provided in Carleton University's Undergraduate Calendar: online at

<https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/academic-integrity-and-offenses-of-conduct/>

and by the University regulations discrimination and human rights

<http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/academic-integrity-and-offenses-of-conduct/#human-rights-policy>

The Algonquin School of Advanced Technology's Standard Operating Procedure on Plagiarism and Academic Honesty defines plagiarism as an attempt to use or pass off as one's own idea or product, work of another without giving credit. *Plagiarism is one of the most serious academic offences a student can commit.* Plagiarism has occurred in instances where a student either directly copies another person's work without acknowledgement; or, closely paraphrases the equivalent of a short paragraph or more without acknowledgement; or, borrows, without acknowledgement, any ideas in a clear and recognizable form in such a way as to present them as one's own thought, where such ideas, if they were the student's own would contribute to the merit of his or her own work. BIT students are also bound by Carleton's Academic Integrity Policy: <https://carleton.ca/secretariat/wp-content/uploads/Academic-Integrity-Policy-2021.pdf>

Violation of the Copyright Act.

- **General** – The Copyright Act makes it an offence to reproduce or distribute, in whatever format, any part of a publication without the prior written permission of the publisher. For complete details, see the Government of Canada website at <https://laws-lois.justice.gc.ca/eng/acts/C-42/>. Make sure you give it due consideration, before deciding not to purchase a textbook or material required for your course.
- **Software Piracy** - The Copyright Act has been updated to include software products. Be sure to carefully read the licensing agreement of any product you purchase or download, and understand the term and conditions covering its use, installation and distribution (where applicable). Any infringement of licensing agreement makes you liable under the law.

The Use of Electronic Devices during classes, other than those sanctioned by the course professor is strictly prohibited. In particular, cell phones are not to be used to communicate during a class. The use of any electronic devices during exams and mid-term tests, other than those sanctioned by the faculty in charge of the examination is strictly prohibited.

In accordance with Algonquin College Directive AA32, any unauthorized use of a prohibited device will be considered plagiarism, and be dealt with as such. This policy can be found at: <https://www.algonquincollege.com/policies/files/2019/06/AA32.pdf>

Disruptive Behaviour is any conduct, or threatened conduct, that is disruptive to the learning process or that interferes with the well-being of other members of the College community. It will not be tolerated.

Members of the College community, both students and staff, have the right to learn and work in a secure and productive environment. The College will make every effort to protect that right.

Incidents of disruptive behaviour must be reported in writing to the departmental Chair as quickly as possible. The Chair will hold a hearing to review available information and determine any sanctions that will be imposed. Disciplinary hearings can result in penalties ranging from a written warning to expulsion.

For further details, consult the Algonquin Student Handbook, available online at: <https://www.algonquincollege.com/studentsupportservices/student-handbook/>

Students with Disabilities requiring academic accommodations in this course are encouraged to contact a coordinator at both the Paul Menton Centre (PMC) for Students with Disabilities and the Algonquin Centre for Accessible Learning (CAL) to complete the necessary *letters of accommodation*. After registering with the centres, make an appointment to meet and discuss your needs with the professor at least two weeks prior to the first in-class test or midterm exam. This is necessary to ensure sufficient time for making any needed arrangements. Please note the deadline for submitting completed forms to the PMC as published in Carleton University's "Academic Year" calendar.

Challenge for Credit

Challenge for credit is a Carleton University policy that enables students to obtain undergraduate academic credit for any learning and experience gained through work and related professional development. It is not intended to overlap in scope with transfer of credits or admission with advanced standing.

For full details, see the section in Carleton University's Undergraduate Calendar on "Academic Regulations of the University", also available online at:

<http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/registration-evaluation-records/#challenge-for-credit>

For this course, candidates will provide evidence of their learning achievement through the successful completion of:

- A challenge exam with a breadth of coverage and level of difficulty equivalent to the final examination in the course; plus,
- A hands-on or practical component to demonstrate the achievement of the requisite applied knowledge and skills.

Eligibility for Deferred Examination

The decision to grant a deferred exam is not determined by course performance. See <https://carleton.ca/registrar/deferral/> for details.

Requests for Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy Obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Religious Obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at

the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator at Algonquin or Carleton, or visit: students.carleton.ca/course-outline