

Information Technology

This section presents the requirements for programs in:

- **Information Resource Management B.I.T.**
- **Interactive Multimedia and Design B.I.T.**
- **Network Technology B.I.T.**
- **Photonics and Laser Technology B.I.T.**

Program Requirements

Course Categories

- Carleton University Electives
- Algonquin college Electives

Please check the current lists of approved electives on the program web site.

Information Resource Management B.I.T. (20.0 credits)

A. Credits Included in the Major CGPA (12.0)

1. 4.0 credits in: 4.0

BIT 1400 [0.5]	Introduction to Programming and Problem Solving
IRM 1002 [0.5]	Reference and Information Services
IRM 1003 [0.5]	Collections management
IRM 1004 [0.5]	Reader's Advisory Services
IRM 1005 [0.5]	Web Interface Development
IRM 1006 [0.5]	Subject Analysis and Indexing
IRM 1007 [0.5]	Cataloguing
IRM 1008 [0.5]	Introduction to Information Resource Management

2. 3.0 credits in: 3.0

BIT 2008 [0.5]	Multimedia Data Management
BIT 2400 [0.5]	Intermediate Programming
IRM 2002 [0.5]	Legal and Business Information
IRM 2003 [0.5]	Classification
IRM 2004 [0.5]	Information Management and Digital Preservation
IRM 2005 [0.5]	Advanced Cataloguing

3. 2.5 credits in: 2.5

IRM 3001 [0.5]	Scientific and Medical Information
IRM 3003 [0.5]	Legal Issues in Information Resource Management
IRM 3004 [0.5]	Project management
IRM 3006 [0.5]	Data Analysis and Research Methodology
IRM 3008 [0.5]	Metadata for IRM

4. 2.5 credits in: 2.5

IRM 4000 [0.5]	Library Software
IRM 4001 [0.5]	Archives and Special Collections
IRM 4002 [0.5]	Network Technology
IRM 4900 [1.0]	Final IRM Project

B. Credits Not Included in the Major (8.0 credits)

5. 3.0 credits in: 3.0

BIT 2000 [0.5]	Introduction to Statistics
BIT 2001 [0.5]	Introduction to Business
BIT 2002 [0.5]	Marketing in the IT sector

CCDP 3006 [0.5]	Communication Skills for IRM	
IRM 3007 [0.5]	Practicum for IRM	
IRM 4004 [0.5]	Big Data Analytics and Applications	
6. 1.0 credit in	French Language (see Note 2, below)	1.0
7. 4.0 credits in	electives to be fulfilled by courses taken to complete a Minor (see Note 1, below)	4.0
Total Credits		20.0

Notes:

1. **Additional requirements:** students must complete a Minor in another academic discipline.
2. **Language requirement:** all students are expected to improve their current French language skill by one credit. Should a student be assessed as fluently bilingual, 1.0 credit of alternate language courses will be accepted. Canadian Aboriginal languages would be encouraged in such cases.

Interactive Multimedia and Design B.I.T. (20.0 credits)

A. Credits Included in the Major CGPA (14.0 credits)

1. 3.0 credits in: 3.0

BIT 1400 [0.5]	Introduction to Programming and Problem Solving
IMD 1000 [0.5]	Introduction to Interactive Multimedia Design
IMD 1001 [0.5]	Visual Communication
IMD 1002 [0.5]	Visual Dynamics
IMD 1004 [0.5]	Design Processes
IMD 1005 [0.5]	Web Development

2. 3.5 credits in: 3.5

BIT 2008 [0.5]	Multimedia Data Management
BIT 2400 [0.5]	Intermediate Programming
IMD 2003 [0.5]	Audio and Video
IMD 2006 [0.5]	Introduction to Computer Games
IMD 2007 [0.5]	Intro to 3D Animation
IMD 2900 [1.0]	Design Studio 1

3. 4.0 credits in: 4.0

IMD 3002 [0.5]	3D Computer Graphics
IMD 3004 [0.5]	Human Computer Interaction and Design
IMD 3005 [0.5]	Sensor-Based Interaction
IMD 3006 [0.5]	Software Design for Multimedia Applications
IMD 3900 [1.0]	Design Studio 2
IMD 3901 [1.0]	Design Studio 3

4. 3.5 credits in: 3.5

IMD 4005 [0.5]	Advanced Topics in Multimedia
IMD 4006 [0.5]	Advanced Computer Gaming
IMD 4007 [0.5]	Advanced Animation and Visual FX
IMD 4008 [0.5]	Mobile User Interface Design and Development
IMD 4901 [1.5]	Senior IMD Project

B. Credits Not Included in the Major CGPA (6.0 credits)

5. 1.5 credits in: 1.5

BIT 1002 [0.5]	Physics for Information Technology I
BIT 1100 [0.5]	Mathematics I for IMD
BIT 1101 [0.5]	Mathematics II for IMD

6. 1.5 credits in:		1.5
BIT 2000 [0.5]	Introduction to Statistics	
BIT 2002 [0.5]	Marketing in the IT sector	
BIT 2006 [0.5]	Elective	
7. 0.5 credit in:		0.5
IMD 3003 [0.5]	Communication Skills for IMD	
8. 0.5 credit in:		0.5
IMD 4002 [0.5]	Technology and Culture	
9. 1.0 credit in	Arts and Social Sciences electives for IMD	1.0
10. 1.0 credit in	electives for IMD, and/or Directed Studies	1.0
BIT 4000 [0.5]	Directed Studies	
Total Credits		20.0

Retention of Work (Interactive Multimedia and Design Program Only)

A portfolio represents a record of the student's progress and design experience over the years, and is an indispensable requirement for any future job application. A portfolio is started in first year and continues to expand until graduation. The School, therefore, requires that each student produce reductions (normally 8 1/2 x 11 inch reproductions, colour or black and white, slides, and/or digital format CD) of his or her work at the end of each term. One copy of the work should be put in the student's portfolio and the other turned in to the instructor for retention in the School's archives. (This facilitates retrospective exhibitions of work, accreditation, publications and any future references for pedagogic purposes.) Original work is the property of the students, but the School retains the right to keep work of merit for up to four years after the date of submission. The School will make every effort to preserve the work in good condition, and will give authorship credit and take care of its proper use.

Network Technology

B.I.T. (20.0 credits)

A. Credits Included in the Major CGPA (9.0 credits)

1. 2.5 credits in:		2.5
BIT 1000 [0.5]	Mathematics I for NET	
BIT 1002 [0.5]	Physics for Information Technology I	
BIT 1400 [0.5]	Introduction to Programming and Problem Solving	
NET 1002 [0.5]	Networking Fundamentals	
NET 1006 [0.5]	Routing and Switching	
2. 1.5 credits in:		1.5
BIT 2400 [0.5]	Intermediate Programming	
NET 2000 [0.5]	Intermediate Networking	
NET 2001 [0.5]	Wide Area Networking	
3. 2.5 credits in:		2.5
NET 3000 [0.5]	Database Concepts and SQL	
NET 3001 [0.5]	Real-time Systems	
NET 3008 [0.5]	Advanced Network Routing	
NET 3010 [0.5]	Web Programming	
NET 3900 [0.5]	Wireless Networks	
4. 2.5 credits in:		2.5
NET 4005 [0.5]	Networked Applications	

NET 4007 [0.5]	Multimedia Networking
NET 4010 [0.5]	Secure Mobile Networking
NET 4901 [1.0]	Network Technology Project

B. Credits Not Included in the Major CGPA (11.0 credits)

5. 2.5 credits in:		2.5
BIT 1001 [0.5]	Mathematics II for NET	
BIT 1003 [0.5]	Physics for Information Technology II	
BIT 1006 [0.5]	Elective	
NET 1001 [0.5]	Computer Technology Basics	
NET 1004 [0.5]	Assembly and Machine Language	
6. 3.5 credits in:		3.5
BIT 2000 [0.5]	Introduction to Statistics	
BIT 2001 [0.5]	Introduction to Business	
BIT 2002 [0.5]	Marketing in the IT sector	
NET 2002 [0.5]	Desktop & Server Environments	
NET 2003 [0.5]	Linux Networking	
NET 2004 [0.5]	Communication Skills for NET	
NET 2007 [0.5]	Basics of Transmission Systems	
7. 2.5 credits in:		2.5
NET 3004 [0.5]	Data Structures	
NET 3006 [0.5]	Network Management and Measurements	
NET 3007 [0.5]	Network Security	
NET 3011 [0.5]	Advanced Network Switching	
NET 3012 [0.5]	IP Architectures and Solutions	
8. 2.0 credits in:		2.0
NET 4000 [0.5]	Emerging Network Technologies	
NET 4001 [0.5]	Network Simulation	
NET 4003 [0.5]	Computer Systems Architecture	
NET 4009 [0.5]	Troubleshooting IP Networks	
9. 0.5 credit in	Arts and Humanities electives for NET.	0.5
Total Credits		20.0

Photonics and Laser Technology

B.I.T. (20.0 credits)

A. Credits Included in the Major CGPA (10.0 credits)

1. 3.5 credits in:		3.5
BIT 1203 [0.5]	Physics for Photonics I	
BIT 1400 [0.5]	Introduction to Programming and Problem Solving	
PLT 1002 [0.5]	Trends in Photonics	
PLT 1003 [0.5]	Optics/Optical Fibers I (Principles)	
PLT 1005 [0.5]	Introduction to Optics	
PLT 1006 [0.5]	Introduction to Automation and Simulation	
PLT 1007 [0.5]	Assembly and Machine Language	
2. 2.0 credits in:		2.0
BIT 2007 [0.5]	Mathematics III for PLT	
PLT 2003 [0.5]	Laser Systems	
PLT 2005 [0.5]	Circuits and Signals	
PLT 2006 [0.5]	Semiconductors	
3. 2.0 credits in:		2.0
PLT 3003 [0.5]	Electro Magnetics	
PLT 3004 [0.5]	Design of Optical Components and Systems	
PLT 3009 [0.5]	Project Management	

PLT 3010 [0.5]	Data Structures	
4. 2.5 credits in:		2.5
PLT 4001 [0.5]	Optoelectronic Devices	
PLT 4006 [0.5]	Image and Signal Processing	
PLT 4900 [1.0]	Photonics Research Project	
PLT 4007 [0.5]	Introduction to Solid State Physics	
B. Credits Not Included in the Major CGPA (10.0 credits)		
5. 1.5 credits in:		1.5
BIT 1200 [0.5]	Mathematics I for PLT	
BIT 1201 [0.5]	Mathematics II for PLT	
BIT 1204 [0.5]	Physics for Photonics II	
6. 4.5 credits in:		4.5
BIT 2000 [0.5]	Introduction to Statistics	
BIT 2001 [0.5]	Introduction to Business	
BIT 2002 [0.5]	Marketing in the IT sector	
BIT 2004 [0.5]	Differential Equations For Photonics	
BIT 2005 [0.5]	Multivariate Calculus for Photonics	
BIT 2400 [0.5]	Intermediate Programming	
PLT 2001 [0.5]	Fundamentals of Light Sources	
PLT 2002 [0.5]	Optical Communication Networks I	
PLT 2008 [0.5]	Manufacturing Photonics Components	
7. 2.0 credits in:		2.0
PLT 3000 [0.5]	Optical Communication Networks II	
PLT 3001 [0.5]	Photonics Manufacturing Systems	
PLT 3002 [0.5]	Real-time Systems	
PLT 3008 [0.5]	Communication Skills for PLT	
8. 1.0 credit in:		1.0
PLT 4000 [0.5]	Introduction to Quantum Information	
PLT 4004 [0.5]	Biomedical Photonics	
9. 0.5 credit in Arts and Humanities electives for PLT.		0.5
10. 0.5 credit in Free Electives		0.5
Total Credits		20.0

Regulations

The regulations presented in this section apply to all students in the Bachelor of Information Technology program.

In addition to the program requirements, students must satisfy the University regulations common to all undergraduate students including the process of Academic Performance Evaluation (consult the Academic Regulations of the University section of this Calendar).

Joint Status

A student registered in the BIT degree has student status at both Algonquin College and Carleton University. At Algonquin College the student is considered to be a post-secondary student; at Carleton University, the student is considered to be a degree student. Students registered in the BIT degree have access to all student services on the Carleton University campus and selected services on the Algonquin College campus.

Academic Regulations

The academic regulations governing the B.I.T. are the academic regulations of Carleton University. These regulations are defined in full in the Academic Regulations of the University section of this Calendar and apply to B.I.T. students on both campuses. Within the context of these regulations, B.I.T. is considered to be a General degree with a defined Major CGPA and requires 20.0 credits. Courses with the designations BIT, NET or IMD are not normally transferable to Engineering, Computer Science or other programs at Carleton University.

Students should note that there are significant differences between the academic regulations of Carleton University and Algonquin College; it is the regulations of Carleton University that apply in all cases as related both to course registrations and program rules.

At Carleton University, the chief examination officer of the BIT is the Dean of Engineering and Design. At Algonquin College, grades are approved by the Dean of the respective School.

Graduation

In order to graduate with the Bachelor of Information Technology Degree and the Advanced Diploma of Technology or Advanced Diploma of Applied Arts, the student must:

1. satisfy all requirements for the program of study;
2. be recommended for graduation by Bachelor of Information Technology Academic Council;
3. be approved for graduation by the Senate of Carleton University;
4. be approved for graduation by the Registrar of Algonquin College.

Discipline

The regulations, procedures and sanctions that apply to student discipline on either campus, both concerning Instructional Offences and Offences of Conduct are those of Carleton University and are described in the Carleton University Undergraduate Calendar. However, while students are on Algonquin's campus, they are expected to follow Algonquin's Directives regarding Student Misconduct and Use of Electronic Devices.

Co-operative Education

For more information about how to apply for the Co-op program and how the Co-op program works please visit the Co-op website.

All students participating in the Co-op program are governed by the Undergraduate Co-operative Education Policy.

Undergraduate Co-operative Education Policy

Admission Requirements

Students can apply to co-op in one of two ways; directly from high school or after beginning a degree program at Carleton.

If a student is admitted to co-op from high school, their grades will be reviewed two terms to one year prior to

their first work term to ensure they continue to meet the academic requirements after their 1st or 2nd year of study. The time at which evaluation takes place depends on the program of study. Students will automatically be notified via their Carleton email account if they are permitted to continue.

Students not admitted to Carleton University with the co-op option on their degree can apply for admission via the co-operative education program website. To view application deadlines, visit carleton.ca/co-op.

Admission to the co-op option is based on the completion of 5.0 or more credits at Carleton University, the CGPA requirement for the students' academic program as well as any course prerequisites. The articulated CGPA for each program is the normal standard for assessment. Please see the specific degree program sections for the unique admission and continuation requirements for each academic program.

English Language Proficiency

Students admitted to Carleton based on CAEL, IELTS or TOEFL assessments and who are required to take an ESL course must take and pass the Oral Proficiency in Communicative Settings (OPECS) Test. The test must be taken before being permitted to register in COOP 1000. Admission to the co-op program can be confirmed with a minimum score of 4+.

Participation Requirements

COOP 1000

Once a student has been given admission or continuation confirmation to the co-op option s/he must complete and pass COOP 1000 (a mandatory online 0.0 credit course). Students will have access to this course a minimum of two terms prior to their first work term and will be notified when to register.

Communication with the Co-op Office

Students must maintain contact with the co-op office during their job search and while on a work term. All email communication will be conducted via the students' Carleton email account.

Employment

Although every effort is made to ensure a sufficient number of job postings for all students enrolled in the co-op option of their degree program, no guarantee of employment can be made. Carleton's co-op program operates a competitive job search process and is dependent upon current market conditions. Academic performance, skills, motivation, maturity, attitude and potential will determine whether a student is offered a job. It is the student's responsibility to actively conduct a job search in addition to participation in the job search process operated by the co-op office. Once a student accepts a co-op job offer (verbally or written), his/her job search will end and access to co-op jobs will be removed for that term. Students that do not successfully obtain a co-op work term are expected to continue with their academic studies. The summer term is the exception to this rule. Students should

also note that hiring priority is given to Canadian citizens for co-op positions in the Federal Government of Canada.

Registering in Co-op Courses

Students will be registered in a Co-op Work Term course while at work. The number of Co-op Work Term courses that a student is registered in is dependent upon the number of four-month work terms that a student accepts.

While on a co-op work term students may take a maximum of 0.5 credit throughout each four-month co-op work term. Courses must be scheduled outside of regular working hours.

Students must be registered as full-time before they begin their co-op job search (2.0 credits). All co-op work terms must be completed before the beginning of the final academic term. Students may not finish their degree on a co-op work term.

Work Term Assessment and Evaluation

To obtain a Satisfactory grade for the co-op work term students must have:

1. A satisfactory work term evaluation by the co-op employer;
2. A satisfactory grade on the work term report.

Students must submit a work term report at the completion of each four-month work term. Reports are due on the 16th of April, August, and December and students are notified of due dates through their Carleton email account.

Workplace performance will be assessed by the workplace supervisor. Should a student receive an unsatisfactory rating from their co-op employer, an investigation by the co-op program manager will be undertaken. An unsatisfactory employer evaluation does not preclude a student from achieving an overall satisfactory rating for the work term.

Graduation with the Co-op Designation

In order to graduate with the co-op designation, students must satisfy all requirements for their degree program in addition to the requirements according to each co-op program (i.e. successful completion of three or four work terms).

Note: Participation in the co-op option will add up to one additional year for a student to complete their degree program.

Voluntary Withdrawal from the Co-op Option

Students may withdraw from the co-op option of their degree program during a study term ONLY. Students at work may not withdraw from the work term or the co-op option until s/he has completed the requirements of the work term.

Students are eligible to continue in their regular academic program provided that they meet the academic standards required for continuation.

Involuntary or Required Withdrawal from the Co-op Option

Students may be required to withdraw from the co-op option of their degree program for one or any of the following reasons:

1. Failure to achieve a grade of SAT in COOP 1000
2. Failure to pay all co-op related fees
3. Failure to actively participate in the job search process
4. Failure to attend all interviews for positions to which the student has applied
5. Declining more than one job offer during the job search process
6. Continuing a job search after accepting a co-op position
7. Dismissal from a work term by the co-op employer
8. Leaving a work term without approval by the Co-op manager
9. Receipt of an unsatisfactory work term evaluation
10. Submission of an unsatisfactory work term report

Standing and Appeals

The Co-op and Career Services office administers the regulations and procedures that are applicable to all co-op program options. All instances of a student's failure during a work term or other issues directly related to their participation in the co-op option will be reported to the academic department.

Any decision made by the Co-op and Career Services office can be appealed via the normal appeal process within the University.

International Students

All International Students are required to possess a Co-op Work Permit issued by Citizenship and Immigration Canada before they can begin working. It is illegal to work in Canada without the proper authorization. Students will be provided with a letter of support to accompany their application. Students must submit their application for their permit before being permitted to view and apply for jobs on the Co-op Services database. Confirmation of a position will not be approved until a student can confirm they have received their permit. Students are advised to discuss the application process and requirements with the International Student Services Office.

Bachelor of Information Technology: Co-op Admission and Continuation Requirements

- Maintain full-time status in each study term (2.0 credits);
- Be eligible to work in Canada (for off-campus work)
- Have successfully completed COOP 1000 [0.0]

In addition to the following:

1. Obtained and maintained a major CGPA of 8.0;
2. Successfully completed all required first-year courses, and
3. Registered as a full-time student in the Bachelor of Information Technology program

Students in the Bachelor of Information Technology must complete three (3) work terms to obtain the co-op designation.

Co-op Work Term Course: BIT 3999

Work/Study Pattern:

Interactive Multimedia and Design, Information Resource management, Network Technology, Photonics and Laser Technology

Year 1		Year 2		Year 3		Year 4		Year 5	
Term	Pattern	Term	Pattern	Term	Pattern	Term	Pattern	Term	Pattern
Fall	S	Fall	S	Fall	S	Fall	W/S	Fall	S
Winter	S	Winter	S	Winter	W	Winter	S	Winter	S
Summer		Summer	W	Summer	W	Summer	W/S		

Legend

S: Study

W: Work

O: Optional

* indicates recommended work study pattern

** student finds own employer for this work-term.

Admission

Degree

- Bachelor of Information Technology (B.I.T.)

The Bachelor of Information Technology is offered jointly with Algonquin College.

Admission Requirements

First Year

To be eligible for admission to the first year of the Bachelor of Information Technology, the applicant must have:

1. The Ontario Secondary School Diploma (OSSD) or equivalent, including a minimum of six 4U or M courses.
2. For Multimedia and Design:
The six 4U or M courses must include Advanced Functions. In addition, candidates for BIT in Interactive Multimedia and Design must submit a portfolio of any kind of work that demonstrates the applicant's creativity and aptitude in design work.
3. For Network Technology:
The six 4U or M courses must include one of Advanced Functions or Calculus and Vectors or Mathematics of Data Management (Calculus and Vectors recommended).
4. For Photonics and Laser Technology:
The six 4U or M courses must include Advanced Functions.
5. For Information Resource Management:
The six 4U or M courses must include English and one of Advanced Functions or Calculus and Vectors or Mathematics of Data Management.

Advanced Standing

Applications for Advanced Standing towards the program leading to the Bachelor of Information Technology will be evaluated on an individual basis upon admission to the program. Students may request that additional courses be considered toward Advanced Standing. Such requests may be made only once and must be received by the

BIT Joint Council (comprised of instructors from Carleton University and Algonquin College) by August 30 of the year in which the student is admitted to the program. Requests must follow the submission format outlined on the BIT web site.

Only university- and college-level courses in which a student has achieved a grade of C- or higher are eligible to be considered for Advanced Standing.

Co-op Option

Direct Admission to the First Year of the Co-op Option

Applicants must:

1. meet the required overall admission cut-off average and prerequisite course average. These averages may be higher than the stated minimum requirements;
2. be registered as a full-time student in one of the streams of the Information Technology degree stated in this section;
3. be eligible for work in Canada (for off-campus work placements).

Meeting the above requirements only establishes eligibility for admission to the program. The prevailing job market may limit enrolment in the Co-op option.

Note: continuation requirements for students previously admitted to the co-op option and admission requirements for the co-op option after beginning the program are described in the Co-operative Education Regulations section of this Calendar.

Information Technology (BIT) Courses

BIT 1000 [0.5 credit]

Mathematics I for NET

Tailored for students in the Network Technology program, this course covers basic concepts in functions (polynomials, exponential, logarithmic) and introduces concepts of limits, derivatives and rules of differentiation, applications of differentiation (max-min problems, curve sketching) and integration.

Precludes additional credit for BIT 1100, BIT 1200, ECON 1401, ECON 1402, MATH 1002, MATH 1004, MATH 1007, MATH 1009, MATH 1401, MATH 1402.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial/laboratory one hour a week.

BIT 1001 [0.5 credit]

Mathematics II for NET

Tailored for students in the Network Technology program, this course covers systems of linear equations, vector space of n-tuples, subspaces and bases, matrix transformations, kernel, range, matrix algebra and determinants, inner products and orthogonality, eigenvalues, diagonalization and applications.

Precludes additional credit for BIT 1101, BIT 1201, ECON 1401, ECON 1402, MATH 1104, MATH 1107, MATH 1119, MATH 1401, MATH 1402.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial and laboratory one hour a week.

BIT 1002 [0.5 credit]

Physics for Information Technology I

An introductory course on energy, thermodynamics, sound and electromagnetic waves, optics, and modern physics. Practical skills are learned in the laboratory, which is a required part of the course.

Precludes additional credit for BIT 1203, PHYS 1001, PHYS 1003, PHYS 1007.

Prerequisite(s): Restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial three hours/ laboratory three hours alternate weeks.

BIT 1003 [0.5 credit]

Physics for Information Technology II

Electrostatics, electric field and potential. Capacitors, inductors. Study of DC and AC Circuits. Introduction to semiconductors. Practical skills are learned in the laboratory, which is a required part of the course.

Precludes additional credit for BIT 1204, PHYS 1002, PHYS 1004, PHYS 1008.

Prerequisite(s): BIT 1002.

Lectures three hours a week, tutorial three hours/ laboratory three hours alternate weeks.

BIT 1006 [0.5 credit]

Elective

Students must choose from among a list of approved Electives at Algonquin College.

Precludes additional credit for BIT 2003 (no longer offered).

Prerequisite(s): restricted to students in the B.I.T. degree program.

BIT 1100 [0.5 credit]**Mathematics I for IMD**

Tailored for students in the Interactive Multimedia Design program, this course covers basic concepts in functions (polynomials, exponential, logarithmic) and introduces concepts of limits, derivatives and rules of differentiation, applications of differentiation (max-min problems, curve sketching) and integration.

Precludes additional credit for BIT 1000, BIT 1200, ECON 1401, ECON 1402, MATH 1002, MATH 1004, MATH 1007, MATH 1009, MATH 1401, MATH 1402.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial/laboratory one hour a week.

BIT 1101 [0.5 credit]**Mathematics II for IMD**

Tailored for students in the interactive Multi-media Design program, this course covers systems of linear equations, vector space of n-tuples, subspaces and bases, matrix transformations, kernel, range, matrix algebra and determinants, inner products and orthogonality, eigenvalues, diagonalization and applications.

Precludes additional credit for BIT 1001, BIT 1201, ECON 1401, ECON 1402, MATH 1104, MATH 1107, MATH 1119, MATH 1401, MATH 1402.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial and laboratory one hour a week.

BIT 1200 [0.5 credit]**Mathematics I for PLT**

Limits. Differentiation of the elementary functions, including trigonometric functions. Rules of differentiation. Applications of differentiation: max-min problems, curve sketching, approximations. Introduction to integration: definite and indefinite integrals, areas under curves, fundamental theorem of calculus.

Precludes additional credit for BIT 1000, BIT 1100, MATH 1002, MATH 1004, MATH 1007, MATH 1009, MATH 1401/ECON 1401, MATH 1402/ECON 1402.

Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions; or MATH 0005 and MATH 0006; or equivalent. Restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial/laboratory one hour a week.

BIT 1201 [0.5 credit]**Mathematics II for PLT**

Systems of linear equations; vector space of n-tuples, subspaces and bases; matrix transformations, kernel, range; matrix algebra and determinants. Dot product. Complex numbers (including de Moivre's Theorem, and n-th roots). Eigenvalues, diagonalization and applications. Note: MATH 1119 is not an acceptable substitute for BIT 1201.

Precludes additional credit for BIT 1001, BIT 1101, MATH 1102, MATH 1104, MATH 1107, MATH 1119, MATH 1401/ECON 1401, MATH 1402/ECON 1402.

Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions, or MATH 0005, or equivalent, or permission of the School. restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial and laboratory one hour a week.

BIT 1203 [0.5 credit]**Physics for Photonics I**

Mechanics, properties of matter, thermodynamics. Applications chosen in part from the life sciences.

Precludes additional credit for BIT 1002, PHYS 1001, PHYS 1003, PHYS 1007.

Prerequisite(s): (i) Grade 12 Mathematics: Advanced Functions or equivalent; or (ii) Grade 12 Mathematics: Calculus and Vectors or equivalent, or MATH 1007 or BIT 1200 (may be taken concurrently); or (iii) permission of the Department. Restricted to students in the B.I.T. degree program.

Lectures three hours a week, laboratory or tutorial three hours a week.

BIT 1204 [0.5 credit]**Physics for Photonics II**

Electricity and magnetism, DC and AC circuits, wave motion and light. Elements of modern physics. Applications chosen in part from the life sciences.

Precludes additional credit for BIT 1003, PHYS 1002, PHYS 1004, PHYS 1008.

Prerequisite(s): BIT 1203 or PHYS 1001 or PHYS 1003 or PHYS 1007 or permission of the Department. Restricted to students in the B.I.T. degree program.

Lectures three hours a week, laboratory or tutorial three hours a week.

BIT 1400 [0.5 credit]**Introduction to Programming and Problem Solving**

Introduction to basic concepts of algorithm design and computer programming in C/C++. Topics include computer architecture, algorithms and pseudocode, basic operators, variables and functions, program control with iteration and conditionals, I/O operations, text processing, structures, arrays, pointers, and debugging.

Precludes additional credit for IMD 1003, ITEC 1400, NET 1000 and PLT 1000.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial/laboratory three hours a week.

BIT 2000 [0.5 credit]**Introduction to Statistics**

This course covers data analysis, introduction to probability theory, some standard discrete and continuous distributions and their application to interval estimation and significance testing, computational aspects of statistics. Precludes additional credit for BIT 2100 (no longer offered), BIT 2300 (no longer offered), ECON 2201 (no longer offered), ECON 2210, ENST 2006, GEOG 2006, STAT 2507, STAT 2606, and STAT 3502.

Prerequisite(s): restricted to students in the BIT degree program.

Lectures three hours a week, tutorial/laboratory one hour a week.

BIT 2001 [0.5 credit]**Introduction to Business**

An overview of the most fundamental business functions. The management of people, human resources, marketing, accounting and finances, business law and operations.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures: three hours a week.

BIT 2002 [0.5 credit]**Marketing in the IT sector**

Basic problems and practices in marketing. Marketing strategies, planning, packaging, branding and promotion at the level of the individual firm; distribution channels.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures three hours a week.

BIT 2004 [0.5 credit]**Differential Equations For Photonics**

First-order equations, linear second- and higher-order equations, linear systems, stability of second-order systems.

Precludes additional credit for MATH 1005, MATH 2404, and MATH 2454.

Prerequisite(s): BIT 1201 and BIT 2007 or MATH 1002 and MATH 1102 or MATH 1107 and MATH 2007, either previously or concurrently; or equivalents; or permission of the School. Restricted to students in the B.I.T. degree program.

Lectures three hours a week, laboratory three hours a week.

BIT 2005 [0.5 credit]**Multivariate Calculus for Photonics**

Curves and surfaces. Polar, cylindrical and spherical coordinates. Partial derivatives, gradients, extrema and Lagrange multipliers. Exact differentials. Multiple integrals over rectangular and general regions. Integrals over surfaces. Line integrals. Vector differential operators. Green's Theorem, Stokes' theorem, Divergence Theorem. Applications.

Also listed as MATH 2004.

Precludes additional credit for MATH 2000, MATH 2004 and MATH 2008.

Prerequisite(s): BIT 2004 or MATH 1005 or MATH 2007; and ii) BIT 1201 or MATH 1104 or MATH 1107; or permission of the School. Restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial one hour a week.

BIT 2006 [0.5 credit]**Elective**

Students must choose from among a list of approved Electives at Algonquin College.

Precludes additional credit for BIT 3003 (no longer offered).

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures three hours a week, or as arranged.

BIT 2007 [0.5 credit]**Mathematics III for PLT**

Techniques of integration, improper integrals. Polar coordinates, parametric equations. Indeterminate forms, sequences and series, Taylor's formula and series.

Precludes additional credit for MATH 1002, MATH 1005, MATH 2007.

Prerequisite(s): BIT 1200 or MATH 1004; or permission of the School. restricted to students in the B.I.T. degree program.

Lectures: three hours a week, tutorial/laboratory one hour a week.

BIT 2008 [0.5 credit]**Multimedia Data Management**

Concepts and fundamentals of database systems.

Design of relational databases, normalisation, referential integrity, structured query language (SQL), server-side scripting, organisation of multimedia content, dynamic page loading, storage and compression of media, media network considerations, digital watermarking and rights management.

Precludes additional credit for ITEC 2000, IMD 2000 (no longer offered), IRM 2000 (no longer offered).

Prerequisite(s): BIT 1400 and IMD 1005 or IRM 1005.

Lecture three hours a week, tutorial/laboratory two hours a week.

BIT 2400 [0.5 credit]**Intermediate Programming**

Introduction to object-oriented programming using C++ language. Topics include detailed study of pointers and structures, encapsulation of data and code through objects and classes, inheritance, polymorphism, object-oriented program design, class libraries, user interface objects and event-driven systems.

Precludes additional credit for IMD 2004, ITEC 2400, NET 2006 and PLT 2004.

Prerequisite(s): BIT 1400. Restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial/laboratory three hours a week.

BIT 3999 [0.0 credit]**Co-operative Work Term****BIT 4000 [0.5 credit]****Directed Studies**

A course of independent study under the supervision of a member of the School of Information Technology, open only to students in the B.I.T. program. Students are required to obtain their supervisor's written approval prior to registration and are limited to one such course in their programs.

Prerequisite(s): permission of the School of Information Technology.

BIT 4001 [0.5 credit]**Selected Topics in Information Technology**

Topics not ordinarily treated in the regular course program due to their contemporary subject matter. The choice of topics varies from year to year.

Prerequisite(s): third-year standing in the BIT Program or permission of the department.

Lecture three hours a week.

Interactive Multimedia and Design (IMD) Courses**IMD 1000 [0.5 credit]****Introduction to Interactive Multimedia Design**

Overview of interactive multimedia design including copyright, user-centred design, web design and mark-up languages, general logic design, multimedia project management, design processes for animated film, video game development, visual effects in movies, ethics and current trends in the field.

Precludes additional credit for ITEC 1100.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lecture three hours a week.

IMD 1001 [0.5 credit]**Visual Communication**

Visual communication techniques commonly used to draft concepts and ideas to support scripts for film, animation, HCI, and/or game development. Topics include: storyboarding, composition, vanishing point, line quality, visual timing, perspective, depth of field, body language and life drawing. A digital drawing tablet is required.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Workshop three hours a week.

IMD 1002 [0.5 credit]**Visual Dynamics**

Fundamentals of composition with emphasis on realistic rendering. Students learn how to execute thumbnails and design comprehensives. Topics include illustration, type, colour, texture, proximity and unity, alignment, repetition and continuity, contrast, size relationships, balance, rhythm, negative space, cropping and view selection.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Workshop three hours a week.

IMD 1004 [0.5 credit]**Design Processes**

Design fundamentals using industry standard software techniques and workflow are explored. Topics include: gestalt principles, grids systems, colour, texture, raster and vector image production, and typography. Students design for publication to output such as Web, print, and electronic book formats. Required digital drawing tablet.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Workshop three hours a week.

IMD 1005 [0.5 credit]**Web Development**

Introduction to Web development. Combining graphics, text, audio, and video to create Web sites; developing different, major working Web sites on an individual basis and in groups, using valid xHTML, cascading style sheets (CSS), JavaScript and XML structures.

Precludes additional credit for ITEC 1005.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Workshop five hours a week.

IMD 2003 [0.5 credit]**Audio and Video**

The creation, production and editing of audio and video for multimedia applications. Topics include single camera recording and capture techniques through to post-production editing. Emphasis is placed on production and operation skills while adhering to industry standard costs and deadlines.

Prerequisite(s): second-year standing in the IMD program.

Workshop four hours a week.

IMD 2006 [0.5 credit]**Introduction to Computer Games**

Basic concepts in the design and development of computer games, including: fundamentals of production cycle, genres, gameplay and game mechanics, story and character development, level design, artificial intelligence for games, game user interface, and common development tools.

Prerequisite(s): BIT 2400 and second-year standing in the IMD program.

Lecture three hours a week, tutorial/laboratory two hours a week.

IMD 2007 [0.5 credit]**Intro to 3D Animation**

Introduction to the basics of 3D computer animation.

Topics include: introduction of 3D animation packages, 12 Principles of Animation, character design, character animation (walking/locomotion, motion, and poses), soft-body animation (shape interpolation and facial animation), and acting for animators.

Precludes additional credit for IMD 2005 (no longer offered).

Prerequisite(s): IMD 1001 and second-year standing in the IMD program.

Lecture/workshop three hours a week.

IMD 2900 [1.0 credit]**Design Studio 1**

Advanced practical studio-based sessions in project management and web development. Topics include: project management styles, team collaboration techniques, prototyping, project and content management, marketing, testing, and product evaluation culminating into a major group web project using client-side and server-side technologies.

Prerequisite(s): second-year standing in the IMD program. Studio/lecture eight hours a week.

IMD 3002 [0.5 credit]**3D Computer Graphics**

Technical aspects of 3D computer graphics. Homogeneous transformations, viewing pipeline, cinematography, modeling techniques (explicit and implicit), scene composition, level of detail methods, advanced lighting techniques (BRDF, IBL, subsurface-scattering), 2D/3D texturing, local/global illumination, match-moving, rendering methods, and shaders.

Prerequisite(s): BIT 1101, BIT 2400 and IMD 3900.

Lectures three hours a week, tutorial/laboratory two hours per week.

IMD 3003 [0.5 credit]**Communication Skills for IMD**

Development of competence in written and oral communication related to multimedia design. Needs analyses, use-case scenarios, development and management of content, technical reports, and related project documents; oral presentations.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lecture and tutorial three hours a week.

IMD 3004 [0.5 credit]**Human Computer Interaction and Design**

Introduction to concepts centered on Human-Computer Interaction from hardware and software perspectives.

Topics include design principles, usability principles and engineering, solving user-centred problems, device interaction, and graphical user interface design (2D and 3D interfaces).

Prerequisite(s): third-year standing in the IMD program.

Lectures three hours a week.

IMD 3005 [0.5 credit]**Sensor-Based Interaction**

Development of interactive applications that connect the physical and virtual space. Topics include using external devices and sensor hardware, sensing objects and people, gestural input, computer vision, processing of live audio input, and networked software and devices.

Precludes additional credit for IMD 2001 (no longer offered).

Prerequisite(s): BIT 2400.

Lecture/ workshop four hours a week.

IMD 3006 [0.5 credit]**Software Design for Multimedia Applications**

Provides students with knowledge and expertise to design and develop complex software systems and programs for common multimedia applications. Topics include: data structures, system and requirement analysis, component identification, common design patterns, and working with reusable components.

Prerequisite(s): BIT 2400.

Lecture three hours a week, tutorial/laboratory two hours a week.

IMD 3900 [1.0 credit]**Design Studio 2**

Intermediate practical studio sessions covering the creative aspects of 3D graphics and animation. Topics include: environment and character modeling, texturing, using bump/displacement maps, advanced materials, 3D cameras, various lighting, keyframe animation, and rendering methods.

Prerequisite(s): IMD 2007 and third-year standing in the IMD program.

Studio/lecture eight hours a week.

IMD 3901 [1.0 credit]**Design Studio 3**

Studio-based course focuses on interdisciplinary group work, and the use of reality-based/ natural-based interfaces for multiuser interaction, understanding social and environmental context in physical design, basic networking, advanced sound design, and haptic feedback.

Prerequisite(s): third-year standing in the IMD program, IMD 2900 and IMD 3005.

Studio/lecture eight hours a week.

IMD 4002 [0.5 credit]**Technology and Culture**

An examination of the relationship between communication technology and society. The course examines the factors that contribute to changes in the collection, storage and distribution of information and the cultural implications of these changes.

Prerequisite(s): third-year standing in the IMD program.

Seminar three hours a week.

IMD 4005 [0.5 credit]**Advanced Topics in Multimedia**

Advanced topics in multimedia industry not ordinarily treated in the regular course program due to their contemporary subject matter. The choice of topics varies from year to year.

Precludes additional credit for IMD 4004 (no longer offered).

Prerequisite(s): fourth-year standing in the IMD program.

Lecture three hours a week.

IMD 4006 [0.5 credit]**Advanced Computer Gaming**

Provides students with knowledge and expertise to design and develop professional computer games with advanced and novel features. Topics include: target audience and inclusive/accessible design, interaction design and emerging technologies, artificial intelligence, interactive stories, procedural content generation, serious games and gamification.

Prerequisite(s): IMD 2006 and IMD 3002.

Lecture three hours a week, tutorial/laboratory two hours a week.

IMD 4007 [0.5 credit]**Advanced Animation and Visual FX**

Advanced topics in animation and visual FX, covering the more technical aspects, including: match-moving, image-based lighting, chromakeying, motion capture of face and body, character rigging (Forward/Inverse kinematics, controls, weighting), retargeting, particle systems, and dynamic systems (cloth, fluid, and hair).

Precludes additional credit for IMD 4003 (no longer offered).

Prerequisite(s): IMD 2007, IMD 3002 and IMD 3900.

Lecture three hours a week, tutorial/laboratory two hours a week.

IMD 4008 [0.5 credit]**Mobile User Interface Design and Development**

Design, development, and evaluation of user interfaces for mobile applications. Topics include: user-centered design methods and develop mobile applications employing the various input and output capabilities available on mobiles, e.g., multi-touch, device motion/rotation, video/audio capture, vibration.

Prerequisite(s): IMD 3004 and IMD 3006.

Lecture three hours a week, tutorial/laboratory two hours a week.

IMD 4901 [1.5 credit]**Senior IMD Project**

Student-initiated design project, developed in association with a project supervisor, and external industry advisor, supported by a written report (with printed and electronic versions), seminar discussions, and appropriate methods of two and/or three- dimensional representation. All proposals must be approved by the Program Project Committee.

Prerequisite(s): IMD 2900, IMD 3900, IMD 3901 and fourth-year standing in the IMD program.

Tutorial hours arranged.

Information Resource Management (IRM) Courses**IRM 1002 [0.5 credit]****Reference and Information Services**

Introduction to the theory and techniques needed to conduct reference interviews and interpret reference queries. Students learn to select and use general reference sources such as dictionaries, encyclopedias, directories, bibliographies, periodical indexes, almanacs, and handbooks in print, and electronic formats.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures two hours a week, tutorial/laboratory two hours a week.

IRM 1003 [0.5 credit]**Collections management**

Introduction to the principals of collections management including techniques and procedures for selecting, ordering and receiving library materials, accounting, collection development and automated acquisitions.

Students also learn policies and procedures required for circulation, document delivery and interlibrary loans.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures two hours a week, tutorial/laboratory two hours a week.

IRM 1004 [0.5 credit]**Reader's Advisory Services**

Students become familiar with fiction and non-fiction materials available to various categories of clients and learn how to market them. In addition, students further develop through various assignments their researching, writing, speaking, listening and communication skills.

Prerequisite(s): Restricted to students in the B.I.T. degree program.

Lectures three hours a week.

IRM 1005 [0.5 credit]**Web Interface Development**

Combining graphics, text, audio and video to develop websites on an individual basis and in groups, using latest versions of HyperText Markup Language(HTML), Cascading Style Sheets (CSS), JavaScript and data interchange formats such as Extensible Markup Language(XML) and JavaScript Object Notation(JSON).
Prerequisite(s): Restricted to students in the B.I.T. degree program.
Lectures three hours a week, tutorial/laboratory one hour a week.

IRM 1006 [0.5 credit]**Subject Analysis and Indexing**

Students learn the basic theory of subject analysis and indexing methods used to provide access to library materials and literature. Practical instruction makes use of thesauri, as well as standard subject heading lists, such as Sears and Library of Congress.
Prerequisite(s): Restricted to students in the B.I.T. degree program.
Lectures two hours a week, tutorial/laboratory two hour a week.

IRM 1007 [0.5 credit]**Cataloguing**

The catalogue is the main finding aid to the collection of the library. Students learn the basic principles and concepts of international standards used to describe library materials. In-class exercises, lectures and practical experience help students apply these cataloguing standards.
Precludes additional credit for IRM 1001 (no longer offered).
Prerequisite(s): restricted to students in the B.I.T. program.
Lectures two hours a week, tutorial/laboratory two hours a week.

IRM 1008 [0.5 credit]**Introduction to Information Resource Management**

Students develop understanding of the concepts of information retrieval, creation, evaluation, organization and client service. Knowledge of legal and ethical implications of information and current trends in the field is studied. Through in-class lectures and hands-on activities, students gain an overview of the field.
Precludes additional credit for IRM 1000 (no longer offered).
Prerequisite(s): restricted to students in the B.I.T. degree program.
Lectures three hours a week.

IRM 2002 [0.5 credit]**Legal and Business Information**

Students develop skills in planning and executing information searches and evaluating print and electronic resources. Students learn to locate information on selected topics, compile subject-specific annotated bibliographies and instruct library clients in the use of specialized materials and databases.
Prerequisite(s): IRM 1002.
Lectures two hours a week, tutorial/laboratory two hours a week.

IRM 2003 [0.5 credit]**Classification**

How to interpret and apply Dewey Decimal and Library of Congress Classification systems. Also includes analysis of the subject content of materials, building notation, using tables, shelf-listing techniques and creating unique book numbers.
Prerequisite(s): IRM 1006.
Lectures two hours a week, tutorial/laboratory one hour a week.

IRM 2004 [0.5 credit]**Information Management and Digital Preservation**

Essentials of information management in an organization including the life cycle management of files in paper and the electronic environment. This course will also cover contemporary issues in information management and digital preservation.
Prerequisite(s): IRM 1008.
Lectures two hours a week, tutorial/laboratory one hour a week.

IRM 2005 [0.5 credit]**Advanced Cataloguing**

Libraries purchase and provide access to a wide variety of print and electronic resources. Building on work done in IRM 1001, students learn to interpret international cataloguing standards to describe more complex materials. In-class exercises, lectures and practical experience help students apply these cataloguing standards.
Precludes additional credit for IRM 2001.
Prerequisite(s): IRM 1007.
Lectures two hours a week, tutorial/laboratory two hours a week.

IRM 3001 [0.5 credit]**Scientific and Medical Information**

Students enhance their knowledge of print and electronic reference sources in science and technology. Students learn to compile specialized subject-specific bibliographies and assignments provide training in the use of science and technology reference sources.
Prerequisite(s): IRM 2002.
Lectures two hours a week, tutorial/laboratory two hours a week.

IRM 3003 [0.5 credit]**Legal Issues in Information Resource Management**

In-depth analysis and assessment of copyright and other forms of intellectual property. Legal issues related to information technology. Topics may include privacy, surveillance and monitoring, access to information, freedom of expression, Charter and human rights issues, and security.

Prerequisite(s): Restricted to students in the B.I.T. degree program.

Lectures three hours a week.

IRM 3004 [0.5 credit]**Project management**

Identification, selection, initiation, and organization of projects. Risk assessment, budget issues, communication, project scheduling, performance monitoring and control. Emphasis on practical techniques related to the field of information management using case studies.

Prerequisite(s): third year standing in the Information resource management program.

Lectures two hours a week, tutorial/laboratory two hours a week.

IRM 3006 [0.5 credit]**Data Analysis and Research Methodology**

Introduction to the logic and design of research. Qualitative and quantitative research methodology with emphasis on the application and interpretation of statistical techniques for data analysis. These may include, but are not limited to, bivariate and multivariate analysis, distribution analysis, visual data analysis, market basket analysis.

Precludes additional credit for IRM 3002 (no longer offered).

Prerequisite(s): BIT 2000.

Lectures three hours a week.

IRM 3007 [0.5 credit]**Practicum for IRM**

Students will design and complete a project related to information management under the supervision of a faculty member or librarian. This course provides the opportunity to apply knowledge gained in previous courses.

Prerequisite(s): third-year standing in the Information resource management program.

Tutorial/laboratory eight hours a week.

IRM 3008 [0.5 credit]**Metadata for IRM**

Students develop an understanding of key metadata schema and apply standards to describe range of digital resources. The metadata schemes include focus on Dublin Core (DC) and MODS with select coverage of specialist schema. Through in-class lectures and hands-on activities, students apply metadata schemes.

Precludes additional credit for IRM 3000 (no longer offered).

Prerequisite(s): IRM 2005.

Lectures two hours a week, tutorial/laboratory two hours a week.

IRM 4000 [0.5 credit]**Library Software**

Using skills and knowledge of automated systems already developed in introductory courses, students learn the theory and receive the hands-on practice needed to use library databases. A component on choosing and comparing library software is included.

Prerequisite(s): Restricted to students in the B.I.T. degree program.

Lectures two hours a week, tutorial/laboratory one hour a week.

IRM 4001 [0.5 credit]**Archives and Special Collections**

Principles and methods used by archivists and record managers in organizing their collections for better access and retrieval. Students also learn aspects of physical bibliography, the book trade, preservation and conservation of books and how to exhibit such material.

Prerequisite(s): Restricted to students in the B.I.T. degree program.

Lectures three hours a week.

IRM 4002 [0.5 credit]**Network Technology**

Foundation knowledge for computer networks and communications. Topics include basic network design, layered communications models, IP addressing and subnets, and industry standards for networking media and protocols, with an emphasis on TCP/IP protocol suite and Ethernet environments.

Prerequisite(s): BIT 2400.

Lectures two hours a week, tutorial/laboratory one hour a week.

IRM 4004 [0.5 credit]**Big Data Analytics and Applications**

Introduction to Big Data. Topics include: big data mining and analysis techniques like Association Rule Mining, Classification, Clustering, Linear Regression, using R, Hadoop, Hadoop Distributed File System, and related technologies. Applications on other domains like networks, finance, and/or business.

Prerequisite(s): IRM 3006.

Lectures three hours a week.

IRM 4900 [1.0 credit]**Final IRM Project**

Student-initiated project developed in association with a project supervisor and external information resource management advisor. Project is supported by a written report, seminar discussions and final presentation. All proposals must be approved by the IRM Program Project Committee.

Prerequisite(s): IRM 3004, IRM 3007 and fourth year standing in the IRM program.

Tutorial hours arranged.

Network Technology (NET) Courses

NET 1001 [0.5 credit]

Computer Technology Basics

Construction and function of PCs. Introduces technical concepts and terminology relating to system boards, system busses, input/output devices, memory, microprocessors and peripherals. Interaction of software and hardware; data storage; performance issues.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures two hours a week, tutorial/laboratory two hours a week.

NET 1002 [0.5 credit]

Networking Fundamentals

Foundation knowledge for computer networks and communications. Topics include basic network design, layered communications models, IP addressing and subnets, and industry standards for networking media and protocols, with an emphasis on TCP/IP protocol suite and Ethernet environments.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 1004 [0.5 credit]

Assembly and Machine Language

Structured approach to assembly language programming. Topics include data and address registers, data and address busses, condition code register and stack pointers, machine code format, instruction sizes, operand encoding, translation of source code into machine language, and how the processor executes instructions. Also listed as PLT 1007.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial/laboratory one hour a week.

NET 1006 [0.5 credit]

Routing and Switching

Introduction to routing and switching concepts including, static and dynamic routing, trunking and VLANs. Topics include configuring routers and switches and resolving common configuration and reachability issues.

Precludes additional credit for NET 1005 (no longer offered).

Prerequisite(s): NET 1002.

Lecture three hours a week, tutorial/laboratory three hours a week.

NET 2000 [0.5 credit]

Intermediate Networking

Architecture, components and operations of routers and switches in larger and more complex networks. Topics include configuration and troubleshooting of OSPF (with introduction to multi-area), EIGRP, STP, redundancy techniques and WiFi in SOHO environments.

Prerequisite(s): NET 1006.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 2001 [0.5 credit]

Wide Area Networking

Theory and technologies extending LANs to WANs including the relevant networking architectures and services. Data link protocols for WAN, network security, tunneling, VPNs and network monitoring, with a focus on implementation and troubleshooting.

Prerequisite(s): NET 2000.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 2002 [0.5 credit]

Desktop & Server Environments

Using Windows Server, study features such as file system, system utilities, memory management, boot process troubleshooting and UI customizations. Client-server architecture is examined with a focus on server configuration and administration, connection to a domain, remote desktop, and services including DHCP, DNS and Active Directory.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lecture two hours a week, tutorial/laboratory two hours a week.

NET 2003 [0.5 credit]

Linux Networking

Introduction to Unix and Linux operating systems, the command line, and network server operating environments. Students study Unix/Linux as a network server, including the configuration of services and protocols such as DNS, NTP, SSH, SMB, SMTP, POP3, IMAP, HTTP, and DHCP. Basic server security is introduced, including the creation of firewalls.

Prerequisite(s): NET 2002.

Lecture two hours a week, tutorial/laboratory two hours a week.

NET 2004 [0.5 credit]

Communication Skills for NET

Development of competence in written and oral communication in relation to network design, development, and management. Focus on technical reports, proposals, and other related project documents; formal and informal oral presentations.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lecture and tutorial three hours a week.

NET 2007 [0.5 credit]**Basics of Transmission Systems**

Introduction to the physical layer of digital communication. Coverage of the transmission media (copper, fiber, cable, wireless), modulation, coding, equalization and synchronization. Examples: dial up modems, ADSL, Ethernet, T-carrier, Cable modem, SONET and wireless LAN. Factors affecting transmission error rates. Lab and field test equipment.

Prerequisite(s): BIT 1003.

Lectures three hours a week, tutorial/laboratory three hours a week.

NET 3000 [0.5 credit]**Database Concepts and SQL**

Concepts and fundamentals of relational database systems. Students learn how to design relational databases starting from a conceptual data model, following accepted logical and physical design principles. Topics include normalisation, referential integrity, SQL, DDL and SQL DML & ODBC and data extraction/ filtering techniques.

Prerequisite(s): second-year standing in the Networking program.

Lecture two hours a week, tutorial/laboratory two hours a week.

NET 3001 [0.5 credit]**Real-time Systems**

Principles of event-driven systems, review of computer organization; parallel and serial interfaces; programmable timer; I/O methods; polling and interrupts. Real-time kernels. Critical design consideration: concurrency, dead lock, synchronization. Maintaining and improving system performance. Programming exercises in low and high level languages.

Prerequisite(s): NET 1004 and BIT 2400.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 3004 [0.5 credit]**Data Structures**

Specification and design of abstract data types and their implementation as stacks, queues, trees, tables and graphs. Common and useful examples. Parsing and finite state machines. Analysis of algorithms, recursion, re-entrance. Special focus: abstraction, interface specification and hierarchical design using object-oriented programming.

Precludes additional credit for PLT 3010.

Prerequisite(s): BIT 2400.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 3006 [0.5 credit]**Network Management and Measurements**

Network management fundamentals, standards, and protocols. The Simple Network Management Protocol (SNMP). Structure of Management Information and MIB. SNMP management challenges and the need for real-time measurements. Introduction to tools and applications for network measurements and monitoring.

Prerequisite(s): third-year standing in the Networking program.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 3007 [0.5 credit]**Network Security**

Basics of network security. Students are introduced to the goals of IT security, common threats and countermeasures including firewalls, intrusion detection and prevention systems (IDPS) and virtual private networks. Several operating environments will be studied as examples. Also includes a section on computer ethics.

Prerequisite(s): NET 2001.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 3008 [0.5 credit]**Advanced Network Routing**

Routing IP at the enterprise level, within and between, autonomous systems. Advanced control and optimization of routing protocols and manipulation of traffic paths with a focus on multi-area OSPF and EIGRP. Working knowledge of Internet reachability via BGP.

Prerequisite(s): NET 2001.

Lectures three hours a week, tutorial/laboratory three hours a week.

NET 3010 [0.5 credit]**Web Programming**

Architectures, protocols and languages used to develop dynamic Web content, including HyperText Markup Language (HTML, DHTML), Universal Resource Identifiers (URI) and HyperText Transport Protocol (HTTP) and Common Gateway Interface (CGI). JavaScript and Java are used to model cross-platform Web programming.

Prerequisite(s): BIT 2400, NET 3000.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 3011 [0.5 credit]**Advanced Network Switching**

VLANs and inter-VLAN routing in a multilayer switched environment. Variants of STP and the use of related enhancements. Techniques for network redundancy and load balancing. Securing a switched infrastructure. Architectures and techniques for delivering converged and multimedia traffic (voice, video) in the enterprise.

Prerequisite(s): NET 2001.

Lectures three hours a week, tutorial/laboratory three hours a week.

NET 3012 [0.5 credit]**IP Architectures and Solutions**

An exploration of various deployment options that can be implemented atop an IP network core. The focus is on techniques, technologies and architectures that serve to enhance IP delivery and connectivity, or provide a service leveraging the IP infrastructure. Includes Layer 2 and 3 VPNs.

Prerequisite(s): NET 3008.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 3900 [0.5 credit]**Wireless Networks**

Design and configuration of Wi-Fi networks as used in commercial and enterprise venues. Topics include 802.11 family of protocols, wireless transmission, RF design, security methods and protocols, and system design.

Topologies include campus, bridge and remote access.

Prerequisite(s): third-year standing in the Networking program.

Lectures two hours a week, tutorial/laboratory three hours a week.

NET 4000 [0.5 credit]**Emerging Network Technologies**

Overview of technologies, protocols and techniques related to Information Technology networking that are either in their early stage of adoption or are not yet mainstream (i.e. beta or prototype stage). Focus will vary from year to year to reflect the evolutionary nature of this domain.

Prerequisite(s): fourth-year standing in the Networking program or permission of the instructor.

Also offered at the graduate level, with different requirements, as ITEC 5110, for which additional credit is precluded.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 4001 [0.5 credit]**Network Simulation**

Introduction to discrete event simulation; fundamental stochastic models for networking; queueing theory; deterministic algorithms for networking; confidence intervals; introduction to network modeling. Use of simulation tools to develop and test scenarios including traffic monitoring, congestion, routing protocols, resource utilization and growth planning.

Prerequisite(s): BIT 2000.

Also offered at the graduate level, with different requirements, as ITEC 5113, for which additional credit is precluded.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 4003 [0.5 credit]**Computer Systems Architecture**

History and evolution of computers. Models and functional descriptions of CPU, bus, memory, I/O. Internal data transfer and storage concepts. Bus protocols. Memory organization and cache principles. Digital logic and simple logic designs of CPU, buses, memory. Concepts of virtual machines, parallel computing, cloud computing.

Prerequisite(s): third year standing in the Networking program, NET 2003 and NET 3001.

Lectures three hours a week, tutorial/laboratory one hour a week.

NET 4005 [0.5 credit]**Networked Applications**

Architectures for computing in modern data networks that adopt the Internet architecture. Topics covered include socket programming, RPC and RMI. Client-server and peer-to-peer models. Emerging application architectures.

Prerequisite(s): NET 3004 and NET 3010.

Also offered at the graduate level, with different requirements, as ITEC 5114, for which additional credit is precluded.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 4007 [0.5 credit]**Multimedia Networking**

Audio and video compression. H.261, JPEG, MPEG and DVI. Accessing audio and video from a web server. Real Time Streaming Protocol (RTSP). Multimedia operating systems. Multimedia database. Network support for multimedia applications. Multimedia synchronization.

Prerequisite(s): fourth-year standing in Networking program or permission of the instructor.

Also offered at the graduate level, with different requirements, as ITEC 5111, for which additional credit is precluded.

Lectures three hours a week, tutorial/laboratory two hours a week.

NET 4009 [0.5 credit]**Troubleshooting IP Networks**

Integrates planned maintenance and troubleshooting techniques, including, tools, applications and formalized methodologies. Study of issues in focused areas (such as routed vs. switched environments, addressing services, performance, security, multimedia), culminating in problem resolution throughout a complex enterprise network.

Prerequisite(s): NET 3011, NET 3008.

Lectures three hours a week, tutorial/laboratory three hours a week.

NET 4010 [0.5 credit]**Secure Mobile Networking**

The concept, principle and rationale of mobile networking. Mobile network architecture, protocols, mobility management, routing and mobile TCP/IP; Security challenges, vulnerabilities and threats in mobile networks; Security defense techniques and countermeasures in mobile networks.

Prerequisite(s): fourth-year standing in Networking program or permission of the instructor.

Also offered at the graduate level, with different requirements, as ITEC 5112, for which additional credit is precluded.

Lectures three hours a week, tutorial/laboratory one hour a week.

NET 4901 [1.0 credit]**Network Technology Project**

This course provides the opportunity to apply knowledge gained in previous courses towards the design and implementation of a major Networking related project.

Working in teams or as individuals under the direction of faculty members, students undertake projects internally or in collaboration with industry.

Prerequisite(s): fourth-year standing in the Networking program.

Tutorial hours arranged.

Photonics and Laser Technology (PLT) Courses**PLT 1002 [0.5 credit]****Trends in Photonics**

Survey of the history and future of photonics. Photonics benefits and impact on technology and society. Emerging applications of photonics in industry and commercial products. The forces (business, social, political, economic, technical, and educational) that influence the development, adoption and success or failure of technologies.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures one hour a week, tutorial/laboratory two hours a week.

PLT 1003 [0.5 credit]**Optics/Optical Fibers I (Principles)**

Principles of optics, optical fiber, waveguides and hands-on experience with optical components. Optical fiber manufacturing and variety of industrial applications.

Topics covered include: optical sources, detectors, fiber modes and mode-coupling, couplers, multiplexers, optical amplifiers, physical layer of optical networks, dispersion and nonlinear effects management.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures / laboratory or tutorial four hours a week.

PLT 1005 [0.5 credit]**Introduction to Optics**

Physics of waves, optics and light propagation through lectures and lab experiments. Geometrical optics, refraction and reflection, interference, diffraction and polarization, thin lens equation, laser beams, Michelson interferometer, birefringence, and Abbe theory of imaging. Electromagnetic spectrum, quantum nature of light, photons, and photoelectric effect.

Prerequisite(s): BIT 1203, restricted to students in the B.I.T. degree program.

Lectures / laboratory or tutorial five hours a week.

PLT 1006 [0.5 credit]**Introduction to Automation and Simulation**

Introduction to basic programming in both the Matlab and Labview environments. Program development, basic structures (loops, control structures), I/O, data visualization and graphing will be covered. Students will learn to use Labview to develop basic applications and model simple physical systems with Matlab.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lectures two hour a week, tutorial/laboratory three hours a week.

PLT 1007 [0.5 credit]**Assembly and Machine Language**

Structured approach to assembly language programming. Topics include data and address registers, data and address busses, condition code register and stack pointers, machine code format, instruction sizes, operand encoding, translation of source code into machine language, and how the processor executes instructions. Also listed as NET 1004.

Prerequisite(s): Restricted to students in the B.I.T. degree program.

Lectures three hours a week, tutorial/laboratory one hour a week.

PLT 2001 [0.5 credit]**Fundamentals of Light Sources**

Introduction to incoherent light sources and lasers. Lasers operation, energy levels, quantum mechanics basics. Pumping/excitation, population inversion, laser cavity design, gain and loss, and characteristics of laser emission. An extensive lab manual of relevant experiments, variety of lasers, spectrometers, and detection equipment will be used.

Prerequisite(s): BIT 1201. Restricted to students in the BIT degree program.

Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 2002 [0.5 credit]**Optical Communication Networks I**

Fiber-laser implementation and optical networks, topologies, OSI, SONET/SDH, synchronous payload envelope, virtual tributaries, optimized mapping techniques, and optical carriers (OC-n/STM-m). Extensive lab manual and hands-on experience using state-of-the-art Optophotonics Lab to work on OAM; P, facility/equipment, synchronization, bandwidth management, and performance monitoring and other functionalities. Prerequisite(s): PLT 1003.

Lectures two hours a week, tutorial/laboratory three hours a week.

PLT 2003 [0.5 credit]**Laser Systems**

Laser theory, devices and systems. Safety procedures, laser power supplies, and laser system applications. Solid state, gas, and other types of lasers. Basic material processing, micro machining, bio/medical, and military applications will be covered. Hands-on experience with advanced laser equipment in lab. Prerequisite(s): PLT 2001.

Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 2005 [0.5 credit]**Circuits and Signals**

Students learn properties of electricity and measurement techniques. Topics covered include RMS, average, applied, peak-to-peak and instantaneous values. Lab experiments deal with RC and RL circuits and LC filters. RLC circuits, and series and parallel resonance are also covered.

Prerequisite(s): BIT 1204 or PHYS 1004 or PHYS 1002
Restricted to students in the BIT degree program.
Lectures two hours a week, laboratory and problem analysis three hours a week.

PLT 2006 [0.5 credit]**Semiconductors**

Fundamentals of logic circuitry in digital systems are studied including basic logic gates, Boolean algebra, signal decoding, logic circuit design, flip-flop circuits, timers and counters. The proper use of semi-conductor components is demonstrated through the use of laboratory experiments.

Prerequisite(s): PLT 2005. Restricted to students in the B.I.T. degree program.
Lectures two hours a week, laboratory and problem analysis three hours a week.

PLT 2008 [0.5 credit]**Manufacturing Photonics Components**

Manufacturing techniques and methods used to produce photonics components and devices/systems. Micro assembly, adhesives, optical tests and measurement, lean manufacturing and quality control standards (Telcordia). Laboratory exposure to optical component production processes: grinding, polishing, coating, mounting, tolerance and accuracy.

Precludes additional credit for PLT 1004 (no longer offered).

Prerequisite(s): PLT 1002. Restricted to students in the B.I.T. degree program.

Lectures / laboratory or tutorial four hours a week.

PLT 3000 [0.5 credit]**Optical Communication Networks II**

Operation, management and maintenance of metro/long haul optical network elements and systems. Hands-on skills using GUI, Transaction Language One (TL1), optical network management to perform line and path protection, alarm provisioning, security and data communications, optical network backup and restore, load upgrade and installation management.

Prerequisite(s): PLT 2002.

Lectures two hours a week, tutorial/laboratory three hours a week.

PLT 3001 [0.5 credit]**Photonics Manufacturing Systems**

Laser based manufacturing, measurement and control systems, further applications of laser machining, welding, emphasizing industrial real world systems. Extensive hands on laser lab experiments, measurement jigs, scanners, swept wave systems (SWS), motion stages, optics, wavelength measuring, pulse detection, oscilloscopes, digital spectrometers.

Prerequisite(s): PLT 2003.

Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 3002 [0.5 credit]**Real-time Systems**

Principles of event-driven systems, review of computer organization; parallel and serial interfaces; programmable timer; I/O methods; polling and interrupts. Real-time kernels. Critical design consideration: concurrency, dead lock, synchronization. Maintaining and improving system performance. Programming exercises in low and high level languages.

Prerequisite(s): BIT 2400 and PLT 1007.

Lectures three hours a week, tutorial/Laboratory two hours a week.

PLT 3003 [0.5 credit]**Electro Magnetism**

Review of basic vector calculus followed by an introduction to electrostatics and magnetostatics. Maxwell's equations and EM wave solutions. EM waves in dielectric media, reflection, refraction, Fresnel relations and Brewster angle. Introduction to guided waves emphasizing slab waveguides.

Prerequisite(s): (BIT 1204 or PHYS 1007 or PHYS 1002) and (BIT 2004 or MATH 2004) and (BIT 2005 or MATH 2004). Restricted to students in the BIT degree program.

Lecture and tutorial three hours a week.

PLT 3004 [0.5 credit]**Design of Optical Components and Systems**

Optical ray-tracing for analysing systems of sources, lenses, mirrors, prisms, fibers, diffractive elements, MEMS. Zemax® fundamentals, pupils, aspherics, non-sequential tracing, aberrations, image metrics, optimization/merit functions. Applications: imaging, illumination, lasers. Trade-offs, mechanical constraints, tolerances and cost. Physical optics modeling of beam propagation. Near-field diffraction and waveguides.

Prerequisite(s): PLT 1003.

Lectures / laboratory or tutorial five hours a week.

PLT 3008 [0.5 credit]**Communication Skills for PLT**

Development of competence in written and oral communication. Focus on technical reports, proposals, and other related project documents; formal and informal oral presentations.

Prerequisite(s): restricted to students in the B.I.T. degree program.

Lecture and tutorial three hours a week.

PLT 3009 [0.5 credit]**Project Management**

Identification, selection, initiation, and organization of projects. Risk assessment, budget issues, communication, project scheduling, performance monitoring and control. Emphasis on practical techniques related to the field of photonics using case studies.

Prerequisite(s): third year standing in the Photonics and Laser Technology program.

Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 3010 [0.5 credit]**Data Structures**

Specification and design of abstract data types and their implementation as stacks, queues, trees, tables and graphs. Common and useful examples. Parsing and finite state machines. Analysis of algorithms, recursion, re-entrance. Special focus: abstraction, interface specification and hierarchical design using object-oriented programming.

Precludes additional credit for NET 3004.

Prerequisite(s): BIT 2400.

Lectures three hours a week, tutorial/laboratory two hours a week.

PLT 4000 [0.5 credit]**Introduction to Quantum Information**

Basic elements of quantum mechanics will be reviewed. Applications of quantum mechanics covered may include: quantum optics, teleportation, information, computing and cryptography.

Prerequisite(s): BIT 2004 or MATH 2404.

Lectures three hours a week, problem analysis two hours alternate weeks.

PLT 4001 [0.5 credit]**Optoelectronic Devices**

Review of semiconductors, semiconductor lasers, detectors, photovoltaics. Electro, magneto and acousto-optic modulation devices. Transmitters, receivers, photo diodes, fiber sensors, and amplifiers, Mach-Zehnder interferometers. Polarization-mode dispersion. Experiments on non-linear optical elements, Sagnac and ring resonator, optical modulation.

Prerequisite(s): PLT 3004.

Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 4004 [0.5 credit]**Biomedical Photonics**

Biological and medical photonics. Effect of light on biological systems, medical imaging, medical treatments, biological research and bio/medical applications. Laser manipulation of cells, laser surgery, and photo-therapy. Biophotonic lab experiments with scanning confocal microscopes, endoscopes, DNA scanners.

Prerequisite(s): PLT 3003.

Lectures / laboratory or tutorial four hours a week.

PLT 4006 [0.5 credit]**Image and Signal Processing**

Developing and evaluating algorithms for extracting the necessary information signals. Topics include filter design, fast transforms, adaptive filters, spectrum estimation and modeling, sensor array processing, image processing, motion estimation from images, applications in biomed, computer-aided tomography, image restoration, robotic vision, and pattern recognition.

Prerequisite(s): BIT 2400.

Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 4007 [0.5 credit]**Introduction to Solid State Physics**

The study of materials via the techniques of solid state physics. Topics include bonding and structure of crystals, energy band in insulators, semiconductors, and metals. Electrical conductivity, optical properties, lattice vibration, elasticity, point defects and dislocations.

Precludes additional credit for PLT 3005 (no longer offered).

Prerequisite(s): PLT 4000.

Lectures three hours a week.

PLT 4900 [1.0 credit]**Photonics Research Project**

Research project develops students' ability to direct own learning and pursue advanced study in variety of subjects. Select topic, perform literature search, theoretical background, preliminary measurements, calculations, and design. Present findings in a preliminary thesis. Encourage writing technical papers. Research opportunities with industry and academia.

Prerequisite(s): fourth-year standing.

Tutorial hours arranged.

Summer session: some of the courses listed in this Calendar are offered during the summer. Hours and scheduling for summer session courses will differ significantly from those reported in the fall/winter Calendar. To determine the scheduling and hours for summer session classes, consult the class schedule at central.carleton.ca

Not all courses listed are offered in a given year. For an up-to-date statement of course offerings for the current session and to determine the term of offering, consult the class schedule at central.carleton.ca