

Information Technology

This section presents the requirements for programs in:

- **Information Resource Management B.I.T.**
- **Interactive Multimedia and Design B.I.T.**
- **Interactive Multimedia and Design Animation & Visual Effects Stream B.I.T.**
- **Interactive Multimedia and Design Game Design/ Development Stream B.I.T.**
- **Interactive Multimedia and Design Web & User Interfaces Stream B.I.T.**
- **Network Technology B.I.T.**
- **Optical Systems and Sensors 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 (10.0 credits)

1. 2.5 credits in: 2.5

BIT 1400 [0.5]	Introduction to Programming and Problem Solving
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IRM 1002 [0.5]	Reference and Information Services
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IRM 1005 [0.5]	Web Interface Development
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IRM 1006 [0.5]	Subject Analysis and Indexing
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IRM 1007 [0.5]	Cataloguing
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2. 3.0 credits in: 3.0

BIT 2008 [0.5]	Multimedia Data Management
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BIT 2400 [0.5]	Intermediate Programming
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IRM 2002 [0.5]	Legal and Business Information
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IRM 2003 [0.5]	Classification
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IRM 2004 [0.5]	Information Management and Digital Preservation
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IRM 2005 [0.5]	Advanced Cataloguing
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3. 2.5 credits in: 2.5

IRM 3001 [0.5]	Scientific and Medical Information
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IRM 3003 [0.5]	Legal Issues in Information Resource Management
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IRM 3006 [0.5]	Data Analysis and Research Methodology
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IRM 3007 [0.5]	Practicum for IRM
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IRM 3008 [0.5]	Metadata for IRM
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4. 2.0 credits in: 2.0

IRM 4000 [0.5]	Library Software
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IRM 4004 [0.5]	Applied Machine Learning and Big Data Analytics
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IRM 4900 [1.0]	IRM Capstone Project
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B. Credits Not Included in the Major (10.0 credits)

5. 1.5 credits in: 1.5

IRM 1003 [0.5]	Collections management
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IRM 1004 [0.5]	Reader's Advisory Services
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IRM 1008 [0.5]	Introduction to Information Resource Management
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6. 1.5 credits in: 1.5

BIT 2001 [0.5]	Introduction to Business
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BIT 2009 [0.5]	Statistics for Technology
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IRM 2006 [0.5]	Data Visualization
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7. 1.0 credit in: 1.0

CCDP 3006 [0.5]	Communication Skills for IRM
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IRM 3004 [0.5]	Project management
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8. 1.0 credit in: 1.0

IRM 4001 [0.5]	Archives and Special Collections
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IRM 4005 [0.5]	Introduction to Deep Learning
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9. 1.0 credit in French Language (see Note 2, below) 1.0

10. 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
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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 (11.0 credits)

1. 2.0 credits in: 2.0

IMD 1001 [0.5]	Visual Communication
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IMD 1002 [0.5]	Visual Dynamics
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IMD 1004 [0.5]	Design Processes
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IMD 1005 [0.5]	Web Development
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2. 3.0 credits in: 3.0

BIT 2008 [0.5]	Multimedia Data Management
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BIT 2400 [0.5]	Intermediate Programming
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IMD 2003 [0.5]	Audio and Video
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IMD 2007 [0.5]	Intro to 3D Animation
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IMD 2900 [1.0]	Design Studio 1
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3. 3.0 credits in: 3.0

IMD 3004 [0.5]	Human Computer Interaction and Design
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IMD 3005 [0.5]	Sensor-Based Interaction
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IMD 3900 [1.0]	Design Studio 2
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IMD 3901 [1.0]	Design Studio 3
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4. 1.5 credits from: 1.5

IMD 4006 [0.5]	Advanced Game Design and Development
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IMD 4008 [0.5]	Mobile User Interface Design and Development
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ITEC 4007 [0.5]	Dynamics and Physics-Based Animation
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ITEC 4009 [0.5]	Rigging and Advanced Character Animation
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ITEC 4010 [0.5]	Visual Effects and Compositing
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ITEC 4011 [0.5]	Artificial Intelligence for Digital Media	
ITEC 4012 [0.5]	Web Application Frameworks	
ITEC 4014 [0.5]	User Experience Design and Accessibility	
5. 1.5 credits in:		1.5
IMD 4901 [1.5]	IMD Capstone Project	
B. Credits Not Included in the Major CGPA (9.0 credits)		
6. 2.5 credits in:		2.5
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	
BIT 1400 [0.5]	Introduction to Programming and Problem Solving	
IMD 1000 [0.5]	Introduction to Interactive Multimedia Design	
7. 2.0 credits in:		2.0
BIT 2002 [0.5]	Marketing in the IT sector	
BIT 2006 [0.5]	Elective	
BIT 2009 [0.5]	Statistics for Technology	
IMD 2006 [0.5]	Introduction to Game Design and Development	
8. 1.5 credits in:		1.5
CCDP 3003 [0.5]	Communication Skills for IMD	
IMD 3002 [0.5]	3D Computer Graphics	
IMD 3006 [0.5]	Software Design for Multimedia Applications	
9. 0.5 credit in:		0.5
IMD 4002 [0.5]	Technology and Culture	
10. 1.0 credit in	Arts and Humanities elective outside the faculties of Business, Science and Engineering.	1.0
11. 1.5 credits in	electives for IMD, Directed Studies, or courses listed in but not used to fulfill Item 4 above:	1.5
BIT 4000 [0.5]	Directed Studies	
IRM 4002 [0.5]	Network Technology	
ITEC 3100 [0.5]	Immersive Storytelling	
ITEC 4015 [0.5]	Designing and Producing Sound	
ITEC 4016 [0.5]	Virtual and Augmented Reality	
ITEC 4017 [0.5]	Photo and Non-Photo-Realistic Rendering	
ITEC 4018 [0.5]	GPU Programming and Real-Time Rendering	
ITEC 4019 [0.5]	Directing and Cinematography for Digital Storytelling	
ITEC 4020 [0.5]	Environment and Architectural Modelling	
ITEC 4021 [0.5]	Empirical Research Methods in HCI	
Total Credits		20.0

Interactive Multimedia and Design Animation & Visual Effects Stream B.I.T. (20.0 credits)

This stream is open to students in the Interactive Multimedia and Design B.I.T. program with 4th year standing.

A. Credits Included in the Major CGPA (11.0 credits)

1. 2.0 credits in:		2.0
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. 3.0 credits in:		3.0
BIT 2008 [0.5]	Multimedia Data Management	
BIT 2400 [0.5]	Intermediate Programming	
IMD 2003 [0.5]	Audio and Video	
IMD 2007 [0.5]	Intro to 3D Animation	
IMD 2900 [1.0]	Design Studio 1	
3. 3.0 credits in:		3.0
IMD 3004 [0.5]	Human Computer Interaction and Design	
IMD 3005 [0.5]	Sensor-Based Interaction	
IMD 3900 [1.0]	Design Studio 2	
IMD 3901 [1.0]	Design Studio 3	
4. 1.5 credits in:		1.5
ITEC 4007 [0.5]	Dynamics and Physics-Based Animation	
ITEC 4009 [0.5]	Rigging and Advanced Character Animation	
ITEC 4010 [0.5]	Visual Effects and Compositing	
5. 1.5 credits in:		1.5
IMD 4901 [1.5]	IMD Capstone Project (1.5)	
B. Credits Not Included in the Major CGPA (9.0 credits)		
6. 2.5 credits in:		2.5
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	
BIT 1400 [0.5]	Introduction to Programming and Problem Solving	
IMD 1000 [0.5]	Introduction to Interactive Multimedia Design	
7. 2.0 credits in:		2.0
BIT 2002 [0.5]	Marketing in the IT sector	
BIT 2006 [0.5]	Elective	
BIT 2009 [0.5]	Statistics for Technology	
IMD 2006 [0.5]	Introduction to Game Design and Development	
8. 1.5 credits in:		1.5
CCDP 3003 [0.5]	Communication Skills for IMD	
IMD 3002 [0.5]	3D Computer Graphics	
IMD 3006 [0.5]	Software Design for Multimedia Applications	
9. 0.5 credit in:		0.5
IMD 4002 [0.5]	Technology and Culture	
10. 1.0 credit in	Arts and Humanities elective outside the faculties of Business, Science and Engineering.	1.0
11. 1.5 credit in	electives for IMD, and/or Directed Studies	1.5
BIT 4000 [0.5]	Directed Studies	
IMD 4006 [0.5]	Advanced Game Design and Development	
IMD 4008 [0.5]	Mobile User Interface Design and Development	
IRM 4002 [0.5]	Network Technology	
ITEC 3100 [0.5]	Immersive Storytelling	
ITEC 4011 [0.5]	Artificial Intelligence for Digital Media	

ITEC 4012 [0.5]	Web Application Frameworks
ITEC 4014 [0.5]	User Experience Design and Accessibility
ITEC 4015 [0.5]	Designing and Producing Sound
ITEC 4016 [0.5]	Virtual and Augmented Reality
ITEC 4017 [0.5]	Photo and Non-Photo-Realistic Rendering
ITEC 4018 [0.5]	GPU Programming and Real-Time Rendering
ITEC 4019 [0.5]	Directing and Cinematography for Digital Storytelling
ITEC 4020 [0.5]	Environment and Architectural Modelling
ITEC 4021 [0.5]	Empirical Research Methods in HCI
Total Credits	20.0

Interactive Multimedia and Design Game Design/Development Stream B.I.T. (20.0 credits)

This stream is open to students in the Interactive Multimedia and Design B.I.T. program with 4th year standing.

A. Credits Included in the Major CGPA (11.0 credits)

1. 2.0 credits in:	2.0
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. 3.0 credits in:	3.0
BIT 2008 [0.5]	Multimedia Data Management
BIT 2400 [0.5]	Intermediate Programming
IMD 2003 [0.5]	Audio and Video
IMD 2007 [0.5]	Intro to 3D Animation
IMD 2900 [1.0]	Design Studio 1
3. 3.0 credits in:	3.0
IMD 3004 [0.5]	Human Computer Interaction and Design
IMD 3005 [0.5]	Sensor-Based Interaction
IMD 3900 [1.0]	Design Studio 2
IMD 3901 [1.0]	Design Studio 3
4. 1.5 credits in:	1.5
IMD 4006 [0.5]	Advanced Game Design and Development
ITEC 4009 [0.5]	Rigging and Advanced Character Animation
ITEC 4011 [0.5]	Artificial Intelligence for Digital Media
5. 1.5 credits in:	1.5
IMD 4901 [1.5]	IMD Capstone Project (1.5)

B. Credits Not Included in the Major CGPA (9.0 credits)

6. 2.5 credits in:	2.5
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
BIT 1400 [0.5]	Introduction to Programming and Problem Solving
IMD 1000 [0.5]	Introduction to Interactive Multimedia Design

7. 2.0 credits in:	2.0
BIT 2002 [0.5]	Marketing in the IT sector
BIT 2006 [0.5]	Elective
BIT 2009 [0.5]	Statistics for Technology
IMD 2006 [0.5]	Introduction to Game Design and Development

8. 1.5 credits in:	1.5
CCDP 3003 [0.5]	Communication Skills for IMD
IMD 3002 [0.5]	3D Computer Graphics
IMD 3006 [0.5]	Software Design for Multimedia Applications

9. 0.5 credit in:	0.5
IMD 4002 [0.5]	Technology and Culture

10. 1.0 credit in Arts and Humanities elective outside the faculties of Business, Science and Engineering. **1.0**

11. 1.5 credit in electives for IMD, and/or Directed Studies **1.5**

BIT 4000 [0.5]	Directed Studies
IMD 4008 [0.5]	Mobile User Interface Design and Development
IRM 4002 [0.5]	Network Technology
ITEC 3100 [0.5]	Immersive Storytelling
ITEC 4007 [0.5]	Dynamics and Physics-Based Animation
ITEC 4010 [0.5]	Visual Effects and Compositing
ITEC 4012 [0.5]	Web Application Frameworks
ITEC 4014 [0.5]	User Experience Design and Accessibility
ITEC 4015 [0.5]	Designing and Producing Sound
ITEC 4016 [0.5]	Virtual and Augmented Reality
ITEC 4017 [0.5]	Photo and Non-Photo-Realistic Rendering
ITEC 4018 [0.5]	GPU Programming and Real-Time Rendering
ITEC 4019 [0.5]	Directing and Cinematography for Digital Storytelling
ITEC 4020 [0.5]	Environment and Architectural Modelling
ITEC 4021 [0.5]	Empirical Research Methods in HCI

Total Credits **20.0**

Interactive Multimedia and Design Web & User Interfaces Stream B.I.T. (20.0 credits)

This stream is open to students in the Interactive Multimedia and Design B.I.T. program with 4th year standing.

A. Credits Included in the Major CGPA (11.0 credits)

1. 2.0 credits in:	2.0
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. 3.0 credits in:	3.0
BIT 2008 [0.5]	Multimedia Data Management
BIT 2400 [0.5]	Intermediate Programming
IMD 2003 [0.5]	Audio and Video
IMD 2007 [0.5]	Intro to 3D Animation

IMD 2900 [1.0]	Design Studio 1	
3. 3.0 credits in:		3.0
IMD 3004 [0.5]	Human Computer Interaction and Design	
IMD 3005 [0.5]	Sensor-Based Interaction	
IMD 3900 [1.0]	Design Studio 2	
IMD 3901 [1.0]	Design Studio 3	
4. 1.5 credits in:		1.5
IMD 4008 [0.5]	Mobile User Interface Design and Development	
ITEC 4012 [0.5]	Web Application Frameworks	
ITEC 4014 [0.5]	User Experience Design and Accessibility	
5. 1.5 credits in:		1.5
IMD 4901 [1.5]	IMD Capstone Project (1.5)	
B. Credits Not Included in the Major CGPA (9.0 credits)		
6. 2.5 credits in:		2.5
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	
BIT 1400 [0.5]	Introduction to Programming and Problem Solving	
IMD 1000 [0.5]	Introduction to Interactive Multimedia Design	
7. 2.0 credits in:		2.0
BIT 2002 [0.5]	Marketing in the IT sector	
BIT 2006 [0.5]	Elective	
BIT 2009 [0.5]	Statistics for Technology	
IMD 2006 [0.5]	Introduction to Game Design and Development	
8. 1.5 credits in:		1.5
CCDP 3003 [0.5]	Communication Skills for IMD	
IMD 3002 [0.5]	3D Computer Graphics	
IMD 3006 [0.5]	Software Design for Multimedia Applications	
9. 0.5 credit in:		0.5
IMD 4002 [0.5]	Technology and Culture	
10. 1.0 credit in	Arts and Humanities elective outside the faculties of Business, Science and Engineering.	1.0
11. 1.5 credits in	electives for IMD, and/or Directed Studies	1.5
BIT 4000 [0.5]	Directed Studies	
IMD 4006 [0.5]	Advanced Game Design and Development	
IRM 4002 [0.5]	Network Technology	
ITEC 3100 [0.5]	Immersive Storytelling	
ITEC 4007 [0.5]	Dynamics and Physics-Based Animation	
ITEC 4009 [0.5]	Rigging and Advanced Character Animation	
ITEC 4010 [0.5]	Visual Effects and Compositing	
ITEC 4011 [0.5]	Artificial Intelligence for Digital Media	
ITEC 4015 [0.5]	Designing and Producing Sound	
ITEC 4016 [0.5]	Virtual and Augmented Reality	
ITEC 4017 [0.5]	Photo and Non-Photo-Realistic Rendering	

ITEC 4018 [0.5]	GPU Programming and Real-Time Rendering	
ITEC 4019 [0.5]	Directing and Cinematography for Digital Storytelling	
ITEC 4020 [0.5]	Environment and Architectural Modelling	
ITEC 4021 [0.5]	Empirical Research Methods in HCI	
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 reproductions (on a digital storage device, e.g. flash drive) of their 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 (10.0 credits)

1. 0.5 credit in:		0.5
NET 1006 [0.5]	Routing and Switching	
2. 2.5 credits in:		2.5
BIT 2400 [0.5]	Intermediate Programming	
NET 2000 [0.5]	Intermediate Networking	
NET 2008 [0.5]	DevOps	
NET 2011 [0.5]	Desktop and Server Environments II	
NET 2012 [0.5]	Networking Technologies and Automation	
3. 3.0 credits in:		3.0
NET 3006 [0.5]	Network Management and Measurements	
NET 3007 [0.5]	Network Security	
NET 3008 [0.5]	Advanced Network Routing	
NET 3011 [0.5]	Advanced Network Switching	
NET 3012 [0.5]	IP Architectures and Solutions	
NET 3900 [0.5]	Wireless Networks	
4. 4.0 credits in:		4.0
NET 4001 [0.5]	Network Simulation	
NET 4005 [0.5]	Networked Applications	
NET 4007 [0.5]	Multimedia Networking	
NET 4009 [0.5]	Troubleshooting IP Networks	
NET 4010 [0.5]	Secure Mobile Networking	
NET 4011 [0.5]	Advanced Topics in Network Security	
NET 4901 [1.0]	NET Capstone Project	

B. Credits Not Included in the Major CGPA (10.0 credits)

5. 3.5 credits in:	3.5
BIT 1000 [0.5]	Mathematics I for NET
BIT 1001 [0.5]	Mathematics II for NET
BIT 1006 [0.5]	Achieving Success in Changing Environments
BIT 1007 [0.5]	Physics for NET
BIT 1400 [0.5]	Introduction to Programming and Problem Solving
NET 1001 [0.5]	Computer Technology Basics
NET 1002 [0.5]	Networking Fundamentals
6. 3.0 credits in:	3.0
BIT 2000 [0.5]	Probability for Technology
BIT 2001 [0.5]	Introduction to Business
CCDP 2004 [0.5]	Communication Skills for NET
NET 2007 [0.5]	Basics of Transmission Systems
NET 2010 [0.5]	Desktop and Server Environments I
NET 2013 [0.5]	Computer Systems Foundations (0.5)
7. 2.0 credits in:	2.0
NET 3000 [0.5]	Database Concepts and SQL
NET 3001 [0.5]	Real-time Systems
NET 3004 [0.5]	Data Structures
NET 3010 [0.5]	Web Programming
8. 1.0 credit in:	1.0
NET 4000 [0.5]	Emerging Network Technologies
NET 4012 [0.5]	Cloud Computing and Virtualization
9. 0.5 credit in Arts and Humanities electives outside the faculties of Business, Science and Engineering.	0.5
Total Credits	20.0

Optical Systems and Sensors B.I.T. (20.0 credits)**A. Credits Included in the Major CGPA (9.0 credits)**

1. 0.5 credits in:	0.5
OSS 1003 [0.5]	Optics/Optical Fibers (Principles)
2. 2.5 credits in:	2.5
BIT 2400 [0.5]	Intermediate Programming
OSS 2001 [0.5]	Fundamentals of Light Sources
OSS 2002 [0.5]	Optical Communication Networks I
OSS 2003 [0.5]	Laser Systems
OSS 2008 [0.5]	Manufacturing Photonics Components
3. 2.5 credits in:	2.5
OSS 3000 [0.5]	Optical Communication Networks II
OSS 3002 [0.5]	Design of Optical Components and Systems (0.5)
OSS 3003 [0.5]	Fundamentals of Electromagnetics
OSS 3013 [0.5]	Software Design for Optical Systems and Sensors
OSS 3014 [0.5]	Optical Waves, Waveguides, and Sensors
4. 3.5 credits in:	3.5
OSS 4001 [0.5]	Optoelectronic Devices
OSS 4004 [0.5]	Medical Imaging and Biosensors
OSS 4006 [0.5]	Image Processing
OSS 4008 [0.5]	Remote Sensing

OSS 4009 [0.5]	Computer Vision
OSS 4900 [1.0]	OSS Capstone Project

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

5. 4.0 credits in:	4.0
BIT 1200 [0.5]	Calculus
BIT 1201 [0.5]	Linear Algebra
BIT 1203 [0.5]	Newtonian Physics
BIT 1204 [0.5]	Electromagnetism & Modern Physics
BIT 1400 [0.5]	Introduction to Programming and Problem Solving
OSS 1002 [0.5]	Photonics and Optoelectronics Applications
OSS 1005 [0.5]	Introduction to Optics
OSS 1006 [0.5]	Introduction to Automation and Simulation
6. 3.5 credits in:	3.5
BIT 2000 [0.5]	Probability for Technology
BIT 2001 [0.5]	Introduction to Business
BIT 2010 [0.5]	Differential Equations & Multivariate Calculus
OSS 2005 [0.5]	Circuits and Signals
OSS 2006 [0.5]	Integrated Circuits
OSS 2009 [0.5]	Assembly and Machine Language
OSS 2010 [0.5]	Signals and Systems
7. 3.0 credits in:	3.0
CCDP 3008 [0.5]	Communication Skills for OSS
OSS 3001 [0.5]	Real-time Systems
OSS 3004 [0.5]	Data Structures
OSS 3009 [0.5]	Project Management
OSS 3012 [0.5]	Digital Signal Processing
OSS 4005 [0.5]	Introduction to Deep Learning
8. 0.5 credit in Arts and Humanities elective outside the faculties of Business, Science and Engineering.	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 Continuation 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 non-honours degree, with a defined Major CGPA, and requires 20.0 credits. Courses with the designations BIT, IMD, IRM, NET, or OSS 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 applies to a degree program with a Co-op option from high school, their university grades will be reviewed two terms to one year prior to their first work term to ensure they meet the academic requirements after their first or second year of study. The time at which the

evaluation takes place depends on the program of study. Students will automatically receive an admission decision via their Carleton email account.

Students who did not request Co-op at the time they applied to Carleton can request Co-op after they begin their university studies. To view application instructions and deadlines, please visit carleton.ca/co-op.

To be admitted to Co-op, a student must successfully complete 5.0 or more credits that count towards their degree, meet the minimum CGPA requirement(s) for the student's Co-op option, and fulfil any specified course prerequisites. To see the unique admission and continuation requirements for each Co-op option, please refer to the specific degree programs listed in the Undergraduate Calendar.

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. 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 Immigration, Refugees and Citizenship 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;
- Be eligible to work in Canada (for off-campus work);
- Have successfully completed COOP 1000 .

In addition to the following:

1. Registered as a full-time student in the B.IT program;
2. Successfully completed 5.0 or more credits;
3. Obtained a Major CGPA of at least 8.00. This CGPA must be maintained throughout the duration of the degree.

B.IT students must successfully 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, optical systems and sensors

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	Fall	S
Winter	S	Winter	S	Winter	W	Winter	S	Winter	S
Summer		Summer	W	Summer	W	Summer	W		

Legend

S: Study

W: Work

Admissions Information

Admission requirements are based on the Ontario High School System. Prospective students can view the admission requirements through the Admissions website at admissions.carleton.ca. The overall average required for admission is determined each year on a program-by-program basis. Holding the minimum admission requirements only establishes eligibility for consideration; higher averages are required for admission to programs for which the demand for places by qualified applicants exceeds the number of places available. All programs have limited enrolment and admission is not guaranteed. Some programs may also require specific course prerequisites and prerequisite averages and/or supplementary admission portfolios. Consult admissions.carleton.ca for further details.

Note: If a course is listed as *recommended*, it is not mandatory for admission. Students who do not follow the recommendations will not be disadvantaged in the admission process.

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 the Ontario Secondary School Diploma (OSSD) or equivalent, including a minimum of six 4U or M courses.

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. Applicants submitting an English language test to satisfy the requirements of the English Language Proficiency section of this Calendar may use that test to also satisfy the 4U English prerequisite requirement.

For Interactive 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. Detailed information about the portfolio requirements can be found at admissions.carleton.ca

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).

For Optical Systems & Sensors: 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). Additionally, 4U Physics is strongly recommended.

Advanced Standing

Applications for advanced standing towards the program leading to the Bachelor of Information Technology degree

will be evaluated on an individual basis upon admission to the program. Students may request that additional courses be considered for 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 programs 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 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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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).

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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 1007, 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.

Includes: Experiential Learning Activity

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

Prerequisite(s): IRM 1007.

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

IRM 2006 [0.5 credit]**Data Visualization**

Web-based data visualization techniques and systems. Good design practices for visualization, tools for visualization of data from a variety of fields, and programming of interactive web-based visualizations focusing on JavaScript, CSS, and related libraries.

Includes: Experiential Learning Activity

Also listed as ITEC 2100.

Prerequisite(s): IRM 1005 and BIT 1400.

Lectures/labs five 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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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. May include, but are not limited to, bivariate and multivariate analysis, distribution analysis, visual data analysis, market basket analysis.

Includes: Experiential Learning Activity

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

Prerequisite(s): BIT 2009 or equivalent.

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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

IRM 4004 [0.5 credit]**Applied Machine Learning and Big Data Analytics**

Introduction to Machine Learning and Big Data Analytics.

Topics include: Association Rule Mining, Classification, Clustering, Linear and Logistic Regression, Distributed File System, Batch and Stream Data Processing, and other related. Applications on other domains such as multimedia, networks, finance, and/or business.

Includes: Experiential Learning Activity

Prerequisite(s): IRM 3006.

Lectures three hours a week.

IRM 4005 [0.5 credit]**Introduction to Deep Learning**

Introduction to classification and regression. Optimization, vectorization, gradient descent, cost, loss and activation functions. Introduction and basics to AI, Artificial Neural Networks, forward and backward propagation, Multi Layer Perceptron, and other types of Deep Neural Network models, their applications in multimedia, networks, finance, etc.

Includes: Experiential Learning Activity

Also listed as OSS 4005.

Prerequisite(s): BIT 2009 and BIT 2400.

Lectures three hours a week.

IRM 4900 [1.0 credit]**IRM Capstone 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.

Includes: Experiential Learning Activity

Prerequisite(s): IRM 3004, IRM 3007 or LIB 2030 and LIB 2047 and fourth year standing in the IRM program.

Tutorial hours arranged.

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.

Includes: Experiential Learning Activity

Precludes additional credit for BIT 1100, BIT 1200, ECON 1401, ECON 1402, MATH 1002, MATH 1004, MATH 1007, MATH 1009, MATH 1052, 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.

Includes: Experiential Learning Activity

Precludes additional credit for BIT 1101, BIT 1201, ECON 1401, ECON 1402, MATH 1104, MATH 1107, MATH 1119, MATH 1152, MATH 1401, MATH 1402.

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.

Includes: Experiential Learning Activity

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

Prerequisite(s): BIT 1100.

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

BIT 1006 [0.5 credit]**Achieving Success in Changing Environments**

Students explore the possibilities ahead, assess their own aptitudes and strengths, and apply critical thinking and decision-making tools to help resolve some of the important issues in our complex society with its competing interests.

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

Lectures three hours a week.

BIT 1007 [0.5 credit]**Physics for NET**

An introductory course on energy, electrical networks (AC and DC circuits, resistance, impedance, capacitance), electrostatics (electric fields, static electricity), electromagnetism, electromagnetic waves, optics, and other topics in modern physics. Practical skills are learned in the laboratory, which is a required part of the course.

Precludes additional credit for BIT 1003 (no longer offered), BIT 1204, PHYS 1002, PHYS 1004, PHYS 1008.

Prerequisite(s): BIT 1000, Restricted to students in the B.I.T. degree program.

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

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.

Includes: Experiential Learning Activity

Precludes additional credit for BIT 1000, BIT 1200, ECON 1401, ECON 1402, MATH 1002, MATH 1004, MATH 1007, MATH 1009, MATH 1052, 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 MultiMedia 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.

Includes: Experiential Learning Activity

Precludes additional credit for BIT 1001, BIT 1201, ECON 1401, ECON 1402, MATH 1104, MATH 1107, MATH 1119, MATH 1152, MATH 1401, MATH 1402.

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

BIT 1200 [0.5 credit]**Calculus**

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.

Includes: Experiential Learning Activity

Precludes additional credit for BIT 1000, BIT 1100, MATH 1002, MATH 1004, MATH 1007, MATH 1009, MATH 1052, 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]**Linear Algebra**

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.

Includes: Experiential Learning Activity

Precludes additional credit for BIT 1001, BIT 1101, MATH 1102, MATH 1104, MATH 1107, MATH 1119, MATH 1152, 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]**Newtonian Physics**

Mechanics, properties of matter, thermodynamics.

Applications chosen in part from the life sciences.

Includes: Experiential Learning Activity

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]**Electromagnetism & Modern Physics**

Electricity and magnetism, DC and AC circuits, wave motion and light. Elements of modern physics.

Applications chosen in part from the life sciences.

Includes: Experiential Learning Activity

Precludes additional credit for BIT 1003 (no longer offered), BIT 1007, 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 procedural programming and algorithm design in C. Topics include: basic variables, functions, operators, program control with iteration and conditionals, I/O operations, text and file processing, structures, arrays, pointers, debugging, algorithmic thinking and pseudocode, computer architecture, operating systems, and libraries.

Includes: Experiential Learning Activity

Precludes additional credit for COMP 1005, COMP 1405, ITEC 1400, ITEC 1401.

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]**Probability for Technology**

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.

Includes: Experiential Learning Activity

Precludes additional credit for BIT 2009, ECON 2210, ENST 2006, GEOG 2006, STAT 2507, STAT 2606, 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.

Includes: Experiential Learning Activity

Precludes additional credit for BUSI 1800.

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.

Includes: Experiential Learning Activity

Precludes additional credit for BUSI 2204.

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

Lectures three hours a week.

BIT 2006 [0.5 credit]**Elective**

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

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

Lectures three hours a week, or as arranged.

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.

Includes: Experiential Learning Activity

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 2009 [0.5 credit]**Statistics for Technology**

This course covers statistical data analysis with an emphasis on hypothesis testing including parametric tests (e.g., t-tests, ANOVA) and non-parametric tests (e.g., Kruskal-Wallis, Friedman, chi-square), correlation and linear regression. Provides an introduction to probability theory and distributions (e.g. binomial, normal).

Includes: Experiential Learning Activity

Precludes additional credit for BIT 2000, 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 2010 [0.5 credit]**Differential Equations & Multivariate Calculus**

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.

Prerequisite(s): BIT 1200.

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

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

Introduction to object-oriented programming and algorithm design in C++. Topics include code and data encapsulation using classes and objects, inheritance, polymorphism, object-oriented design, data and code abstraction, program efficiency, user interface objects, event-driven systems, and an introduction to linked-lists and searching.

Includes: Experiential Learning Activity

Precludes additional credit for COMP 1006, COMP 1406, ITEC 2400, ITEC 2401.

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**

Includes: Experiential Learning Activity

BIT 4000 [0.5 credit]**Directed Studies**

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 program.

Includes: Experiential Learning Activity

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

BIT 4001 [0.5 credit]**Special 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

Introduction to interactive multimedia and design, focused on the production and processes of animation, visual fx, game design and development, web design and development, and user experience/interfaces.

Topics include: mark-up languages, design process/problem-solving tools, human-centered design, product development, ethics, and copyright and intellectual property.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

Prerequisite(s): IMD 1000 and IMD 1002.

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

Precludes additional credit for ITEC 1005.

Prerequisite(s): IMD 1000 and IMD 1004.

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.

Includes: Experiential Learning Activity

Prerequisite(s): IMD 1000 and IMD 1002.

Workshop four hours a week.

IMD 2006 [0.5 credit]

Introduction to Game Design and Development

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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

Prerequisite(s): BIT 1002 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 focused on project management. Topics include: project management styles, team collaboration techniques, prototyping, project and content management, marketing, and testing/validation. The studio emphasizes the management of web design and development projects.

Includes: Experiential Learning Activity

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, rendering methods, and shaders.

Includes: Experiential Learning Activity

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

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

Includes: Experiential Learning Activity

Prerequisite(s): BIT 2009 and third-year standing in the IMD program.

Lecture three hours a week, tutorial/laboratory two 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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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

Lecture three hours a week.

IMD 4006 [0.5 credit]**Advanced Game Design and Development**

Provides students with knowledge and expertise to design and develop professional computer games with advanced and novel features. Topics include: game feel, game analysis techniques, prototyping & playtesting, inclusive/accessible design, interaction design, simulations in games, procedural content generation, and game research.

Includes: Experiential Learning Activity

Prerequisite(s): BIT 1100, IMD 2006 and IMD 3002.

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.

Includes: Experiential Learning Activity

Prerequisite(s): IMD 3004 and IMD 3006.

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

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

Student-initiated digital media project, under the supervision of a project advisor, consisting of complete end-to-end production, from design to final product. Development will be assessed via design documents, project plans, progress presentations, culminating in a final exposition in front of a panel of industry experts.

Includes: Experiential Learning Activity

Prerequisite(s): IMD 2900, IMD 3004, IMD 3900, IMD 3901 and fourth-year standing in the IMD 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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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

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

Includes: Experiential Learning Activity

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 Enterprise networks. Topics include configuration and troubleshooting of OSPF, including Multi-area, redundancy, NAT and troubleshooting techniques.

Includes: Experiential Learning Activity

Prerequisite(s): NET 1006.

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

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

Introduction to the fundamentals of information transmissions systems used in physical layer of the Internet. Covers time- and frequency-domain concepts, digital and analog transmission, signal encoding, sampling, modulation, demodulation, error detection and correction. Examples: DSL, Cable modem, and wireless LAN. Includes: Experiential Learning Activity.
Includes: Experiential Learning Activity
Prerequisite(s): BIT 1001 and BIT 1007.
Lectures three hours a week, tutorial/laboratory three hours a week.

NET 2008 [0.5 credit]**DevOps**

Exposure to unifying software development (Dev) and software operation (Ops). Use of Python to monitor and automate network management tasks.
Prerequisite(s): BIT 2400.
Lectures three hours a week, tutorial/laboratory three hours a week.

NET 2010 [0.5 credit]**Desktop and Server Environments I**

Using Linux and Windows Server, study of the basic features such as file system, system utilities, memory management, boot process troubleshooting and UI customizations. Client-Server architecture is examined with a focus on basic Server configuration and administration. Includes: Experiential Learning Activity.
Includes: Experiential Learning Activity
Precludes additional credit for NET 2002 (no longer offered).
Prerequisite(s): NET 1001.
Lecture two hours a week, tutorial/laboratory two hours a week.

NET 2011 [0.5 credit]**Desktop and Server Environments II**

Using Unix and Linux Operating systems, study of the command line and network Server operating environments. Configuring Services and Protocols such as DNS, NTP, SSH, SMB, SMTP, POP3, IMAP, HTTP, and DHCP. Basic Server security using firewalls is also introduced. Includes: Experiential Learning Activity.
Includes: Experiential Learning Activity
Precludes additional credit for NET 2003 (no longer offered).
Prerequisite(s): NET 2010.
Lecture two hours a week, tutorial/laboratory two hours a week.

NET 2012 [0.5 credit]**Networking Technologies and Automation**

Enterprise technologies and QoS mechanisms used for networks access. Topics include virtualization, and automation concepts. Software-defined networking, controller-based architectures and how application programming interfaces (APIs) enable network automation.
Includes: Experiential Learning Activity
Precludes additional credit for NET 2001 (no longer offered).
Prerequisite(s): NET 2000.
Lectures three hours a week, tutorial/laboratory two hours a week.

NET 2013 [0.5 credit]**Computer Systems Foundations**

Introduction to the design and implementation of digital circuits and microprocessors. Topics include: binary numbers and arithmetic, fundamentals of boolean algebra, combinational circuits, sequential circuits, computer architecture and organization: CPU, cache, memory, input/output, bus structures, interrupts, computer arithmetic, CPU assembly instruction sets.
Includes: Experiential Learning Activity
Precludes additional credit for NET 1004 (no longer offered), PLT 1007 (no longer offered), NET 2009 (no longer offered), PLT 2009 (no longer offered), OSS 2009.
Prerequisite(s): BIT 2400.
Lectures three hours a week, tutorial/laboratory one hour 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.
Includes: Experiential Learning Activity
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.

Includes: Experiential Learning Activity

Also listed as OSS 3001.

Prerequisite(s): NET 2013.

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.

Includes: Experiential Learning Activity

Also listed as OSS 3004.

Precludes additional credit for PLT 3010 (no longer offered).

Prerequisite(s): BIT 2400.

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

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

Key network management models (FCAPS, TMN), protocols and standards, such as SNMP. Introduction to and use of various management tools and methodologies. Current trends in network management and measurement. Security issues in collecting networking management information.

Includes: Experiential Learning Activity

Prerequisite(s): NET 3000 and NET 3004.

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.

Includes: Experiential Learning Activity

Prerequisite(s): NET 2012.

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 multiple routing protocols. Working knowledge of Internet reachability via BGP.

Includes: Experiential Learning Activity

Prerequisite(s): NET 2012.

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 and Hypertext Formatting Languages (HTML, XML, CSS), Universal Resource Identifiers (URI), and the Hypertext Transport Protocol (HTTP). JavaScript and PHP are used to model cross-platform web programming.

Includes: Experiential Learning Activity

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 traffic in an enterprise environment.

Includes: Experiential Learning Activity

Prerequisite(s): NET 2012.

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

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

An exploration of deployment options that can be implemented atop of a MPLS network. The focus is on technologies and architectures that serve to enhance IP delivery, or IP service leveraging the MPLS infrastructure. Includes Layer 2 and 3 tunneling techniques. Includes: Experiential Learning Activity.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

Prerequisite(s): NET 2007.

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.

Includes: Experiential Learning Activity

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 and network modeling; fundamental stochastic models for networking; introduction to queueing theory; random numbers; analysis of simulation data; confidence intervals. Use of different software tools to plan and perform simulations.

Includes: Experiential Learning Activity

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 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.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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, VPN), culminating in problem resolution throughout a complex enterprise network.

Includes: Experiential Learning Activity

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.

Includes: Experiential Learning Activity

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 4011 [0.5 credit]**Advanced Topics in Network Security**

Understanding classes of advanced attacks. Building secure networks. Adversarial Machine Learning. Security in clouds, virtualized networks, and IoT. Understanding impact of OS and software security issues. Security in next generation networks such as 5G.

Prerequisite(s): NET 3007.

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

NET 4012 [0.5 credit]**Cloud Computing and Virtualization**

The basics of cloud computing and its driving technology behind: virtualization. Topics include how virtual machines and containers are deployed and orchestrated; how various resources and networks are virtualized and managed; hypervisor technology; virtual network management and micro-segmentation; cloud service provisioning; cloud security.

Includes: Experiential Learning Activity

Prerequisite(s): NET 2013 and NET 3006.

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

NET 4901 [1.0 credit]**NET Capstone 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.

Includes: Experiential Learning Activity

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

Tutorial hours arranged.

Optical Systems and Sensors (OSS) Courses**OSS 1002 [0.5 credit]****Photonics and Optoelectronics Applications**

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.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 1002 (no longer offered).

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

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

OSS 1003 [0.5 credit]**Optics/Optical Fibers (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.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 1003 (no longer offered).

Prerequisite(s): OSS 1006.

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

OSS 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.

Includes: Experiential Learning Activity

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

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

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

OSS 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.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 1006 (no longer offered).

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

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

OSS 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.

Includes: Experiential Learning Activity

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

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

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

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

Adaptive Optical Communication Networks with 10Gb/s-200Gb/s Packet-Optical Platforms and WaveServers, OTN, flexible WaveLogic Photonics, ROADM, SONET/SDH, programmable network, optimized mapping techniques, optical carriers (OC-n/STM-m).

Extensive hands-on experience using state-of-the-art Optophotonics Lab to work on OAM&P, facility/equipment, synchronization, bandwidth management, performance monitoring and other functionalities.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 2002 (no longer offered).

Prerequisite(s): OSS 1003.

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

OSS 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.

Includes: Experiential Learning Activity

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

Prerequisite(s): OSS 2001 or PLT 2001 (no longer offered).

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

OSS 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.

Includes: Experiential Learning Activity

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

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.

OSS 2006 [0.5 credit]**Integrated Circuits**

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.

Includes: Experiential Learning Activity

Precludes additional credit for ELEC 2507, PLT 2006 (no longer offered).

Prerequisite(s): OSS 2005 or PLT 2005 (no longer offered). Restricted to students in the B.I.T. degree program.

Lectures two hours a week, laboratory and problem analysis three hours a week.

OSS 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.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 2008 (no longer offered).

Prerequisite(s): OSS 1002 or PLT 1002 (no longer offered). Restricted to students in the B.I.T. degree program.

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

OSS 2009 [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.

Includes: Experiential Learning Activity

Precludes additional credit for NET 1004 (no longer offered), NET 2013, PLT 1007 (no longer offered), PLT 2009 (no longer offered).

Prerequisite(s): BIT 2400.

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

OSS 2010 [0.5 credit]**Signals and Systems**

This course provides a solid theoretical foundation for the analysis and processing of experimental data, and real-time experimental control methods. Topics include various properties of signals and systems, convolution, the Fourier transform, sampling theorem, z-transform, spectral analysis, filter design, and system identification.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 2010 (no longer offered).

Prerequisite(s): BIT 1200 and BIT 1201. Restricted to students in the B.I.T. degree program.

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

OSS 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: alarm provisioning, line and path protection switching, security, data communications management, optical network backup and restore, load upgrade and installation management.

Includes: Experiential Learning Activity

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

Prerequisite(s): OSS 2002.

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

OSS 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.

Includes: Experiential Learning Activity

Also listed as NET 3001.

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

Prerequisite(s): OSS 2009 or PLT 2009 (no longer offered).

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

OSS 3002 [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.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 3004 (no longer offered).

Prerequisite(s): OSS 1003 or PLT 1003 (no longer offered).

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

OSS 3003 [0.5 credit]**Fundamentals of Electromagnetics**

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

Includes: Experiential Learning Activity

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

Prerequisite(s): BIT 1204 and BIT 2010.

Lecture and tutorial three hours a week.

OSS 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.

Includes: Experiential Learning Activity

Also listed as NET 3004.

Precludes additional credit for PLT 3010 (no longer offered).

Prerequisite(s): BIT 2400.

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

OSS 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.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 3009 (no longer offered).

Prerequisite(s): third year standing in the Optical Systems and Sensors program.

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

OSS 3012 [0.5 credit]**Digital Signal Processing**

Operations-related topics including: sampling/reconstruction of continuous time signals, Fourier and Z-transforms, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT). Examination of other time and frequency domain techniques for designing and applying infinite impulse response (IIR) and finite impulse response (FIR) digital filters.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 3012 (no longer offered).

Prerequisite(s): OSS 2010 or PLT 2010 (no longer offered).

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

OSS 3013 [0.5 credit]**Software Design for Optical Systems and Sensors**

Provides students with knowledge and expertise to design and develop complex software systems and programs for common optical systems and sensors using Python. Topics include: system and requirement analysis, algorithms, component identification, common design patterns, and working with reusable components.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 3013 (no longer offered).

Prerequisite(s): BIT 2400.

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

OSS 3014 [0.5 credit]**Optical Waves, Waveguides, and Sensors**

Analysis of guided-wave propagation and sensors.

Topics include Maxwell's time-dependent wave equations, dielectric waveguides (slab, planar, segmented, rib, strip), optical fibres (modes, dispersion relations, propagation in dispersive media, nonlinear fibres), beam propagation methods, free space beam propagation, waveguide devices, and study of sensors technology.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 3014 (no longer offered).

Prerequisite(s): OSS 3003 or PLT 3003 (no longer offered).

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

OSS 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.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 4001 (no longer offered).

Prerequisite(s): OSS 3002 or PLT 3004 (no longer offered).

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

OSS 4004 [0.5 credit]**Medical Imaging and Biosensors**

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.

Includes: Experiential Learning Activity

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

Prerequisite(s): OSS 3003 or PLT 3003 (no longer offered).

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

OSS 4005 [0.5 credit]**Introduction to Deep Learning**

Introduction to classification and regression. Optimization, vectorization, gradient descent, cost, loss and activation functions. Introduction and basics to AI, Artificial Neural Networks, forward and backward propagation, Multi Layer Perceptron, and other types of Deep Neural Network models, their applications in multimedia, networks, finance, etc.

Includes: Experiential Learning Activity

Also listed as IRM 4005.

Prerequisite(s): BIT 2000 and BIT 2400.

Lectures three hours a week.

OSS 4006 [0.5 credit]**Image 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.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 4006 (no longer offered).

Prerequisite(s): BIT 2400 and OSS 3012.

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

OSS 4008 [0.5 credit]**Remote Sensing**

Introduction to the basics of remote sensing, characteristics of remote sensors, and applications. Topics include: image acquisition and data collection, LIDAR sensors and platforms and derived digital products, imagery analysis, topographic mapping, and 3D modeling of urban infrastructure for autonomous vehicles.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 4008 (no longer offered).

Prerequisite(s): OSS 3014 or PLT 3014 (no longer offered).

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

OSS 4009 [0.5 credit]**Computer Vision**

Introduction to topics in computer vision, including: fundamentals of image formation, camera imaging geometry, f camera models, camera calibration, structure from motion, feature detection and matching, depth and stereo, image stabilization, image classification, automated alignment, scene understanding, recognition, and image searching.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 4009 (no longer offered).

Prerequisite(s): OSS 4006 or PLT 4006 (no longer offered).

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

OSS 4900 [1.0 credit]**OSS Capstone 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.

Includes: Experiential Learning Activity

Precludes additional credit for PLT 4900 (no longer offered).

Prerequisite(s): fourth-year standing.

Tutorial hours arranged.