GRADUATE STUDIES CALENDAR

Royal Military College of Canada

2011-2012

FOR INTERNAL DISTRIBUTION ONLY

National Defence Défense nationale

Canada

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Important Dates and Notices

Dates

August 2011

- Pre-registration for Fall Session (2 – 12 Aug)
- End of Summer Session (31 Aug)
- Graduate Studies Committee meeting (31 Aug)

September 2011

- Graduate Student Orientation - military students only (1 Sep)
- Labour Day – statutory holiday – no classes (5 Sep)
- Start of Fall Session for Undergraduate Studies and Master of Business Administration (6 Sep)
- Graduate Student Academic Orientation - location TBD (8 Sep)
- Start of Fall Session for Graduate Studies - except Master of Business Administration (12 Sep)
- Portal marks entry deadline for Summer courses (14 Sep)
- Fall registration deadline - late registration fees applied after this date (16 Sep)
- Release of Summer marks on the portal (18 Sep)
- Deadline to submit Application for Graduation - Fall Convocation (22 Sep)
- Graduate Studies Committee meeting (28 Sep)
- Deadline for payment of fall tuition by full-time students - paying per term fees (30 Sep)

October 2011

- Deadline for graduate students to add a course and/or withdraw from a course without a "WD" - fees forfeited after this date (7 Oct)
- Thanksgiving - statutory holiday - no classes (10 Oct)
- Deadline for receipt of course marks, project/thesis acceptances - Fall Convocation (20 Oct)
- Graduate Studies Committee marks meeting - Fall Convocation (26 Oct)
- Last date to withdraw from a course with a "WD" - no refund - courses dropped after this date will have a mark assigned (Oct 28)
- Portal registration begins for Winter courses - WS, SDMP and MBA only (31 Oct)

November 2011

- Remembrance Day - no classes (11 Nov)
- **Fall Convocation *(17 Nov)***
- Graduate Studies Committee meeting (23 Nov)

December 2011

- Pre-registration period for Winter Session (1 – 16 Dec)
- Fall Session classes end (2 Dec)
- Fall Session exam period – Undergraduate (5 – 16 Dec)
- End of Fall Session (16 Dec)
- Graduate Studies Committee meeting (21 Dec)
- Christmas Day – statutory holiday (26 Dec)
- Boxing Day – statutory holiday (27 Dec)
- Pedagogical leave (28 – 31 Dec)

January 2012

- New Year's Day - statutory holiday (2 Jan)
- Pedagogical leave (3 Jan)
- Start of Winter Session (9 Jan)
- Winter registration deadline - late registration fees applied after this date (13 Jan)
- Portal marks entry deadline for Fall Term courses (13 Jan)
- Release of Fall Term marks on the Portal (17 Jan)
- Graduate Studies Committee meeting (25 Jan)
- Deadline for payment of winter tuition by full-time students - paying per term fees (31 Jan)

February 2012

- Last date for graduate students to withdraw from a course without a "WD" - fees forfeited after this date (3 Feb)
- Reading Week (20 – 24 Feb)
- Last date to withdraw from a course with a "WD" - no refund - courses dropped after this date will have a mark assigned (24 Feb)
- Graduate Studies Committee meeting (29 Feb)

March 2012

- Portal registration period begins for Summer Session courses – WS, SDMP and MBA only (13 Mar)
- Deadline to submit Application for Graduation - Spring Convocation (22 Mar)
- Graduate Studies Committee meeting (28 Mar)

April 2012

- Winter Session classes end (5 Apr)
- Good Friday - statutory holiday - no classes (6 Apr)
- Easter Monday - statutory holiday - no classes (9 Apr)
- Winter Term exam period - Undergraduate (16 – 27 Apr)
- End of Winter Session (27 Apr)
- Deadline for receipt of course marks, project/thesis acceptances - graduands only (30 Apr)

May 2012

- Pre-registration for Summer Session (1 – 11 May)
- Deadline to submit Application for Graduation - June Convocation (3 May)
- Graduate Studies Committee marks meeting - Spring Convocation (4 May)
- Portal entry marks deadline for Winter courses and Fall/Winter courses (11 May)
- Release of Winter and Fall/Winter marks on Portal (15 May)
- Convocation rehearsal (16 May)
- **Spring Convocation *(17 May)***
- Graduation Parade and Presentation of Commissions – Graduation Ball (18 May)
- Victoria Day - statutory holiday - no classes (21 May)
- Start of Summer Term (22 May)
- Summer registration deadline - late registration fees applied after this date (25 May)
- Deadline for receipt of course marks, project/thesis acceptances – June graduands only - (31 May)
- Deadline for payment of summer tuition by full-time students - paying per term fees (31 May)

June 2012

- Graduate Studies Committee marks meeting - Summer Convocation (6 Jun)
- Summer Convocation - CFC Toronto (28 Jun)

July 2012

- Portal registration period begins for Fall courses and Fall/Winter courses - WS, SDMP and MBA only (2 Jul)

Notices

If there is a divergence between the information in the printed version of the Graduate Calendar or any of the departmental web pages within the RMC website and, that in the Graduate Calendar web pages, the information in the Graduate Calendar web pages will prevail, since it is recognized as the official Calendar.

The course listings and academic programmes described in this Calendar represent Senate-approved requirements and electives for completion of degree requirements. Circumstances beyond the control of the University, such as severe budget shortfalls, may result in restrictions in the number and range of course and programme choices available to students as compared with those listed herein or in other University publications. The University reserves the right to limit access to courses or programmes, and, at its discretion, to withdraw particular programmes, options, or courses altogether.

In such circumstances the University undertakes to the best of its ability to enable students registered in affected programmes to complete their degree requirements in a satisfactory manner. Prospective students or new registrants are advised to consult the most current information available from the Offices of the Graduate Studies Division and/or of the Registrar in printed or electronic form before making registration decisions or course/programme choices.

The Senate and the Board of Governors of the Royal Military College of Canada reserve the right to invoke changes in this Calendar, in either its printed or electronic forms, at any time without prior notice.

1. Graduate Studies & Research Division

1.1 Contact Information

Address
Royal Military College of Canada
Office of the Dean
Graduate Studies and Research Division
P.O. Box 17000, Station Forces
Kingston ON K7K 7B4

Telephone Switchboard: 613-541-6000
Dean of the Division of Graduate Studies and Research: 3854
Administrative Officer (Dean): 3728
Research Grant Officer: 3575
Administration Officer (Research) 6826
Facsimile: 613-541-6064
Web page: Division of Graduate Studies

1.2 Background

The Division of Graduate Studies was established by the RMC Senate in 1959. The title became Division of Graduate Studies and Research in 1963. The first graduate degree was granted in 1966.

The mission of the Division of Graduate Studies and Research is to provide advanced degree programmes and professional development for postgraduate students in key areas of engineering, humanities, and science in support of the Canadian Forces, to carry out research at the level needed to sustain the teaching programmes, and to support the CF mandate through collaboration and alliance with Defence Research & Development Canada (DRDC), the Defence Research Establishments, Engineering Classifications, and Operational Commands.

The Chairs of the Division have been:

1959-1963	J.R. Dacey, MBE, BSc, MSc, PhD, FCIC - Chairman, Division Graduate Studies
1963-1972	T.S. Hutchison, BSc, PhD, FInstP, FAPS, FRSE - Dean of The Division of Graduate Studies and Research
1972-1984	Captain (N) (Retired) J.B. Plant, CD, ADC, ndc, PhD, PEng - Dean of The Division of Graduate Studies and Research
1984-1995	W.F. Furter, rmc, ndc, BASc, SM, PhD, FCIC, PEng - Dean of The Division of Graduate Studies and Research
1995-2003	R.D. Weir, CD, BSc, DIC, PhD, FCIC, FEIC, FIUPAC, FRSC, CChem, PEng - Dean of the Division of Graduate Studies and Research
2003-	B.J. Fugère, BSc, MSc, PhD - Dean of The Division of Graduate Studies and Research

1.3 Officers of the Division

Dean of Graduate Studies and Research Division:

B.J. Fugère, BSc, MSc, PhD

Associate Deans of Graduate Studies:

H. Bonin, BA, BSc, BScA, MIng, PhD, FCIC, FCNS, ing, PEng

F. E. Boucher, BA, MA, PhD

D.L. Wehlau, BSc, MA, PhD

1.4 Graduate Studies Committee

The Graduate Studies Committee is a committee of the Faculty Council and shall make recommendations to the Faculty Council concerning:

1. the promotion and development of graduate studies and research at the University;
2. the acceptability of applicants; and
3. new graduate courses and degree programmes

In addition, the Committee will, on behalf of the Council:

1. act as a marks committee for graduate courses;
2. adjudicate the registrations and individual programmes of study of graduate students;
3. adjudicate thesis examination procedures;
4. act as the syllabus committee of the graduate faculty; and
5. ensure that the graduate studies calendar is up to date;

and will report to Faculty Council on these matters

1.5 Faculty of the Graduate Studies and Research Division

While all faculty members may participate in some aspects of graduate programmes, including the teaching of graduate courses, there are particular requirements to be permitted to act as the primary supervisor of a graduate student or to sit as an examiner at a thesis defence. Normally, to carry out these functions, a faculty member

1. Shall have the PhD or equivalent, it being understood that holding the rank of UT 3 (Associate Professor) or UT 4 (Professor) establishes the equivalence automatically, and
2. Shall have a recent history of productive scholarship which is reflected by the dissemination of the results of that scholarship.

By exception, new faculty members in a first university appointment are held to a lesser standard than others when assessing (2) above, for the first two years of their service at RMC.

Heads of Departments are expected to recommend to the Dean of their Faculty the names of those who meet these criteria. The Dean of the Faculty shall make a decision in consultation with the Dean of Graduate Studies and Research.

Faculty members with complete privileges will be identified by an asterisk (*) beside their names in the graduate calendar.

The Dean of Graduate Studies may, with the concurrence of the Dean of the Faculty, permit faculty members who are not so identified to supervise or examine a thesis in special circumstances, where the particular expertise of the faculty member aligns especially well with the thesis topic. Exceptions of this nature are more readily granted when the degree being sought is a Master's degree rather than a Doctoral degree.

1.6 Interdepartmental Committees of the Division

The interdepartmental degree programmes in War Studies, Defence Engineering and Management, and Security and Defence Management and Policy, are controlled directly by committees, rather than by individual departments of the Graduate Division.

War Studies Committee:

Dr. D. Delaney as Chair

Defence Engineering and Management Committee:

Dr. W.G. Phillips as Chair

Security and Defence Management and Policy Committee:

Dr. P.J.S. Dunnett as Chair

1.7 Ethical Conduct for Research

The Royal Military College policy on integrity in research and scholarship is defined in the Collective Agreement, Article 35, Treasury Board and the Canadian Military College Faculty Association 1999.

Research conducted by RMC staff and students must conform to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans, as set by;

- the Canada Institutes of Health Research (CIHR),
- the Natural Sciences and Engineering Research Council (NSERC), and
- the Social Sciences and Humanities Research Council (SSHRC) (MR 21-18/1998E; ISBN 0-662-27121-7).

Chair: Dr D. Charbonneau

Vice-Chair: Dr. G.M. Torrie

Additional information and forms are available at:
The Research Ethics Board

1.8 Library

Staff
Mission
Collections
Facilities

Staff

S. Toomey, BA (McGill), MLS (McGill) - Chief Librarian

C. Olsen, BA, MLS - Head Access Services

L. Béchard, BA, MLS - Head Technical Services and Systems

Mission

The Library's primary mission is to contribute to the achievement of the College Academic Wing's stated mission to carry out university level education at the undergraduate and graduate levels, in both official languages, and to support the pursuit of learning through scholarly research, teaching and study in a spirit of intellectual freedom. The Library's secondary mission is to be a repository of specialised information sources and items of national heritage in partnership with other federal and academic libraries.

Collections

Massey Library is located in the Massey building. The book stacks are open to the public but borrowing privileges are restricted to authorized users. The RMC Library being a constituent member of a bilingual institution is committed to collect and to offer all library services in both official languages.

The Library houses a substantial collection of books, government documents, journals, technical reports, microforms, video/audio cassettes, CDs and DVDs and special collections. The collection includes approximately 250,000 books and 1,200 journals, over 3,000 electronic journal subscriptions (CRKN), plus 2000 audio-visual items, in both English and French. More than 60 indexes and databases are available online. The special collections consist of monographs, prints, photographs and archival material, including the RMC Archives.

The Leadership Library Collection, presented to RMC by the Class of 1956, has a prominent place on the main floor. This floor also houses the library's regular collection of science and engineering books (call nos. TA403-Z), as well as the library's reference and journal collections. Recent issues of journals and daily newspapers are available in the reading area. The collection of newspapers on microfilm, plus the microfiche collection, is found in this area. The microfiche collection covers mainly military and history topics, including Canadian history.

On the second floor, the library's regular collection of politics, history, religion, philosophy, economics, sociology and psychology books (call nos.: A-JS) are located. In the basement there is the rest of the library's collection, which covers subjects such as political science, law, music, art, literature, science and engineering (call nos.: JV-TA402). On this floor there is also the microfilm collection of primary sources. This includes government reports and documents from Great Britain and the U.S. concerning countries and time periods of historical interest, plus the papers of some U.S. presidents and other persons of note. In room 30 there is the government documents collection, which has mainly Canadian federal government publications and some provincial publications.

Facilities

The library has access to the internet, as well as computer stations. Patrons can read the latest journals and newspapers in the Reading Area. Photocopiers, printers and microform reader/printers are available.

On the second floor there is a computer lab with laptops, as well as a multipurpose room with space for reading/studying and group work. All computers and laptops offer access to the web and are equipped with standard software such as MS Office and Acrobat Reader. The Writing Centre is also on this floor, and offers tutorials and workshops to assist students with the writing process. In the basement there are study carrels and computers, as well as one quick look-up station.

2. Programmes Offered

2.1 General Information

The programmes of graduate studies at RMC are open to Officers and non-commissioned members of the Canadian Armed Forces, Regular and Reserves, and to civilians who are either Canadian citizens or permanent residents. All the graduate programmes are subjected to the appraisal process administered by the Ontario Council of Graduate Studies, Council of Ontario Universities.

The RMC Senate has ruled, as a matter of policy, that programmes failing to meet this external standard will not be offered. The Institutional philosophy of RMC is predicated on limiting the number of programmes and maintaining the standards to be among the best.

2.2 Master's Degree Programmes

The Royal Military College of Canada offers to commissioned officers of the Canadian Armed Forces and to civilian students who are Canadian citizens or permanent residents, a graduate study programme leading to the following Master's degrees:

Master of Arts

- Security and Defence Management and Policy
- War Studies

Master of Business Administration

Master of Defence Engineering and Management

Master of Defence Studies

Master of Science

- Chemical & Materials Science
- Computer Science
- Environmental Science
- Mathematics
- Nuclear Science
- Physics

Master of Engineering (Project) and Master of Applied Science (Thesis)

- Aeronautical Engineering
- Chemical & Materials Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Environmental Engineering
- Mechanical Engineering
- Nuclear Engineering
- Software Engineering

2.3 Doctoral Degree Programmes

The Royal Military College of Canada offers to Commissioned Officers of the Canadian Armed Forces and civilian students, a graduate study programme leading to the following Doctoral degrees:

Doctor of Philosophy (Arts)

- War Studies

Doctor of Philosophy (Science)

- Chemical & Materials Science
- Environmental Science
- Mathematics
- Computer Science
- Nuclear Science
- Physics

Doctor of Philosophy (Engineering)

- Chemical & Materials Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Environmental Engineering
- Mechanical Engineering
- Nuclear Engineering
- Software Engineering

3. General Programme Requirements

3.1 General Information

These general regulations specify the minimum academic requirements in order to obtain a Master's or Doctoral degree with the Division of Graduate Studies and Research. The student's major department may have additional requirements.

3.2 Master's Degrees

Requirements - Masters Programme

Normally a period of two academic years, plus the intervening summer, of full-time graduate study is required for completion of a Master's degree programme.

The minimum RMC content required for the awarding of an RMC Master's degree is work equivalent to two full-time terms (one academic year) of full-time graduate study under the RMC faculty.

Programme of Studies - Master's Programme

A minimum of four (4) approved term courses or the equivalent at the graduate level, plus a thesis will be required for a Master's degree. A term course is defined as one consisting of three (one-hour) periods per week for one academic term. Work done at other universities will be accepted if recommended by the Graduate Studies Committee and approved by Faculty Council. Results of original research or contribution to knowledge will normally be presented in the form of a thesis.

The minimum number of RMC courses is fifty percent (50%) of the required course load, excluding the thesis.

The normal requirement for an RMC Master's degree is:

1. five (5) term courses or the equivalent at the graduate level plus a thesis,
2. eight (8) term courses or the equivalent at the graduate level plus a project, or
3. ten (10) term courses or the equivalent at the graduate level.

Please see the various degree programmes by Department for degree requirements.

A candidate's major department is the department in which the thesis research is conducted. In the case of graduate degree programmes conducted by interdepartmental committees of the Division of Graduate Studies and Research rather than by departments, the interdepartmental committee and its chair will assume the responsibilities of the major department and departmental chair respectively.

The programme of studies and research recommended by the major department concerned must be approved each term by the Graduate Studies Committee.

Time Limit - Master's Programme

The period allowed from first registration into the Master's Programme to the final submission of the thesis normally shall be no more than five years. Requests for extension of the thesis will be considered on a case by case basis.

3.3 Doctoral Degrees

Residence Requirements - Doctoral Programme

The minimum residence requirement for the Doctoral degree is four full-time terms (two academic years), dated from the initial registration in the programme.

The minimum RMC content required for the awarding of a RMC PhD degree is work equivalent to four academic terms or two academic years of full-time graduate study in a PhD programme at RMC.

In the case of candidates who are full-time members of the RMC faculty while undertaking a PhD programme on a part-time basis in their own time, one-half of an academic year of residence requirement will be credited for each year on staff during the period in which the candidate is registered in a PhD programme. For the purpose of this regulation, the academic year is considered to extend from 1 September to 30 April.

A Master's student, who is allowed to transfer into a PhD programme, must fulfil two academic years of full-time study, but dated from the initial registration in the Master's programme.

Programme of Studies - Doctoral Programme

The candidate will be required to take sufficient courses to provide proper preparation for the comprehensive examination. Normally, a minimum of eight approved term courses or the equivalent at the graduate level past the Bachelor's level will be required or a minimum of four

approved courses past the Master's level. Major departments may have additional course work requirements.

The minimum number of RMC courses is fifty percent (50%) of the required course load, excluding the thesis.

A candidate's major department is the department in which the thesis research is conducted. In the case of graduate degree programmes conducted by interdepartmental committees of the Division of Graduate Studies and Research rather than by departments, the interdepartmental committee and its chair will assume the responsibilities of the major department and departmental chair respectively. Graduate level courses previously completed at RMC or another university, including courses credited toward the granting of a Master's degree, will be accepted for credit up to a maximum of four term courses or equivalent, if recommended by the major department and Graduate Studies Committee and approved by Faculty Council.

Credit for additional graduate courses may be considered on petition by the candidate.

Time Limit - Doctoral Programme

The period allowed from first registration into the Doctoral Programme to the final submission of the thesis shall normally be no more than seven years. Requests for extension of the thesis will be considered on a case by case basis.

Language Requirements - Doctoral Programme

Individual departments may require demonstration of reading knowledge in one or more languages considered a requirement for the conduct of effective research in the particular topic of study.

3.4 Student Responsibilities

The Dean of Graduate Studies and Research is responsible to the Principal for the control and direction of all academic matters affecting graduate studies.

In academic matters, the graduate student is responsible directly to the Head of his or her major department (or, in the case of a programme controlled by an interdepartmental committee of the Division of Graduate Studies and Research, to its Chair), and thence to the Dean of Graduate Studies and Research.

For military purposes, command of all officers posted to RMC on postgraduate education is vested in the Commanding Officer for Post Graduates (CO PG & Mil Fac) who is specifically appointed by the Commandant.

Full-time graduate students may be required to perform laboratory assistance or tutorial duties (excluding marking) for up to three hours a week, and minor military duties from time to time.

A civilian and a military Postgraduate Class Senior will be appointed annually.

The civilian Class Senior will be chosen by the civilian graduate students in consultation with the Dean of Graduate Studies and Research, the military Class Senior by the COPG in consultation with the Dean of Graduate Studies and Research.

The military Class Senior shall be responsible to the COPG for the general control and deportment of the military graduate students, and shall also provide liaison between the military graduate students and the COPG and the Dean of Graduate Studies and Research.

The two seniors will sit on the Graduate Studies Committee.

4. Admissions

4.1 Application for Admission

For candidates seeking admission to the Royal Military College of Canada as graduate students, the application form and corresponding instructions can be found at: Graduate Studies and Research Forms

Should additional information be required, please contact the Office of Graduate Studies and Research .

4.2 General Admission Requirements

Master's Programme
Doctoral Programme

Students applying, who may not have the requisite language skills for university study, will normally be required to submit proof of their ability to study in the language, in which the program is being offered. This proof should be in the form of language test results. This may be required for students whose earlier education has been in a language other than those normally used at this institution.

For candidates whose first language is neither English nor French, the minimum Test of English as a Foreign Language (TOEFL) score for admission is: 600 for "Paper-based (pbt)", 250 for "Computer-based Test (cbt)" or 100 for "Internet-based (ibt)".

On the admission form, each student will be required to indicate he or she has read and understood Academic Regulation 5.17 .

Upon admission to graduate studies, each student will be required to sign a document indicating he or she has read and understood Academic Regulation 5.17.

Master's Programme

Decisions on academic admissibility are made on the recommendation of the major department and of the Dean of Graduate Studies and Research, and with the approval of the Faculty Council.

For direct admission as a Master's "Regular" Graduate Student to courses of study in Arts or Science, an applicant must hold an honours degree from a recognised university with at least B- (70%) in the field in which graduate studies and research are to be pursued.

For direct admission as a Master's "Regular" Graduate Student to courses of study in Engineering, the applicant must hold a degree from a recognized university with at least B- (70%) in the appropriate field of Engineering or Applied Science.

Some departments impose additional requirements and even though the applicant may appear to satisfy the general admission requirements, acceptance into a graduate degree programme is not guaranteed. Please see the various admission requirements by programme.

Doctoral Programme

The normal admission requirements for a PhD student shall be a Master's degree by thesis or its equivalent by thesis, in a field closely related to the proposed field of study.

Direct Admission to Doctoral Programme from Masters Programme

Students registered in a Master's degree programme with at least A- (80%) in the programme who display exceptional performance and promise in their research may, with the approval of their sponsor and after at least one full calendar year of full-time enrolment, apply to be admitted to a full-time PhD programme without having to complete the requirements for the Master's degree.

Such admission to a doctoral programme requires the successful completion of a transfer examination, the recommendation of the appropriate department or programme, the approval of the Graduate Studies Committee and its Dean as well as Faculty Council.

4.3 Acceptance

The acceptance of an applicant is recommended by the Department to the Graduate Studies and Research Division.

Official letters of acceptance are sent by the Dean of Graduate Studies and Research Division, and are only valid for the academic year indicated in them. A successful applicant must reply at an early date, declining or accepting the offer.

If the applicant wishes to commence study in a term other than the one offered or in a subsequent academic year, a deferral request may be made to the Dean of Graduate Studies and Research for consideration.

5. Academic Regulations

5.1 Student Categories

General Information

All policies and procedures governing sponsored graduate and postgraduate training, including selection of officer candidates, will be made by National Defence Headquarters (NDHQ). These policies are presented in Canadian Forces Administrative Order (CFAO) 9-33 and in Departmental Administrative Orders and Directives (DAOD).

5.1.1 Degree Student

A degree student is one who is registered in a graduate degree programme with the Division of Graduate Studies and Research and who is actively working toward their degree on a part-time or full-time basis.

5.1.2 Visiting Student

i) RMC - Queen's Graduate Student Agreement

Students from either university are permitted to take courses at the graduate level at the host university for degree credit at their home university. Courses may not be audited. Fees are paid at the home university.

ii) Ontario Visiting Graduate Student Plan (OVGS)

This plan allows a graduate student of an Ontario University (Home University) to take graduate courses at another Ontario University (Host University) while remaining registered at his/her own university. The plan allows the student to bypass the usual application for admission procedures and resultant transfer of credit difficulties. The student pays fees to his/her Home University and is classed as a "visiting graduate student" at the Host University where he/she pays no fees. The student must make application for study under this Plan by completing a Visiting Graduate Student Application form available at their Home University departmental offices. Students may not take courses under this Plan which are audit courses or which are not to be credited toward their degree programme.

iii) Visiting Students Outside Ontario

Students visiting RMC from universities outside Ontario, or RMC Students visiting a university outside Ontario are permitted to take graduate level courses at the host university for degree credit at their home university provided they have a Letter of Permission from their home university. Courses may not be audited. Fees are paid at the host university.

5.1.3 Interest Student

A graduate or equivalent student who is not enrolled in a graduate degree programme at RMC may take one or two term courses or one full-year course, for a total of two credits, as an interest student. The interest student is required to apply for admission and will pay tuition according to the department that offers the course.

5.2 Study Status

Introduction

A graduate student may be accepted into a programme as a Regular, Provisional or Probationary student, on either a part-time or full-time basis.

5.2.1 Regular

A Regular graduate student is a student who aspires to a Master's or PhD degree and has given evidence of capacity for graduate work acceptable to the Major Department, to the Dean of Graduate Studies and Research and to the Faculty Council.

5.2.2 Probationary Student

A graduate student may be accepted to the graduate school on a probationary basis, subject to demonstration of a suitable level of academic work during the initial period of graduate study. Probationary status may be assigned if the student has been admitted with an academic record which is below the normal requirements for graduate school admission, or if the undergraduate degree was in a field different from the graduate programme. Students admitted on probationary status are not required to complete extra makeup work as part of their degree requirements. They must, however, achieve a satisfactory level of academic performance (normally a grade of not less than B standing in all courses taken during the probationary period) in order to be retained in the programme and to be removed from probationary status. The Graduate Studies Committee will review the academic record of probationary full-time students at the end of two terms of study and make recommendations to Faculty Council regarding retention or removal from the programme. For part-time students, the status will be reviewed at a corresponding later date, once a sufficient number of courses have been completed to assess academic performance.

5.2.3 Provisional Student

A student may be admitted to a graduate programme on a provisional basis when completion of the graduate degree is dependent upon successful completion of additional graduate or undergraduate courses beyond the usual degree requirement. Provisional status will normally be assigned when a student is admitted to a graduate program without having competed an Honours or equivalent degree or when the undergraduate academic background is otherwise inadequate. The required additional courses may be specified in the letter of admission, or directed by the programme chair or departmental head. Additional courses should be taken in the early part of the programme, if the course of study permits. The additional work required will be reviewed in light of a student's evident body of knowledge based on performance in the programme. The programme chair will review provisional status in consultation with the appropriate dean. Once admission provisions are deemed to have been met and on the recommendation of a dean, the Graduate Studies Committee may remove provisional status.

5.2.4 Part-time

A part-time student is a student accepted by the Dean of Graduate Studies and Research into a graduate programme as a Regular, Probationary or Provisional student, who takes a minimum of one course (either a one-credit course or a two- credit course) for the academic year in either the Fall, Winter or Summer term and a maximum of two courses (either a one-credit course or a two-credit course) in any given term (either Fall, Winter or Summer) of the academic year.

Students accepted as part-time may request a change to their enrolment status by writing to the Dean of Graduate Studies. Normally a change in enrolment status may be made only once during the duration of the programme.

Please note that part-time PhD students are required to pay full-time fees for two academic years or for four terms.

5.2.5 Full-time

A full-time student is a student who is accepted by the Dean of Graduate Studies and Research into a graduate programme as a Regular, Probationary or Provisional student. The full-time status is not entirely determined by the number of courses taken in a given term.

Full-time PhD students are required to pay full-time fees for two academic years or for four terms.

5.2.6 Inactive Status

An inactive student is one who is given permission for a deferral in commencement of studies or is granted a leave of absence for duty or illness. This term also applies to a full-time student who fails to register in two consecutive terms (not including summer). These students will be withdrawn and must reapply to the graduate school. A part-time student who fails to register in a minimum of one course in any given academic year is considered inactive and will be withdrawn.

5.2.7 Leave Of Absence

A student enrolled in a graduate programme may request to take a leave of absence (LOA) from their programme of study for operational commitments or personal reasons. The request should be made to the student's Department Head or Programme Chair and be approved by the Dean of Graduate Studies. A student whose request is granted is placed in "inactive" status without prejudice to his or her academic standing. A LOA does not count toward the time limit (3.1.3, 3.2.3) of the student's programme. Normally the period of inactive status due to LOA will be one year, but may be extended upon written request.

5.2.8 Deferral

A graduate student who has not yet begun a graduate programme may request to commence study in a term other that the one offered or in a subsequent academic year. A deferral request may be made to the Dean of Graduate Studies and Research for consideration.

5.3 Registration

All full-time graduate students will register every term. Each graduate student is responsible for ensuring his or her own registration in each term. Deadline dates are listed in the Important Dates section.

Registration forms may be downloaded at:

Graduate Studies and Research Division Forms

5.4 Course Coding

Courses offered by the graduate departments will either be:

- two-term courses (two terms in length, worth 2 credits) or;
- one-term courses (one term in length, worth 1 credit).

Normally the term course consists of three one-hour periods per week for one term (12 weeks) while the two-term course consists of three one-hour periods per week for two terms (24 weeks).

Example:

- EE509 (electrical engineering, master's level)
- MBA539 (MBA, master's level)

Course codes at the graduate level normally consist of either two or three letters followed by three digits. The letters describe either the department or programme. The first digit describes the level of the course. Master's level and PhD level courses are normally in the (500) five hundred series. Doctoral level courses in the War Studies Programme are in the (600) series.

5.5 Course Withdrawal

Students who withdraw from a course before the 4th week of the term start date will be deregistered from the course.

Courses dropped after the 4th week of the term start date will result in forfeiture of tuition fees.

Withdrawals between the 4th and 7th week of the term start date will be reflected as "WD" or "Withdrawn" on the transcript, whereas after this period a mark will be assigned.

Normally a student will not be permitted to withdraw from a course after the 7th week of the term start date.

Students are reminded that changes to their academic programme (adding or dropping courses) must be completed by the registration change deadline by submitting a request through the Portal or an Academic Change Form to the Office of the Registrar. Neither notifying the instructor nor discontinuing class attendance will suffice.

The responsibility for initiating course changes or withdrawal rests solely with the student.

5.6 Withdrawal From A Degree Programme

Students who wish to withdraw from the University must submit a request in writing to the Dean of Graduate Studies and Research.

Voluntary programme withdrawals after the 4th week of term normally result in forfeiture of tuition fees.

Departments have the right to ask students to withdraw from the programme if progress is not satisfactory or if they have failed a course required for their programme.

5.7 Incomplete Courses

Students are expected to complete all required course work prior to the last day of the term in which the course is offered.

Under exceptional circumstances, professors may agree to accept work after this date. In such cases, until a final course mark is submitted, the professor will submit a mark of "IN" with a numeric mark based on work completed to date.

The student's record will reflect the grade code of "IN" with the remark "incomplete." A course record may be incomplete for a maximum period of one term. After this time, a mark will be assigned based on the course work completed.

This one-term maximum may be extended when failure to complete course requirements is clearly due to exceptional operational requirements (i.e. not simply workload demands). However, when it is unlikely that a student will be able to complete a course due to these reasons, the student is encouraged to withdraw without academic penalty.

5.8 Required Courses vs Extra Courses

A "Required Course" is defined as a course required for the degree sought. This definition is intended to include all courses required for the degree, whether in fields considered major or minor to the degree sought, and whether graduate or undergraduate.

An "Extra Course" is a course that is not required for the degree sought. The decision as to whether each course taken is "Required" or "Extra" is made by the student's major department at the time of registration, but may be changed at a later date upon the recommendation of the Graduate Studies Committee and approval by Faculty Council.

5.9 Course Auditing

Students may audit only one RMC course per term with the approval of the department and of the course instructor. Audit students do not submit assignments nor do they write exams for academic evaluation; they must, however, attend classes. Audited courses will appear on a student's transcript with the grade code "AU".

Part-time students who wish to audit a course will be charged one-half the current course tuition fee according to programme of enrolment.

Students who pay full-time fees will not be assessed any additional tuition fees.

Visiting students may not audit courses.

5.10 Transcript Notations

In addition to numeric and letter grades, the Division of Graduate Studies and Research of the Royal Military College of Canada uses the following entries to reflect course status:

Transcript Notation	Meaning
AC	Accepted (refers to thesis or project)
AU	Audit
CG	Credit Granted
EX	Extra Course (in excess of normal degree requirements)
IN	Incomplete
IP	In progress
TC	Transfer Credit
WD	Withdrawn
WDS	Withdrawn (military service commitment)

5.11 Grading Scheme

A graduate degree student must achieve a B- (70%) or higher in each "Required Course" in the student's graduate programme.

A "Required Course" is considered failed if a lesser mark is obtained.

Letter Grade	Percentage Grade Relationship
A+	94-100
A	87-93
A-	80-86
B+	76-79
B	73-75
B-	70-72
C+	*66-69
C	*63-65
C-	*60-62
D+	*56-59
D	*53-55
D-	*50-52
FAIL	*Below 50

*Failure in a RMC graduate level "required course".

5.12 Course Results

The Graduate Studies Committee will review the progress of graduate students at regular intervals. The Committee will recommend students who fail to maintain satisfactory levels of performance to Faculty Council for withdrawal from their respective programmes of graduate studies.

Courses recorded on the student's summary or transcripts are assumed to be "Required Courses".

The Office of the Registrar should be advised if a student wishes to take "Extra Courses" which are not counted toward their degree, in order to annotate this on the transcript or summary.

"Extra Courses" are graded on the pass standard applied to undergraduate courses, as are undergraduate courses taken by those students who are required to undertake one

or more terms of probationary, undergraduate work prerequisite to their admission to graduate study.

No grades, whether numerical or letter, will be assigned to a thesis or most projects credited toward graduate degrees. An accepted thesis or project will be recorded on the transcript only as "AC" for "Accepted". For some programmes, a mark will be recorded for the project.

5.12.1 RMC Course Results

Results for individual courses taken at RMC will be recorded on the student's transcript as percentage grades with corresponding letter grades.

5.12.2 Course Results From Other Universities

In the case of approved courses for credit toward a RMC graduate degree taken at another university while enrolled in a RMC programme, the results will be recorded as the letter grade provided by the host university. In this circumstance the host university determines the grade.

5.13 Submission of Results

The results of all academic work undertaken at RMC by graduate students, including both course grades and thesis acceptances, will be reported by the instructor or supervisor directly to the Registrar, with a copy to the head of the student's major department or programme for information purposes. In the case of thesis acceptances, results must be reported to the Dean of Graduate Studies and Research before being submitted to the Registrar.

The results of authorized academic work undertaken at other universities for credit toward an RMC degree, by students enrolled in graduate degree programmes at RMC, will be reported to the Registrar by inter-university Visiting Graduate Student procedures.

The Registrar presents marks and thesis examination results to the Graduate Studies Committee.

Academic results must be submitted to the Registrar in accordance with the deadlines set out in the list of Important Dates at the front of the Graduate Calendar. Results for fall term courses are normally due no later than four weeks after the last day of term; results for winter and summer courses are due two weeks after the end of these terms.

Academic results for students wishing to graduate at one of the three annual RMC convocation ceremonies must be reviewed by the Graduate Studies Committee and must be submitted to the Registrar in accordance with earlier deadlines set out in the list of Important Dates at the front of the Graduate Calendar.

5.14 Supplemental Exams

In the case of a student who has failed a required course (i.e. received a grade of less than 70%); the department may petition Faculty Council through the Dean of Graduate Studies and Research for permission to assign a supplemental examination in the failed required course.

Normally a total of only one (1) supplemental examination will be permitted in each student's entire programme of required courses for a graduate degree.

If this supplemental examination is failed, achievement of less than B- (70%), the student will be required to withdraw from the graduate programme in which he or she is registered.

A supplemental examination may not be written until at least one (1) month after the date of the final examination in the course failed, and in no event before the date of the official notification of permission to write a supplemental.

The supplemental examination must be written within four (4) months of the date of official notification to the student of permission to write a supplemental.

5.15 Transfer Credit

Credit may be granted for university courses taken prior to enrolment into a RMC programme, if they have been assessed as duplicating RMC courses, provided that marks of B- (70%) or higher have been earned and an overall satisfactory academic record has been maintained.

Students may make their request in writing to their Department Head or Chair of their programme. The request will then be sent to the Dean of Graduate Studies for final approval.

The marks summary and transcript will annotate these credits as "TC" or "Transfer Credit" and will include the mark provided by the university attended.

5.16 Credit Granted

Credit may be granted for military courses or experience gained if the course or experience gained has been assessed as duplicating a RMC course. Students can make their request in writing to their Department Head or Chair of their Programme. The request will then be sent to the Dean of Graduate Studies for final approval. If approved, the marks summary and transcript will annotate these credits as "CG" for "Credit Granted", for the RMC course which the Department or Programme Chair deems appropriate.

5.17 Academic Misconduct

5.17.1

Plagiarism is the presentation or submission of work as one's own, which originates from some other, unacknowledged source. In term papers, assignments and examinations, the verbatim or almost verbatim presentation of someone else's work without attribution constitutes an example of plagiarism.

5.17.2

Cheating is the act or attempt to give, receive, share or utilise unauthorised information or assistance before or during a test or examination. The presentation of a single work to more than one course without the permission of the instructors involved; the improper acquisition through theft, bribery, collusion or otherwise of an examination paper prior to the examination; the impersonation of a candidate at an examination: all constitute examples of cheating.

5.17.3

Penalties are imposed upon students found guilty of cheating or plagiarism. Academic sanctions for such misconduct may range from the award of a zero grade for the work involved, to a recommendation for expulsion from the College.

5.18 Appeals, Re-reads and Petitions

A student with a complaint or grievance that is academic in nature should communicate that concern to the instructor, Head of Department and/or Dean of the division involved. If the matter remains unresolved in this informal process, a formal petition to the Faculty Council may be initiated.

If the complaint or grievance pertains to the mark awarded on a final exam, the student may make a formal request to have the exam re-evaluated. This request is to be made in writing to the Registrar. The Registrar will forward the request for re-read to the head of the appropriate department, who will decide how the re-read will be conducted. The result of the final exam re-read will be used to determine the student's final course grade. To ensure that such matters are addressed with due diligence, a request for re-read must normally be submitted not later than 30 days after the student has been made aware of the result. Requests for re-reads will address only one exam, and normally will not be entertained for assignments, tests, or any other work that has been removed from the custody of the instructor after being marked and recorded.

Formal petitions to the Faculty Council must be made in writing and be submitted through the Registrar for consideration by the Council. Normally, petitions will be heard only if submitted within 90 days of the event or academic decision, giving rise to the appeal. For more specific information and other principles governing student appeals, the Registrar, as Secretary to the Faculty Council, should be consulted.

6. Thesis and Dissertation Regulations

6.1 Thesis Registration

A student, who is actively working on their thesis, must have completed a registration form and registered for either TH500 for the Master's Thesis or TH600 for the Doctoral Thesis or Dissertation.

Once students are registered in their thesis, both full-time and part-time students are required to re-register on a continuous basis for three terms (Fall, Winter, Summer) per academic year until completed (includes corrections), with an overall minimum thesis registration of not less than two terms.

6.2 Thesis Supervision

6.2.1 Master's Level Thesis

The student's research programme shall be under the direction of a thesis supervisor.

The thesis supervisor shall be appointed as early in the student's programme of studies as possible, consistent with the readiness of the student to elect the desired research topic and supervisor. Normally this is done by the end of the first year of full-time study in the Master's Programme.

6.2.2 Doctoral Level Thesis/ Dissertation

The student's research programme shall be under the direction of a thesis supervisor. At the doctoral level, an advisory committee shall also be appointed, consisting of the supervisor as chair and normally two other members, which will periodically review the progress of the research.

The thesis supervisor and at least one other member of the advisory committee shall be full-time members of the student's major department and of the Graduate Faculty.

The appointments shall be approved by the Dean of Graduate Studies and Research upon the recommendation of the head of the major department.

The thesis supervisor shall be appointed as early in the student's programme of studies as possible, consistent with the readiness of the student to elect the desired research topic and supervisor. Normally this is done by the end of the first year of full-time study in the Doctoral Programme. The remainder of the committee will be appointed either at the same time or as soon after as possible.

6.3 Doctoral Thesis Requirement

A doctoral thesis is required for the PhD programme and must embody the results of original investigation conducted by the student on the approved topic of research, and must constitute a significant contribution to the furthering of existing knowledge in the field.

6.4 Doctoral Thesis/Dissertation Comprehensive Examination

The doctoral student will be required to pass a comprehensive examination, which may contain a number of both written and oral components. This examination is for the purpose of assessing a student's academic appreciation of the field of study and scholarly qualifications for the degree. The results of this examination determine whether or not the student will be permitted to continue in the programme. It is normally held after all coursework requirements are completed at the end of the first year, and must be held at least one calendar year before the submission of the thesis.

The student must register in CP600 Comprehensive Examination until its completion and pay appropriate tuition fees while studying to prepare for the examination.

The major department conducts the examination. The examining committee shall be chaired by the head of the major department or delegate, and will normally consist of the student's supervisor and other members of the major department, as appointed by the examining committee chair. The method adopted for examination and evaluation, and the areas to be examined shall be specified by the major department subject to approval by the Graduate Studies Committee and Faculty Council.

The examining committee shall determine the result of the examination. If the result is not favourable, the examining

committee may recommend to Faculty Council through the Graduate Studies Committee either that the examining committee reconvene at a later date to re-examine the student, or that the student be required to withdraw. Re-examination, if authorized, shall not take place before the elapse of at least three months, but no later than twelve months, from the date of the first examination.

If the result is favourable the major department advises the Registrar and credit for the comprehensive examination is entered on the student's transcript as "AC" or "Accepted".

6.5 Doctoral Thesis/Dissertation Proposal

The Doctoral student, under the supervision of his or her supervisor and upon satisfactory completion of the comprehensive examination, will present a thesis research proposal to the advisory committee for approval.

6.6 Examination of the Thesis - Master's and PhD

The student shall submit the thesis to his or her thesis supervisor not less than six (6) weeks prior to the date of defence.

The student shall then defend the thesis at a final examination, which will be conducted by the Division of Graduate Studies and Research, that will consist of an oral presentation by the student and an oral examination by the Examining Committee. The scope of the examination shall be limited to the subject and contents of the thesis, and subjects related to them. A written assessment from an external examiner will be required.

The chair of the Examining Committee will be appointed by the Dean of Graduate Studies and Research in consultation with the Head of Department of the student. The Examining Committee shall be appointed by the Head of Department or delegate and shall consist of at least four voting members including among them the student's supervisor(s), the examiner external to the university, one member of the RMC Graduate Faculty from outside the student's major department or field, and one member from the student's department.

The public will normally be welcome to attend the oral presentation, where questions may be asked of the student, and the oral examination, at the discretion of the Chair, where only the Examining Committee is permitted to ask questions.

Security considerations for the research may require the final examination to be open only to the Examining Committee.

6.7 Acceptance of the Thesis

Once a thesis has been accepted, no major revisions or additional work relating to the thesis may be required of the student. Should major revisions or additions to the thesis be required, it shall remain unaccepted until these are completed.

A rejected thesis may be submitted once for re-examination, but not before the elapse of at least three months from the time of its rejection.

6.8 Submission of Thesis Results

The thesis acceptance will be reported by the Chair of the Thesis Examining Committee to the Dean of Graduate Studies and Research with a copy to the Registrar.

No grade, whether numerical or letter, will be assigned to a thesis credited toward a graduate degree. An accepted thesis will be recorded on the transcript as "AC" for "Accepted" for courses TH500 or TH600.

6.9 Reproduction of the Thesis

6.9.1 Procedure for Thesis Approval and Deposit

Following acceptance of the thesis, with all the corrections and modifications complete, and prior to the Convocation at which the degree is to be granted, the student will submit to the supervisor the final, unbound manuscript, complete with all tables, figures, illustrations, and attachments. At the same time, the student will also submit to the supervisor(s):

- one copy of the signed Non-exclusive License to Reproduce Theses form also available at: http://www.collectionscanada.ca/thesescanada/s4-270-e.html
- one copy of the thesis binding checklist available at: Binding of Theses for Graduate Students at RMC
- one copy of the UMI subject codes form available at: http://www.collectionscanada.ca/obj/s4/f2/s4-300.1-e.pdf

These forms are available from departmental administrative assistants and from the Library.

6.9.2 Number of Copies of Thesis

The major department of the candidate will arrange for reproduction of the thesis, and will provide the Library with the original and five (5) (six (6) if there is a sponsor) complete copies, ready for binding.

6.9.3 Non-exclusive License to Publish

As mentioned in section 6.9.1, the candidate must complete the "Non-exclusive License to Reproduce Theses" form. The College Library will arrange for submission of the thesis to the National Library of Canada.

6.9.4 Binding

As mentioned in section 6.9.2, the Library will make arrangements for binding the original and a specific number of copies of the thesis. A checklist and instructions are provided on the web at: Binding of Theses for Graduate Students at RMC .

Theses are sent out for binding in April and October of each year, and normally must be received six to eight (6-8) weeks before convocation (departmental administrative assistants are informed of the exact date) in order to be processed in time, otherwise the thesis will be sent in the next shipment.

If the candidate and/or the supervisor(s) want additional bound copies, they must make the proper arrangements and assume the costs related to duplicating and binding these copies.

6.9.5 Distribution of Thesis Copies

The College library will retain the original and one (1) copy. It will send one (1) copy to Director, Research and Development Knowledge and Information Management (DRDKIM), and three (3) (four (4) if there is a sponsor) copies back to the major department.

The major department will retain one (1) copy, send one (1) to the sponsor (if there is one), one (1) to the principal supervisor and one (1) to the author.

The distribution of any additional copies of the thesis will be the responsibility of the candidate and his or her supervisor(s).

6.9.6 Copyright

The title page of the thesis will include the following statement at the foot of the page:

"This thesis may be used within the Department of National Defence but copyright for open publication remains the property of the author".

it is important here to note that citation copyrighted other authors, well as publication of proprietary material data, must not appear in thesis without proper reference and permission from the authors or companies involved.

6.9.7 Confidentiality Status

In general, the thesis is open to the public domain. However, there are cases where the whole thesis, or parts of it, includes protected information. These documents must be fully identified with appropriate warning messages, according to the procedures used in the Department of National Defence for protected and classified documents. If no such warning messages are displayed, the thesis is then considered as unclassified. More information may be found at: Thesis Preparation Guidelines

6.10 Convocation

An "Application to Graduate " form should be completed and sent to the Office of the Registrar no later than eight (8) full weeks before the date on which the Convocation is scheduled to be held.

A graduate student wishing to be considered as a candidate for receiving a Master's degree or a Doctoral degree involving a thesis at a particular Convocation will so inform the Head of the major department in writing no later than eight (8) full weeks before the date on which the Convocation is scheduled to be held. At this time the department head, on the advice of the student's supervisor that the thesis will be ready for examination, will so inform the Dean of Graduate Studies and Research.

The student will submit to his or her supervisor, no later than six (6) full weeks before the scheduled date of the thesis defence, copies of the thesis, each complete but unbound, suitable for examination purposes.

For each Graduate Degree student, the Graduate Studies Committee shall adjudicate whether or not the requirements for the degree have been met, and will report its recommendation to Faculty Council.

6.11 Publication of Results of Research

Publication of results of research is encouraged.

Agreement on publication must be reached between supervisor and graduate student prior to publication.

Officers are reminded that the provisions of Queen's Regulations and Orders for the Canadian Forces, Articles 19.36 and 19.37, govern publication of theses and journal articles.

7. Administration and Tuition Fees

Notice

The Royal Military College reserves the right to make changes, without notice, in the published scale of fees. If fee changes are approved after publication deadlines, every effort will be made to notify students affected. However, lack of notification does not exempt a student from paying the appropriate fee. Fee increases, if applicable, become effective in the Fall term of each year.

Fees

Administrative fees, Tuition fees and Policies related to them can be viewed at: Office of the Registrar - Fees

Thesis, Comprehensive Exams and Project students:

Only students who have received formal approval from the Dean of Graduate Studies and Research to transfer to "Inactive Status " (Academic Regulation 5.2.6) by way of a Leave of Absence are exempt from continuous registration and associated thesis fees. All other students must register every term until comprehensive exams, theses, and projects are completed (including corrections) and formally accepted.

When a student would otherwise be financially penalized through no fault on his or her part, the Dean of Graduate Studies may authorize suspense of payments for one term.

Due Dates for Payment of Fees

For students paying full-time fees, term payments are due the thirtieth (30th) day of September (fall term), the thirty-first (31st) day of January (winter term) and the thirty-first (31st) day of May (summer term, if applicable).

Tuition fees (per course) are due at time of registration. Registrations will not be processed without payment.

Income Tax Receipts - T2202A

Income tax receipts will be mailed in February for the previous calendar year. The amount deemed eligible is a deduction for provincial tax purposes and a tax credit according to federal tax regulations. Income tax receipts will not be issued for unpaid balances due to RMC.

8. Research Grants & Contracts

The Dean of Graduate Studies and Research is responsible to the Principal for administration of research grants and contracts awarded to members of the RMC Faculty by organizations external to the University. Specifically included are the Academic Research Programme (ARP) awards and research contracts issued by agencies of the Department of National Defence and other departments of Government.

9. Scholarships, Bursaries, Prizes and Awards

Scholarship websites

Some of the links below lead to a site belonging to an entity not subject to the *Official Languages Act* . Information on this site is available in the language of the site.

Association of Universities & Colleges of Canada
Canadian Bureau for International Education (**Note:** It also applies to Canadians studying in Canada)
Foundation for the Advancement of Aboriginal Youth
The Kavli Prize
The Soroptimist Foundation of Canada
Trudeau Foundation
Canadian Engineering Memorial Foundation
Eurographics Awards Programme - Sustainable Energy Development
StudentAwards.com
Scholarships Canada.com

9.1 The Governor General's Gold Medal

The Governor General's Gold Medal is awarded to the graduating student who achieves the highest academic standing in a Master's or Doctoral programme.

9.2 Milton Fowler Gregg VC Memorial Trust Fund Bursary

A bursary in memory of Brigadier, The Honourable M.F. Gregg, VC, is offered annually to those students entering the Royal Military College Division of Graduate Studies and Research whose programmes will include environmental studies or international affairs. The student should not normally be in receipt of full Department of National Defence financial support for these studies. The bursary is sponsored by the Royal Canadian Regiment Trust, and is presented on the recommendation of the Faculty of the Division of Graduate Studies and Research. (November)

9.3 The Barry D. Hunt Memorial Prize

The Barry D. Hunt Prize is awarded annually to the best graduate student graduating in War Studies. (Spring)

9.4 Natural Sciences and Engineering Research Council Scholarships

The Natural Sciences and Engineering Research Council (NSERC) fosters the discovery and application of knowledge through the support of university research and the training of scientists and engineers. The Council promotes the use of this knowledge to build a strong national economy and improve the quality of life of all Canadians. NSERC fulfils its mission by awarding grants and scholarships through a competitive process and by building partnerships among universities, governments and the private sector.

9.5 Defence Research and Development Canada

The Defence Research and Development Canada (DRDC) is the national authority for providing scientific, engineering and technological leadership in the advancement and maintenance of Canada's defence capabilities. The R&D programme is carried out directly in five laboratories (Defence Research Establishments) located across Canada and indirectly through support at the Royal Military College of Canada in Kingston, Ontario.

The DRDC and RMC support the development of high-calibre Canadians in engineering, humanities and science through a number of fellowships tenable at the Royal Military College of Canada that provide financial assistance to graduate students engaged in Master's or

Doctoral programmes in engineering or humanities or natural sciences.

9.6 War Studies Scholarship

The Barry D. Hunt Memorial Fund and RMC support the development of top-rated scholars in the interdisciplinary programme of War Studies through a number of scholarships tenable at the Royal Military College of Canada that provide tuition assistance to graduate students engaged in Master's or Doctoral programmes.

9.7 Security and Defence Management And Policy Scholarship

RMC promotes the development of high-calibre instruction in the field of Defence Management and Policy in support of professional development in the officer corps of the Canadian Forces. A number of scholarships are available at the Royal Military College of Canada to provide tuition assistance for military and civilian graduate students engaged in the Master's degree programme.

9.8 The G.L. Pickard Prize in Acoustics and Oceanography

This prize is awarded to the outstanding Master of Science graduating student in Ocean Sciences, based on marks achieved in graduate courses and on the quality of the thesis. (November)

9.9 The Royal Canadian Naval College Class of '46 Scholarship

This scholarship is awarded to the graduating Regular Force member of the Naval Environment with the highest academic average in a post-graduate programme. (Spring)

9.10 The High Performance Computing Virtual Laboratory (HPCVL) Scholarship

The Sun Microsystems of Canada Scholarship in Computational Science was developed to encourage research in the broad areas of computational science, computational engineering, computational social science, computational humanities and computational medicine.

Applicants must be enrolled in an accredited post-graduate degree programme at Carleton University, University of Ottawa, Queen's University or the Royal Military College of Canada. Deadlines for competitions will be posted on the HPCVL website www.hpcvl.org .

9.11 Canadian Forces Logistics Branch Medal of Academic Excellence in The MBA Programme

The Canadian Forces Logistics Branch Medal of Academic Excellence in the MBA Programme is awarded annually to the graduating student of the RMC MBA programme who has achieved the highest academic standing. (Spring)

10. Areas of Military Specialization

10.1 General Information

Each year, the Canadian Forces selects, sponsors and sends to graduate study a number of officers to obtain education and qualification in subject areas of special importance and need to the military. These areas of speciality are denoted as the Occupational Speciality Specification (OSS) and are denoted within the military administration by a four letter alphanumeric code.

Some of the descriptors used by the military for the OSS codes link directly to a degree programme such as the ADTU, AEOV, AEOW, AEOX, AEPB, AESV that are respectively named Electrical, Mechanical, Civil, Nuclear, and Chemical Engineering, and Business Administration. Other codes may not link in an obvious way to a degree programme such as ADOM Aerospace Systems, ADSB Telecommunications Management and AEPC Guided Weapons Systems, all of which require study in Electrical Engineering; AEOR Underwater Acoustics and AIEI Ocean Acoustics lie in Physics; and AESX Military Strategic Studies lies in War Studies.

Some OSS codes describe a speciality that may be best realized via an interdisciplinary programme tailored to meet the needs of the military and the sponsor. These include AENM Operations Research, AEPM Management Information Systems, AERK Systems

Engineering, all of which would involve the Departments of Electrical & Computer Engineering, Mathematics & Computer Science, and Business Administration.

Graduate degrees currently offered at RMC under Department of National Defence sponsorship are listed by degree title in the left hand column below. For convenience, in the right hand column where available are shown the corresponding OSS (Occupational Speciality Specification) designators for those programmes of graduate study sponsored under the Canadian Forces Postgraduate General Training Program which are normally available at RMC.

10.2 OSS Code Table

Degree	OSS
Master of Arts in	
Security and Defence Management and Policy	AEPM, AESV
War Studies	AERL, AESX
Master of Business Administration	AEPM, AERK, AESV, AICW
Master of Science in	
Computer Science	AEOM, AEPM, AEPP, AEPR
Materials Science	AENF
Mathematics	AENM, AERK, AEZV
Ocean Science	AEMD, AEOR, AIEI
Physics	AEJT, AEPD, AFAC, AIEI
Master of Engineering and Master of Applied Science in	
Civil Engineering	AHPI, ADUM, ADUK, ADVK, AEOW
Chemical and Materials Engineering	ADUM, ADVK, AENF, AEPB, AFAH
Computer Engineering	ADQI, ADTU, AELD, AEOM, AEPM, AEPP, AEPR, AEQF, AERK, AUYN
Electrical Engineering	ADOH, ADOM, ADON, ADQI, ADSB, ADTQ, ADTU, ADUJ, AELN, AENI, AENJ, AENM, AENS, AEQF, AERK, AEYJ, AEYN
Mechanical Engineering	ADOF, AHQR, ADUJ, ADTI, AEKI, AEOV, AEPD
Nuclear Engineering	AEOX
Software Engineering	AEYN
PhD in Arts	
Business Administration	AIIM
War Studies(Economics, History, Political Science)	AIIN, AIIL, AIIO
PhD in Science	
Chemistry	AIII
Computing Science	AIIG
Mathematics	AIIA
Physics	AIIH
PhD in Engineering	
Chemical Engineering	AIII
Chemical and Materials Engineering	AIII
Civil Engineering	-
Computer Engineering	AIIG
Electrical Engineering	-
Mechanical Engineering	-
Nuclear Engineering	-

Faculty of Arts

* = Faculty members with complete privileges

Department of Business Administration
Department of English
Department of French Studies
Department of History
Department of Military Psychology and Leadership
Department of Politics and Economics
Department of Defence Studies

Department of Business Administration

Head of Department

* Associate Professor - W.J. Graham, BA, LLB, MBA, PhD

Professor

* M. Amami, BSc, Lic.Sc.Eco., PhD, Ing

* J. Brimberg, BEng, MEng, PEng, MBA, PhD

* W.J. Hurley, BSc, MBA, PhD

* A. St. Pierre, BSc (informatique), BSc (comptables), MBA, EdD, CMA, CGA

* B.W. Simms, CD, rmc, BEng, MASc, PhD, PEng (cross appointed to the Mechanical Engineering Department)

Associate Professor

* T. Dececchi, BEng, MBA, PhD, PEng

N. Essaddam, BAdm, MBA, PhD

* P. Roman, CD, rmc, BEng, PEng, PhD

Associate Professor (Adjunct)

F.P. Wilson, CD, BSc, MEd, PhD

Assistant Professor

B. Dececchi, BA, B.Ed., M.Ed., D.Ed.

Major J.M Karagianis, CD, BBA, MBA, Plog

F. Yousoffzai, BA, MSc (Economics), PhD

K. Schobel, BA, MBA

M.B.K. Shepherd, BA, MA

Lana Pinhey, B.Adm, M.Ed.

Department of English

Head of Department

Associate Professor - S. Lukits, BA, MA, PhD

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Capt. A. Belyea, BA, MA, PhD

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Professor

* E.J. Errington, BA, BEd, MA, PhD - Dean of The Faculty of Arts

F. Gendron, BA, MA, PhD

* R.G. Haycock, BA, MA, PhD

* A.H. Ion, BA, MA, PhD

* B.C.J. McKercher, BA, MA, PhD, FRHistS

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B. Richard, BA, MA, PhD

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* R. St. John, BA, MA, PhD

R. Tiessen, BA, MA, PhD

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L. Cherif, BA, MA, PhD

R. Dickenson, CD, BA, MA

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Lecturer

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* P. Constantineau, BA, MA, PhD

* N. Schwartz-Morgan, BA, MA, MA, PhD

* J.J. Sokolsky, BA, MA, PhD - Principal of the Royal Military College of Canada

* A.J. Whitehorn, BA, MA, PhD

Professor of Economics

* P.J.S. Dunnett, BSc, MA, PhD -(cross appointed to the Business Administration Department) and Chair of Defence and Security Management

* L.C. McDonough, rmc, BA, MA, PhD

* P.J. Paquette, BCom, MA, PhD

Professor of Geography and International Law

* G. Labrecque, BA, LLL, MA, PhD

Professor of Geography

* L.Y. Luciuk, BSc, MA, PhD

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* J. Boulden, BAH, MA, LLM, PhD - Canada Research Chair

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W.H. Dorn, BA, MA, PhD

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* C. Leuprecht, BA, DÉA, MA, MA, PhD

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Department of Defence Studies

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Professor

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P.T. Mitchell, BA, MA, PhD

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Department of Business Administration

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Programme Offered

The degree Master of Business Administration (MBA) provides a general graduate education in management to those students who successfully complete the programme requirements listed below.

There are three completion patterns:

- Course Pattern (20 courses);
- Project Pattern (17 courses plus a project); and
- Thesis Pattern (14 courses plus a thesis).

In addition there are two streams:

- the General Stream which provides a broad-based management education.
- the Logistics Stream which focuses on the management of the logistics function in an organization; and

In both streams, students are given specific knowledge in a variety of subject areas that combine the viewpoints of the military, government, and commercial sectors.

The MBA curriculum is designed to accommodate the needs of any Military Occupation Classification or individual with resource management responsibilities.

The programme accepts both full and part-time applicants and a limited number of civilians.

Admission

Students will be admitted under the general admission requirements of the Division of Graduate Studies as set out in this Calendar.

For admission into the MBA programme, an applicant must normally meet the following criteria:

- Hold an Honours Baccalaureate degree from a recognized university with at least B- (70%);
- Obtain a satisfactory score on the Graduate Management Admissions Test (GMAT);

The requirement of writing the GMAT may be waived for an applicant who has an academic file of quality.

We will follow the established practise of other Ontario universities in admitting the occasional candidate who has a 3-year rather than a 4-year undergraduate degree provided that individual is a very high quality applicant and has had other types of educational and leadership exposures of a substantial nature. These candidates may be expected to do additional work over and above the normal degree requirements for a candidate with an Honours Baccalaureate degree. Normally such students will be admitted under Provisional or Probationary Status.

Details regarding admission to the Royal Military College as a graduate student can be found in the Application Admissions section of this Calendar

Programme Requirements

To complete the MBA, students must successfully complete the equivalent of twenty (20) one-credit courses. Students have the option to complete one of three study patterns: course, course plus project, and course plus thesis. Normally the decision to undertake a specific pattern is made after the first year of study. Finally, there are two streams of study, the General and the Logistics stream. Students may select their stream of study at any time.

Core Component (all 12 courses);

- MBA521 - Economics
- MBA523 - Quantitative Methods
- MBA525 - Financial Accounting
- MBA527 - Management Accounting
- MBA529 - Marketing
- MBA531 - Management Information Systems
- MBA537 - Financial Management
- MBA555 - Operations Management
- MBA561 - Strategic Management
- MBA567 - Organisational Behaviour and Theory I
- MBA569 - Strategic Human Resources Management
- MBA587 - Organizational Behaviour and Theory II

General Resource Management

To complete the degree requirements for the General Resource Management Stream, students must complete the Core, and an Elective Component consisting of 8 MBA credit courses or its equivalent. Please refer to the course descriptions for available elective courses.

Students who want a more specialized programme may substitute courses from other programmes. These substitutions require the approval of the MBA Chair.

Logistics Management

To complete the degree requirements for the Logistics Management Stream via the Course Pattern students must complete:

The Advanced Logistics Component (at least 4 courses);

- MBA539 - Analysis and Design of Logistics Systems
- MBA541 - Supply Chain Management
- MBA547 - Business Law
- MBA549 - Logistics Modeling and Simulation
- MBA551 - Advanced Finance
- MBA563 - Topics in Industrial Relations
- MBA579 - Management of Technology

And, an Elective Component (one course);

- MBA571 - Directed Studies in Business Administration I
- MBA573 - e-Business
- MBA577 - Social and Ethical Issues of Business
- MBA581 - Directed Studies in Business Administration II
- MBA583 - Consumer Behaviour
- MBA585 - Government, Business and Policy

To complete the degree requirements for the Logistics Management Stream via the Project Pattern students must complete:

- the Core Component;
- at least four (4) courses from the Advanced Logistics Component;
- at most one (1) Elective Course; and
- a Project.

Students wishing to substitute courses from other programmes at RMC or other universities require the approval of the MBA Chair.

Advanced Standing

Due to the nature of the MBA degree, candidates with suitable undergraduate formation and/or professional experience may apply for advanced credit. This application should be made in writing to the MBA Chair and should occur at the time a candidate is applying to the programme. Such application will normally require the candidate to provide documentation on the nature of the undergraduate and/or professional formation for which credit is sought. The awarding of advanced standing is discretionary. The MBA Committee will make a determination of eligibility for advanced standing and make a recommendation to the Dean of Graduate Studies. The candidate will be informed of any advanced credit in the letter of offer from the Dean of Graduate Studies.

Credit Granted

An applicant may apply for credit for graduate courses taken at other recognized universities. An application for this type of credit will be considered where a student has taken a course similar to a course offered in the Royal Military College of Canada (RMC) MBA programme and obtained a passing mark in that course.

For students who have completed such courses prior to being admitted to the RMC MBA programme, a request for credit should normally be made in writing to the MBA Chair at the time of entry into the programme. The awarding of the credit is discretionary. The MBA Committee will make a determination of eligibility for this type of credit and make a recommendation to the Dean of Graduate Studies.

Other Regulations

Failed Courses

For RMC graduate courses, a failing grade is any grade less than B- (70%).

For graduate courses taken at other universities for the purposes of satisfying RMC MBA degree requirements, the pass standard is that university's standard. For courses taken and failed at other universities, it is the obligation of the student to inform the MBA Chair of a failure as soon as the student has received notice of the failure.

If the failed course is a Core MBA course, and the student has obtained a B average in all other courses taken, the student may apply to the MBA Committee to obtain permission to write a supplemental examination in the failed course. The MBA Committee shall determine if the student is to be recommended to the Graduate Studies Committee for the privilege of writing a supplemental examination. If such permission is granted, the MBA Committee will specify the terms and conditions for writing the supplemental examination subject to the general regulations of the Graduate Division concerning supplemental examinations. If such permission is not granted or the student fails the supplemental examination, the student must withdraw from the programme.

If the failed course is an Elective course, and the student has obtained a B average in all other courses taken, the student may apply to the MBA Committee to obtain permission to write a supplemental examination in the failed course or to substitute another Elective course in its place. The MBA Committee will then seek permission from the Graduate Studies Committee for either the privilege of writing a supplemental examination or the course substitution. If such permission is granted, the MBA Committee will specify the terms and conditions for writing the supplemental examination subject to the general regulations of the Graduate Division concerning supplemental examinations. If such permission is not granted, the student must withdraw from the programme.

Only one supplemental examination will be permitted. Students having Probationary Status are not entitled to supplemental examinations.

Normal Course Load

For those students who register as full-time students, the normal course load in the Fall and Winter terms of the first year is four courses per term or the equivalent of four courses per term. Students seeking a reduction in this normal load must obtain the permission of the MBA Chair. It is the obligation of the MBA Committee to inform the Dean of Graduate Studies and Research and

programme sponsors of deviations from the normal course load.

Project Approval and Evaluation

Students wishing to complete the Project Pattern must first arrange a topic with a Supervisor. Under the direction of the Supervisor, the student must write a Project Proposal. Once the Proposal has been accepted by the Supervisor, it must be submitted to the MBA Chair for approval. Only when the MBA Chair has given his or her approval will the student be allowed to register in PR500.

The Supervisor is free to design any evaluation scheme he or she sees fit subject to the following requirements. The student must prepare a written Project Report summarizing the research. This Project Report will be examined in a formal defence by at least three Examiners, one of whom is the Supervisor. At least two of the Examiners must be members of the Graduate Faculty. It is the Supervisor's responsibility to put together the Examination Committee. This Committee must be approved by the MBA Chair. A copy of the Project Report must be in the hands of the Examiners at least a week (7 full days) prior to the day of the defence. Normally the defence will be preceded by a presentation to the wider RMC community. The object of the defence is to provide significant feedback to the student. Unless otherwise stipulated by the Supervisor, no grade will be assigned for the defence.

After the defence, the student is expected to incorporate any substantive concerns raised at the defence into a Final Project Report. Once these concerns have been dealt with to the satisfaction of the Supervisor, the Supervisor will assign a final grade. The Supervisor may incorporate the advice of the Examiners in the determination of this final grade. It is the responsibility of the Supervisor to submit a copy of the Final Project Report to the MBA Chair.

Thesis Eligibility

To be eligible for the thesis pattern, students must have completed at least four courses and have maintained an A average.

Approval and Evaluation

Students wishing to complete the Thesis Pattern must first arrange a topic with a Supervisor. Under the direction of the Supervisor, the student must write a thesis Proposal. Once the Proposal has been accepted by the Supervisor, it must be submitted to the MBA Chair for approval. The MBA Chair will convene a special meeting of the MBA committee to review the thesis proposal. The committee will review the proposal and will render a recommendation (accept or reject) for the thesis. Only after the MBA Chair has approved the thesis will the student be permitted to register in TH 500. Once the thesis has commenced, the student will be required to pay ongoing fees each term until the project is completed, or until the student formally withdraws from TH 500.

The thesis will be assessed by four Examiners, one of whom is the Supervisor, two RMC examiners and non-RMC examiner with expertise in the field. It is the Supervisor's responsibility to put together the Examination Committee. This Committee must be approved by the MBA Chair. A copy of the thesis Report must be in the hands of the Examiners at least two weeks (14 days) prior to the date of the defence. Normally the defence will be preceded by a presentation to the wider RMC community. The object of the defence is to provide significant feedback to the student. Unless otherwise stipulated by the Supervisor, no grade will be assigned for the defence.

After the defence, the student is expected to incorporate any substantive concerns raised at the defence into a Final thesis Report. Once these concerns have been dealt with to the satisfaction of the Supervisor, the Supervisor will assign a final grade. The Supervisor may incorporate the advice of the Examiners in the determination of this final grade. A copy of the Final thesis Report is to be submitted to the MBA Chair.

Directed Studies Course Approval

For students wishing to take one of the Directed Studies courses (MBA571/MBA581), the first step is to arrange a Supervisor. Once a Supervisor has been arranged, it is the responsibility of the Supervisor to submit a written Course Syllabus to the MBA Chair who must then approve the undertaking. The Course Syllabus must define the way the student will be evaluated. The Supervisor may require a written submission by the student in order to construct the Syllabus. Only when the course has been approved by the MBA Chair will the student by allowed to register.

Course Descriptions

MBA521 Economics
MBA523 Quantitative Methods
MBA525 Financial Accounting
MBA527 Management Accounting
MBA529 Marketing
MBA531 Management Information Systems
MBA537 Financial Management
MBA539 Analysis and Design of Logistics Systems
MBA541 Supply Chain Management
MBA543 International Logistics
MBA547 Business Law
MBA549 Logistics Modeling and Simulation
MBA551 Advanced Finance
MBA555 Operations Management
MBA557 Financial Management Accounting Topics
MBA561 Strategic Management
MBA563 Topics in Industrial Relations
MBA567 Organizational Behaviour and Theory I
MBA569 Strategic Human Resources Management
MBA571 Directed Studies in Business Administration l
MBA573 E-Business
MBA575 Public Financial Management
MBA577 Social and Ethical Issues of Business
MBA579 Management of Technology
MBA581 Directed Studies in Business Administration II
MBA583 Consumer Behaviour
MBA585 Government, Business and Policy
MBA587 Organizational Behaviour and Theory II
MBA589 International Management
MBA591 Audit and Tax Planning
PR500 MBA Project
BA601 Probability And Statistics With Business And Military Applications

MBA521 Economics

This course is divided into two distinct parts - microeconomics and macroeconomics. The portion of the course on microeconomics is intended to provide theoretical and practical knowledge of individual economic agents, including consumers, business firms, public sector agencies, workers and investors. The general approach is to examine the formulation of economic models of consumer behaviour and production. The macroeconomics portion of the course will examine national issues and interrelationships in the economy. The debates concerning fiscal, monetary and exchange rate policies will also be examined and foreign economies will be investigated.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA523 Quantitative Methods

The course is intended to provide students with some of the quantitative tools and principles needed to analyse business problems in e.g. logistics systems. The emphasis is on the modelling of problems and interpretation of solutions, but some of the underlying mathematical theory will be covered as well. Material will be chosen from the following areas: network models; inventory models; linear and integer programming; dynamic and stochastic programming; and queuing theory. Classroom examples will emphasise defence applications.

Pre-requisite: Students are assumed to have previously completed a half-course in probability and statistics, and a half-course in operations research or management science (linear programming in particular).

Students lacking the former may take BAE242A as a co-requisite; students lacking the latter will need to do extra work up-front in order to catch up.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA525 Financial Accounting

This course provides an introduction to the principles, practices, and processes of financial accounting. The course emphasis is on accounting as an information system, which supports decision making in many different contexts. The theory and mechanics of financial accounting are introduced and consideration is given to how these aspects of accounting are manifested in practice and vary across settings. The four major financial statements are introduced and their component parts examined. The course emphasises the interpretation and use of accounting data downplaying the bookkeeping aspects.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA527 Management Accounting

This course is intended for students who are or will be assuming managerial roles in DND and will need to make use of Managerial Accounting Systems and Management Information Systems in their workplace. It is intended to help students make better use of the basic organisational data from these systems in order to make better decisions. All students will be required to submit a project as part of this course to demonstrate that they understand the application of the theory in the field.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA529 Marketing

This course will focus on key areas in marketing management including; the role of marketing and the relationship with other areas of the organisations, market oriented strategic planning and market strategies, information systems, business and government markets, marketing programmes, logistics and marketing, and managing the marketing effort. The impact of customer behaviour, the effect of various levels of competition, and the impact of a variety of other organisational functions on strategy in the market place will be given particular attention.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA531 Management Information Systems

This course explores current capabilities and likely developments in computers and telecommunication technology, including software for database management and logistics support, and computer-based information systems (CBIS) as a transformer of business practice. A special emphasis is placed on CBIS for operational and managerial decision-making, decision-support systems for routine decisions and high level planning, and the development and control of CBIS.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA537 Financial Management

This course will provide the basic knowledge required in analysing financial data and making financial decisions. Financial decisions fall into three main categories. The first category relates to the investments that the firm makes in both short and long term assets. The second addresses how the firm is financed and the third covers how the firm makes its day-to-day operating decisions. The course will examine the framework in which financial managers work and the tools and concepts that they use. Topics will include the nature of the financial environment (domestic and international), the time value of money, valuation of stocks and bonds, risk and return, capital budgeting and the capital structure decision. Some time will be spent discussing derivatives, their increasing importance in the financial environment and their use as a key risk management tool.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA539 Analysis And Design Of Logistics Systems

The purpose of this course is to provide theoretical and practical foundations in logistics systems. It will define and analyse logistics from a perspective of a total system/product design and development process. The quality design of a system or product for reliability, maintainability and supportability has a major impact on the overall resources required to operate and support the system. The course will focus on major considerations such as system definition and analysis, design, choice, implementation and evaluation. It will emphasise how to develop logistics systems that fulfill their mission at the lowest overall life-cycle cost.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA541 Supply Chain Management

Supply Chain Management is essential to any organisation. The twenty-first century organisation will use the supply chain to gain strategic advantages. Organisations must emphasise designing, planning and controlling their equipment, processes, materials and human resources in order to produce and deliver quality goods and services to their clients. Moreover, the linkage among suppliers, producers, and distributors heavily depends on the information co-ordination in the supply chains. Adoption and usage of information technology and electronic commerce on the Internet will be a strategic enabler to improve business processes and supply chains. The course will explore how organisations should use integrated supply chain management to reduce costs, improve customer service, and increase returns on assets and overall gain in market share.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA543 International Logistics

The relationship between manufacturers, operations, the logistics function, and the CF at the international and multinational levels will be studied. A brief review of coalition formation will be given and applied to international and multinational operations. The important factors for co-operation between two or more nations as well as possible sources of friction at international and multinational levels will also be studied. A major logistics war game will be introduced and discussed. Topics that will also be included are: legal questions, inventory management, traffic management, material handling, the management of international logistics, the impact of cultural differences, and environmental protection. Cases will be used to motivate discussion of some of the issues.

Lectures - 3 periods per week (one term)

Credit(s):

MBA547 Business Law

The various ways the law influences business practice are studied in this course. The Canadian court system, civil procedure, and the growing influence of the Canadian Charter of Rights and Freedoms on business will be studied. Emphasis is placed on the law of tort and contract.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA549 Logistics Modeling And Simulation

This course offers advanced material in the application of modeling and simulation analysis techniques to logistics problems, particularly military logistics problems. Both process and Monte Carlo simulation are presented. Students will be introduced to simulation software tools such as @risk (Monte Carlo) and SIMUL8 (process simulation). Examples are drawn from human resource management, finance, and operations management.

Prerequisite: MBA523

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA551 Advanced Finance

Corporate and Governmental Agency financial decisions will be examined in this course. The focus will be placed on areas such as agency theory, transaction cost theory, capital structure, dividend policy, control of the organisation through financial decisions, and risk management. A significant topic will be the use of equity and debt derivatives as tools in risk management.

Prerequisites: MBA537 and MBA521

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA555 Operations Management

The focus of this course is on the important concepts of managing organisations and in particular on the effective and efficient creation and delivery of goods and services, including the important logistics elements. The blend of technical, human and economic considerations in an organisational setting will be studied. Topics that will be given particular consideration include design of product or service and process, capacity and demand management of services, materials management, and scheduling.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA557 Financial Management Accounting Topics

Studied in this course are selected topics in the fields of Financial and Management Accounting. The intention is that the course will be divided roughly in half with each half devoted to either Financial Accounting or Management Accounting.

Prerequisites: MBA525 and MBA527

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA561 Strategic Management

This course examines the formulation and implementation of long-term strategy for the organisation and determination of strategic direction, as well as the management of the strategic process. Topics covered include: strategy formulation and strategic thinking; strategy, industry and competitive analysis; organisational redesign; strategic outsourcing and building of core competencies and strategic networks; strategy, resources and competencies; technology and strategic advantage; and strategic change process. The course is organised around cases and readings that structure and extend the student's understanding of complex organisational decisions, problems and situations.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA563 Topics In Industrial Relations

Selected topics of current interest in the area of Industrial Relations serve as the focus in this course. Areas that may be studied include alternate methods of contract negotiations, the changing workplace and the effects of relationships between the employee, management, and employer that exist in the public and private sectors.

Prerequisite: MBA567 or MBA569, or with permission

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA567 Organisational Behaviour and Theory I

Modern organisations find themselves in a climate of constant change. Without knowledge and understanding of the new workplace, leaders and managers will not be able to prepare their people and organisations for the challenges of tomorrow. Using the most recent developments from organisation theory and organisational behaviour, this course will examine topics such as leadership and management, group dynamics, and corporate culture. Linkages will be explored between these new organisations and strategic human resource management policies and procedures. Extensive reference will be made to the Canadian Forces human resource system. The course uses a lecture and case study format, with members responsible for researching and presenting case study analyses.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA569 Strategic Human Resources Management

This course is intended to provide an overview of strategies and management practices in Human Resources (HR) management with a specific focus on strategic issues rather than training HR professionals. The course will therefore help the student understand how the external environment and the internal organisational environment combine to affect the choice and implementation of strategies and policies in the traditional human resource disciplines. These disciplines include HR planning, recruitment and selection, compensation, motivation, evaluation, training, career development and career planning, as well as the field of employee relations and its sub-disciplines

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA571 Directed Studies In Business Administration I

This is an elective course for graduate students who are pursuing a degree under the Directed Studies Pattern. It provides students the opportunity to pursue a subject of academic merit that particularly interests them. The student is to determine a topic and then find a member of the faculty to supervise. Under the professor's guidance, the student will investigate the topic and prepare a written final report in a form appropriate for the chosen topic.

Prerequisite: Satisfactory progress in the student's programme and permission of the MBA Programme Chair

There are no lectures but work equivalent to a course of 3 periods per week for one term is required.

Credit(s): 1

MBA573 e-Business

E-Business has become a key enabler for business transformation through the use of Electronic Service Delivery (ESD) in both the public and private sectors. This course covers the essential elements necessary for planning and implementing successful ESD initiatives and strategies. It examines what has fundamentally changed for business and government with the advent of the World Wide Web (WWW) technologies on the Internet and looks at their impact on marketing, emergence of new business models, and the nature of business transactions with customers and between business entities. The course also provides an introduction to the technical dimension of planning and building ESD infrastructure such as security, electronic payment systems and supply chain integration. A balanced approach is taken in addressing issues from both the private sector and government ESD planner's perspectives.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA575 Public Financial Management

Public Financial Management aims at developing student capabilities in the analysis of financial operations and the management of public sector at all level of governments. The course covers the principles of finance, economics, accounting and fiscal administration that are relevant to the understanding of financial functions and financial management in the public sector. Relevant areas of study are: (1) Public budgeting - the budgetary process, politics and reforms (including performance budgeting); (2) Debt, investments, cash and risk management techniques; (3) Financial accounting, reporting and analysis of financial statements and; (4) Structure and administration of

selected taxes. Additional areas may be included on the basis of student interests.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA577 Social And Ethical Issues Of Business

This course focuses on the relevance of morality to business by introducing the student to ethical issues in business. The course starts with a general consideration of the nature of morality and a brief introduction to ethical theory. After this introduction the course focuses on specific ethical issues arising in the workplace such as; privacy in the workplace, sexual harassment, safety in the workplace, whistle blowing and employee loyalty, insider trading, property rights, incentives, bribes and kickbacks and ethics in production and marketing. Issues such as corporate responsibility as reflected in a business's relationship with the community, the family and the environment are considered. Ethical issues arising out of international business and cross-cultural differences are also examined. The course emphasizes the importance of ethical and moral considerations to management planning and decision-making.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA579 Management Of Technology

The aim of this course is to help students develop a strong conceptual foundation for managing technology. It introduces concepts and frameworks for analysing how organisations can create, develop, commercialise, diffuse and capture value from high technology-based products and services. It studies how organisations manage the technological change process (marketing, R&D, engineering, and manufacturing) in new organisational forms. Topics covered include: 1) technological change and how it affects competition between new and existing organisations, 2) strategies for organisations competing in high-technology industries, 3) management of innovation within a corporation, 4) management of innovation across organisation boundaries (strategic alliances, entrepreneurship, and venture capital), 5) technology commercialisation, and 6) protection of an invention that might someday be commercialised.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA581 Directed Studies In Business Administration II

This is an elective course for graduate students who are pursuing a degree under the Directed Studies Pattern. It provides students with a second opportunity to pursue a subject of academic merit that particularly interests them. Under the professor's guidance, the student will investigate the topic and prepare a written final report in a form appropriate for the chosen topic.

Prerequisite: Satisfactory progress in the student's programme, permission of the MBA Programme Chair, and completion of MBA571.

There are no lectures but work equivalent to a course of 3 periods per week for one term is required.

Credit(s): 1

MBA583 Consumer Behaviour

This course aims to assist graduate students in developing an analytical understanding of how Government and Business interact with each other in the Canadian economy. The Course will discuss rationale and limitations of government intervention and it will review policy tools and options available to Government in its dealings with Business. Current Canadian policy issues will be addressed throughout the review of framework legislation, regulations and other instruments as well as selected cases. International comparisons and cases will also be presented and discussed on numerous issues.

Lectures - 3 periods per week (one term)

Credit(s): 1

MBA585 Government, Business and Policy

This course aims to assist graduate students in developing an analytical understanding of how Government and Business interact with each other in the Canadian economy. The Course will discuss rationale and limitations of government intervention and it will review policy tools and options available to Government in its dealings with Business. Current Canadian policy issues will be addressed throughout the review of framework legislation, regulations and other instruments as well as selected cases. International comparisons and cases will also be presented and discussed on numerous issues.

3 periods per week (one term)

Credit(s): 1

MBA587 Organizational Behaviour and Theory II

This course builds on, MBA567 - Organizational Behaviour and Theory I. The course examines and integrates individual, group and organizational level phenomena and processes using topics and theory from organizational behaviour and theory. Some topics introduced in Organizational Behaviour and Theory I such

as individual and organizational decision making, organizational culture and management of change in organizations are expanded and developed. New topics such as emotional labour, network structure of social capital, social loafing, management of innovation, management of high reliability organizations (i.e. nuclear plants, aircraft carriers), and management of interorganizational relationships are examined. The course uses a seminar format with discussion being based on books, journal articles, and cases.

Prerequisite: MBA567.

3 periods per week (one term)

Credit(s): 1

MBA589 International Management

New challenges have arisen in management due to the exponential growth of international business. Increasingly, managers are expected to cope with issues spanning national boundaries, and are challenged to find international opportunities. This graduate course in International Management offers a foundation that will prepare current and future managers for working in this global business environment. Students are introduced to the challenges and opportunities provided by globalization, including specific issues facing Canadian managers in the areas of international business decision-making, trade issues and institutions, finance, strategy, resources, marketing and organizations. The course also takes an institutional view of business strategies being adopted in emerging country markets, including China, India, Brazil and Russia.

3 periods per week (one term)

Credit(s): 1

MBA591 Audit and Tax Planning

This graduate course in audit and tax planning will provide students with a foundational understanding of contemporary auditing concepts, techniques, and other assurance services. Students will also learn about taxation planning and the evaluation of internal audit, management audit, and "value-for-money" audit procedures used in the public sector. During the term, students will review recent research papers published in auditing journals, taxation journals and associated disciplines. Students will read relevant topic papers, prepare assigned responses, and will lead class discussions pertaining to one or several of the assigned readings or cases.

3 periods per week (one term)

Credit(s): 1

PR500 MBA Project

Equivalent to three (3) term courses or three (3) credits.

BA601 Probability And Statistics With Business And Military Applications

This is a PhD level course in the application of probability and statistics to problems in business and military settings. Topics include mathematical statistics (probability, estimation, confidence intervals, hypothesis testing, and design of experiments, re-sampling, and other topics), regressions, queuing problems and Monte Carlo situation. The emphasis will be on how probability and statistics can be applied to administrative problems.

Lectures - 3 periods per week (one term)

Credit(s): 1

Interdepartmental Programme in Security and Defence Management and Policy

General Information

Contact Information

Programme Chair - Dr Abdelkérim Ousman

Telephone: Programme Chair - 613-541-6000 ext 6443

Programme Representative - Lucie Readman

Telephone: Programme Representative - 613-541-6000 ext 6586/3991

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Web Page: Interdepartmental Programme In Security and Defence Management and Policy

Programmes Offered

The Master of Arts in Security and Defence Management and Policy MA(SDMP) is an interdisciplinary academic degree. The Programme collaborates closely with RMC's MBA and War Studies Programmes and draws significantly on material and staff of the Departments of Business Administration, Political Science and Economics, and Military Psychology and Leadership. Military and civilian individuals engaged or interested in the security environment, as it is and is emerging, in Canada and internationally, including traditional defence issues, will find the Programme relevant and useful.

Admission

Candidates for the MA(SDMP) will be admitted under the General Admission Requirements of RMC. Candidates with lesser qualifications may be considered for acceptance under provisional or probationary status. Details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this Calendar.

Registration Procedures

Students need to be aware that registrations will not be approved until 30 days prior to the start of classes. During this early registration period, preference will be given to students who require a particular course to graduate. Registrations that are submitted less than 30 days prior to the commencement of classes will be on a first come first served basis. Final course registration dates are posted on the portal under Important Dates.

Course Withdrawal Procedures

Student wishing to withdraw from a course are required to follow the procedures outlined in section 5.5 of this calendar. Failure to follow these regulations has serious programme and financial implications.

Programme Details

Programme Time Frames

It normally takes five (5) academic terms to complete the Programme (i.e. two (2) academic years and the intervening summer) by full-time enrolment.

In part-time enrolment, a student is expected to complete their studies over a period of time not normally longer than five (5) years, in accordance with RMC regulations.

Programme Professional Internship Credits

Students with appropriate career experience may apply to the Chair for up to two (2) credits by submitting evidence of their experience and its relevance to the Programme. These credits will be recorded on the transcript as DM505 - Professional Internship and DM507 - Advanced Professional Internship, as elective credits. The student should consult with the Programme representative for further guidance.

Programme Formats

The Programme is offered in three (3) formats:

- All Course;
- Course plus Project; and
- Course plus Thesis.

All students are initially registered in the all-Course format. Students who are close to completing the core requirements of the Programme may pursue either the Project or Thesis format following a discussion and approval of their project/thesis topic with the Chair of the MA(SDMP) Programme.

Course Format

Twelve (12) one-term graduate courses.

The student must successfully complete six (6) core courses plus six (6) elective courses. Experience has shown that those students who focus first on core courses complete the Programme sooner.

Course plus Project Format

Ten (10) one-term graduate courses plus a project.

The student must successfully complete six (6) core courses plus four (4) elective courses and a project. The project title and scope will normally be approved by the Chair after the student has completed three (3) or more core courses.

Course plus Thesis Format

Six (6) one-term graduate courses plus a thesis.

The student must successfully complete six (6) core courses and submit and defend a thesis. The thesis title, scope and supervisor(s) will normally be approved by the Chair after the student has completed Five (5) or more core courses.

Programme Requirements

Core Courses for the MA(SDMP):

- DM537: Financial Decision-making
- DM539: Economics of Defence
- DM555: Management Information Systems for Defence Management
- DM569: Organisational Theory

and two (2) of the following three (3) courses;

- DM521: Canadian Government And Public Policy
- DM523: Defence Decision-making
- DM529: Canadian Defence and Foreign Policy

Elective Courses for the MA(SDMP):

- DM505: Professional Internship
- DM507: Advanced Professional Internship
- DM527: Professional Ethics and Defence Management
- DM549: Economics of National Security
- DM557: Strategic Management For Defence
- DM559: Project Management
- DM565: Conflict Analysis and Management
- DM567: Managing and Resolving Violent Conflicts
- DM571: Defence Technology: Strategies And Policies
- DM573: Leading and Working in a Diverse Environment
- DM575: Human Security: Theory and Practice
- DM581: Decision and Policy Analysis

and

- Various Business Administration (MBA)**, War Studies (WS) and other Programme courses.

*Students must take at least half their courses from the list of SDMP courses.

**Normally there is a maximum of four (4) MBA courses that students can take in the course of their studies.

Course Descriptions

DM505 Professional Internship
DM507 Advanced Professional Internship
DM521 Canadian Government and Public Policy
DM523 Defence Decision Making
DM525 Policing Administration
DM527 Professional Ethics and Defence Management
DM529 Canadian Defence and Foreign Policy
DM537 Financial Decision Making
DM539 Economics of Defence
DM549 Economics of National Security
DM555 Management Information Systems for Defence Management
DM557 Strategic Management for Defence
DM559 Project Management
DM565 Conflict Analysis and Management
DM567 Managing and Resolving Violent Conflicts
DM569 Organizational Theory
DM571 Defence Technology: Strategy and Policies
DM573 Leading and Working in a Diverse Environment
DM575 Human Security: Theory and Practice
DM577 Interagency Coordination
DM579 Government Procurement
DM581 Decision and Policy Analysis
PR500 Project
TH500 Thesis

DM505 Professional Internship

One elective credit awarded for professional experience. The student applies to the chair for the credit with detailed description of five years or more experience after achieving a first degree.

Credit(s): 1

DM507 Advanced Professional Internship

One elective credit awarded for professional experience. The student applies to the chair for the credit with detailed description of ten years or more experience after achieving a first degree.

Credit(s): 1

DM521 Canadian Government And Public Policy

This course analyses different theories of public policy-making as applied by the Canadian government in the pursuit of "rationality", and in the determination of the "public interest" for Canadian citizens. Theories of public policy making are ways of making sense of the structures, the processes and the people involved in deciding for the citizens. To explain the application of these theories is one purpose of this course. There is a substantive aspect to public policy-making, which is even more important than the procedural one. This course is designed to demonstrate this importance and its relevance to public policy-making in Canada.

DNDLearn

Credit(s): 1

DM523 Defence Decision-making

This course examines the concepts that have been advanced from time to time to provide the structure for formulating and managing defence policy and commanding the Canadian Armed Forces. The main vehicles for this investigation are the studies and reports concerning the higher direction of national defence prepared between 1936 and 1992.

DNDLearn

Credit(s): 1

DM525 Policing Administration

This course introduces students to the administration of policing and public safety in Canada. Topics covered include police reform, staffing, oversight, budgeting, legislated mandates and institutional structure across the three levels of government in Canada. Previous knowledge of policing or police management is not required; however, students would benefit from having taken DM521 prior to enrolling in this course.

DNDLearn

Credit(s): 1

DM527 Professional Ethics And Defence Management

This course is an examination of the military and ethical responsibilities of officers. Alternative ethical systems and norms of behaviour are evaluated. Moral conclusions as to the right, proper, and just decisions, and required military actions facing managerial morality problems are also drawn. The defence ethics programme and the conflict of interest philosophy are also two important subjects of the course, in keeping with the goals and ethical culture of the Canadian Forces. The approach will be multidisciplinary but the focus will be on the complexities of military operations from a legal perspective. Military professionalism, philosophical theories, and psychological perspectives are topics in the course. The aim is to assist the student in understanding the practical applications to military life of moral principles and ethical theories. The curriculum introduces opposing views on current controversial issues in order to incorporate debate as a useful instructional methodology for applying the military ethical doctrine to current practise within the Canadian Forces while respecting the Canadian Charter of Rights and Freedom.

DNDLearn

Credit(s): 1

DM529 Canadian Defence And Foreign Policy

This course examines the development of Canadian defence policy and the factors that have helped mould and determine it from the Great War to the present. Such themes as threat perception, geopolitical considerations, alliance associations, governmental structures for decision making, personalities, force development, defence economics, the socio-military interface, and foreign and domestic policy concerns are part of the study. The course will be run using the specialized readings-seminar paper method.

DNDLearn

Credit(s): 1

DM537 Financial Decision-making

This course introduces students to principles of financial decision-making within a corporation and government department. Topics included are: costing theory and analysis (including regression analysis), construction of income statements for a manufacturing concern, cost-volume-profit analysis including break even analysis, the budget cycle for a manufacturing concern, standard costs and variance analysis, fixed cost allocation including Activity Based Costing, Business Planning, discounted cash flow analysis, security valuation, the cost of capital, Life Cycle Costing, risk analysis in financial planning,

special DND budgeting issues, and derivative securities and their use in risk management.

DNDLearn

Credit(s): 1

DM539 Economics Of Defence

This course is concerned with the application of economic methods of reasoning to defence policy issues and to questions of defence resource allocation. Elementary ideas of micro-and macroeconomic analysis are reviewed and employed to address issues such as the appropriate level of defence expenditures and the appropriate distribution of defence budgets between manpower and equipment. Specific topics include the economics of alliances, arms races, arms control, budget distributions, weapons procurement, manpower planning, economic warfare, disarmament and conversion. Elementary economic concepts are employed to develop approaches to structuring complex problems of defence resource allocation involving risk and uncertainty. The course also examines the effect of defence activities on economic performance at the national, regional and industrial levels.

DNDLearn

Credit(s): 1

DM549 Economics Of National Security

This course is concerned with the application of economics reasoning to national security policy issues and to questions of resource allocation toward national security and within government agencies for national security. Complex problems of national security resource allocation are addressed using game theoretic concepts of strategic analysis. The course reviews the fundamental concepts of economic analysis and then proceeds to apply them to demand side issues such as domestic security and democracy, regional and global security, and to supply side issues such as intelligence, enforcement, and legislation. Specific topics include street, food and health security, immigration, information and cyberspace, peacekeeping, intelligence, deterrence and pre-emption, domestic and international legislation.

DNDLearn

Credit(s): 1

DM555 Management Information Systems For Defence Management

This course will focus on strategic issues involving the use of Information Systems/Information Technology (IS/IT). The course will focus on how the effective use and management of the Information Systems/Information Technology of a firm can help the firm meet its long-range goals and objectives. The course will help the student to develop a basic understanding of the concepts of IS/IT. It will then focus on how the external environment and the internal organizational environment combine to effect the choice and implementation of strategies and policies in the traditional IS/IT areas of: Management Information Systems, Decision Support Systems, Expert and Expert Support Systems, Information Systems Planning, and Information Systems Design and Development.

DNDLearn

Credit(s): 1

DM557 Strategic Management For Defence

The course studies and analyzes environmental scanning, policy formulation, policy implementation, high command influence and control, environmental adaptation and management of change. The emphasis is on understanding the fundamental concepts as well as acquiring the ability to study and analyze complex managerial situations requiring strategic management thinking. Areas of study include: environmental scanning, critical resources, outsourcing, technology adoption, environmental adaptation, strategic planning, operational support, organizational design, crisis management and international management. The course uses case studies in both the public and private sectors. Particular attention is given to strategic management in the military context, and in the DND organization.

DNDLearn

Credit(s): 1

DM559 Project Management

Addressing project management from a "management" perspective, this course examines the discipline from a defence perspective. Topics covered include requirement definition, project selection, organization, planning, scheduling, budgeting, control and termination. The course discusses the role of the project manager and his/her interaction with the defence management system. Specific project management methods and techniques, including computer software, negotiation approaches, risk and quality management and procurement procedures are investigated. Completed and on-going projects are studied.

DNDLearn

Credit(s): 1

DM565 Conflict Analysis And Management

This course introduces the student to the area of Conflict Analysis and Management. The course will study conflict

at three levels of resolution: Intrafirm, Inter-firm and International Conflict. Conflict Analysis and Management concepts will be studied in more depth from the point of view of qualitative and quantitative analysis. Quantitative analysis will include the systems theory and risk analysis and management perspectives. This will be followed by an examination of the different types and models prevalent in the area. Finally, various case studies will be used to highlight the important concepts which have been covered.

DNDLearn

Credit(s): 1

DM567 Managing And Resolving Violent Conflicts

This course examines the causes and correlates of violent conflict, and applies this to the study of conflict resolution before, during and after armed and organized violence within and between states. The evolution of conflict resolution as a discipline from the 1950s to the present, and hanging patterns of violence in the 20th century highlight third party roles and coercive and collaborative strategies. These themes are then explored through three phases in the conflict cycle: previolence, violence, and post-violence. Comparative case studies of prevention, management, and post-conflict reconstruction are drawn from post-Cold War conflicts. The course assumes knowledge of basic conflict analysis tools and vocabulary, and requires wide reading about contemporary conflicts. It is strongly recommended that DM565 Conflict Analysis and Management be taken before this course.

DNDLearn

Credit(s): 1

DM569 Organisational Theory

Organizational theory is the study of how socioeconomic entities called organizations function and how they affect and are affected by the environment in which they operate. Organizational theory is a multi-disciplinary body of knowledge that draws on sociology, psychology, political science, and economics. It explains the origins, development, transformation, persistence, and decline of organizations that order today's life in a more and more complex and uncertain environment. This course attempts to explore core concepts in organizational theory and their inter-relationships. It examines current theories as well as the major known classical approaches about organizations. The main objectives are to understand why organizations exist, why organizations have the structure that they do, what is organizational structure; what are mechanisms of coordination, control, formalization, and centralization of power in organizations.

DNDLearn

Credit(s): 1

DM571 Defence Technology: Strategies And Policies

This course discusses defence technology as a goods/service/ideology process by examining its relationships with international affairs, national policies and security, and with military and paramilitary doctrine, capability and performance in peace and war. Topics include: history of defence technology; civilian-military relations; the military industrial complex; cycles of development; contemporary use of defence technology; tools and trends of technology foresight, national defence and trade policies; defence planning, programming and budgeting; and resource strategies for war and peace in alliance, coalition, and conflict settings now and in the future. Topical technology security issues to be addressed include: smart weapons, standardization and interoperability, dual-use goods and services, and impacts of globalization.

DNDLearn

Credit(s): 1

DM573 Leading and Working in a Diverse Environment

This course will examine leading and working a diverse and multicultural environment within three contexts: (1) domestic organizations, (2) global or multinational organizations, and (3) military organizations. Diversity and multiculturalism add to the complexity of organizational environments by increasing the number of perspectives, interaction patterns, and approaches to leadership and management. Designed for the MA(SDMP) programme, the course explores many of the questions and challenges facing today's leaders.

DNDLearn

Credit(s): 1

DM575 Human Security: Theory and Practice

This course addresses the evolving global security environment in terms of existing and possible strategies, policies and actions for the demands and opportunities of a Human Security regime. Theories and practises from the fields of history, psychology, international relations, politics, economics, project management and field engineering will be used in the study of the ways and means that determine how much freedom and dignity individuals enjoy as they live, move and work. A course focus will be real-world cases of interest and importance to Canada.

DNDLearn

Credit(s): 1

DM577 Interagency Coordination

Government structures are characterized by the existence of various agencies in the delivery of services as well as in the performance of some functions. The course first introduces government agencies as distinct organizations. The second part examines coordination or integration of different agencies with different functions and jurisdictions as responses to changing environments. The third part covers applications such as national security, emergency management and procurement.

DNDLearn

Credit(s): 1

DM579 Government Procurement

Procurement amounts to a significant proportion of government expenditures, particularly in defence capital programs. After an introduction to the fundamentals of procurement, the course discusses various sourcing methods in procurement. The second part concentrates on procurement offsets. The third part covers contract design and contract management issues, from processes leading to contract award to risk management and to audits and litigation. The final part of the course introduces the legal framework, from competition, trade and contract laws to litigation and ethics.

DNDLearn

Credit(s): 1

DM581 Decision and Policy Analysis

Analytic approaches to decision-making and policy formulation within and across public-sector organizations are considered. The course will begin with an overview of decision-making and the general characteristics of the organizational frameworks within which decisions and policy are made. Then, analytic techniques such as multi-criteria decision analysis techniques, plural evaluation methods (e.g. voting), and cost-benefit analysis will be covered as well as some qualitative techniques. Particular emphasis is put on the process of analysis and its effect on decision and policy quality. Finally, systems analysis and policy formulation in multi-organization environments will be introduced.

DNDLearn

Credit(s): 1

PR500 Project

The project is worth two (2) elective credits. The project title and scope will normally be approved by the Chair after the student has completed three or more core courses.

Credit(s): 2

TH500 Thesis

The thesis is worth six (6) elective credits. The thesis title, scope and supervisor(s) will normally be approved by the Chair after the student has completed three or more core courses.

Credit(s): 6

Department of Defence Studies

General Information

Contact Information

Department Head - J.C. Stone

Programme Chair - J.C. Stone

Admissions Committee Chair - J.C. Stone

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Fax: 416-482-6802 or 613-541-6972

Email: stone@cfc.dnd.ca

The Department of Defence Studies is a department of the Faculty of Arts that is located at the Canadian Forces College in Toronto, Ontario.

Programme Offered

The Department offers courses in defence studies that are either specifically designed for the degree Master of Defence Studies (MDS) or fall within the framework of the MA in War Studies MA(WS) and MA in Security and Defence Management and Policy MA(SDMP) degrees, depending on which professional military education programme an individual is undertaking at the Canadian Forces College.

The degree Master of Defence Studies (MDS) is offered to students of the Joint Command and Staff Programme (JCSP) concurrently with the JCSP. It is a professional one-year Master's Degree awarded by the Royal Military College of Canada (RMC) and approved by the Ontario Council of Graduate Studies.

The Masters of Arts degree in War Studies MA (WS) or Master of Arts in Security and Defence Management and Policy MA (SDMP) is potentially offered to students of the National Security Programme (NSP). Both of these degrees are Masters of Arts degrees awarded by the Royal Military College of Canada and approved by the Ontario Council of Graduate Studies.

Masters of Defence Studies

The degree Master of Defence Studies investigates the relationships between the Profession of Arms and National Security policies. It includes military command, leadership and the conduct of major military operations and strategy including war fighting, peace support operations, and domestic operations for national security. The management of defence resources is also encompassed within defence studies. The degree covers both applied and theoretical topics. Since defence studies are inherently interdisciplinary, it draws upon defence management, economics, history, human resources management, international relations, peace studies, sociology, anthropology, strategic and security studies, warfare studies, and other academic disciplines. The degree is generally limited to competitively selected members of the profession, according to nationally and internationally recognized standards of professional competence.

Defence Studies (DS) credits may be acceptable toward other graduate programmes. Check each programme's section in the calendar.

Admission

Officers admitted to the Canadian Forces College through professional selection are deemed to be students of RMC, and their work is assessed as part of a graduate programme. Graduate level Defence Studies courses are an integral aspect of professional programmes of study designed for both the third and fourth development periods (DP3 and DP4) for Canadian officers. All Defence Studies courses are offered at the Canadian Forces College as components of the Joint Command and Staff Programme (JCSP) and the National Security Programme (NSP).

Students wishing to read for the MDS degree along with the JCSP or the MA(WS) and MA(SDMP) degrees along with the NSP must apply for admission to RMC in accordance with the procedures outlined in the general regulations defined in the RMC Graduate Studies Calendar. Students applying to these graduate programmes will normally require an Honours (four year) Bachelor's degree in Arts, Science or Engineering, or an equivalent from a recognized university with at least a "B" average (73% or better) standing in the last year.

The JCSP and NSP programmes are only available to military officers competitively selected for attendance or to civilians selected by their employer for attendance. Those individuals who do not undertake the degree programme while completing the JCSP and NSP programmes must apply within three years of completion of the respective programme.

Information for Non JCSP students seeking details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this Calendar

JCSP and NSP students will be briefed on their respective degree programmes at CFC.

Programme Requirements

Students admitted into the MDS must complete the JCSP curriculum, which includes eight (8) credits for Defence Studies courses. In addition, students must write an Independent Research Project (PR500). Credits for Defence Studies courses may be applied towards other degrees with the approval of the Chair of the relevant programme.

Students admitted to either the MA(WS) or MA(SDMP) as part of the NSP will be required to meet the requirements of their respective degrees in accordance with the information contained in the appropriate section of this calendar.

Students undertaking the JCSP or NSP and reading for a degree will have all written work marked in accordance with graduate studies standards that require that they maintain a minimum grade of B- (70%). Students will be assigned an academic advisor who will supervise and mark their work. The advisor will be an academic resident at the CFC campus of RMC in Toronto, at the main RMC campus in Kingston, or based on subject matter expertise at a local area university. Upon successful completion of all work required for the MDS degree, the CFC Registrar will forward the file to RMC for consideration by the RMC Senate. For those who have completed all the required work, degrees will normally be awarded at the graduation ceremony at the CFC campus.

Programme Descriptions

The Canadian Forces College offers a variety of courses for Canadian Forces regular and reserve officers, allied officers, and selected civilians. These courses are counted toward programmes either managed by the Department of Defence Studies or other Committees at RMC. Not all of the defence studies courses listed below are acceptable in all degree programmes. Students must ensure they check each degree programme's section in the graduate studies calendar.

In the course descriptions that follow, the timing is indicative of credit weight. Actual timing and delivery may vary according to the scheduling of the JCSP and NSP (for example, a course indicated as three periods for one term may actually be delivered over two terms, but would still be worth one credit, based on total contact hours and forms of evaluation).

Joint Command and Staff Programme

The Joint Command and Staff Programme (JCSP) is for mid-level leaders and managers, available in two learning streams, both of which include the option of reading for a Master of Defence Studies, and designed to extend the knowledge base required by professional officers. It is intended primarily for Majors and Lieutenant-Commanders, and seeks to provide officers with the analytical and interpretive skills necessary for military success and quality leadership of the Canadian Forces. Students on the JCSP are competitively selected from amongst their peers, in accordance with exacting professional criteria. The curriculum emphasizes command and leadership, ethics, and military operations across the spectrum of conflict. Operational art, understanding of national security, defence management and professional officership skills are developed through individual and collective effort on the following courses:

- DS541: Leadership and Ethics
- DS542: Command and Management
- DS543: War and Society
- DS544: Basic Joint Operational Planning
- DS545: Component Capabilities
- DS546: Advanced Operational Planning
- DS547: National Security and International Affairs

National Security Programme

The National Security Programme (NSP) is a ten-month residential programme for selected security and defence professionals who are ready for employment as executive leaders of their respective institutions. Canadian Forces and international officers of the colonel and naval captain rank, and Public Servants of EX-1 status are competitively selected in accordance with professional standards and potential for advancement. The curriculum emphasizes strategic leadership, strategic management and whole of government engagement in complex security environments at the strategic level. The nature of the modern military profession makes international standards for the conduct of complex security operations an essential element of each course.

The professional NSP core courses are:

- DS571: Canada in the Global Strategic Environment
- DS572: Canadian Governance in Comparative Context
- DS581: Executive Leadership
- DS582: Strategic Resource Management
- DS591: The Theory and Practice of High Command

- DS592: Comprehensive Operations
- DS597: Contemporary Security Studies

In addition to the cores courses listed above, there are a number of electives that may be taken in conjunction with the NSP core courses depending on the particular circumstances of individual students. This may include NSP elective defence studies courses, core MA (WS) and MA (SDMP) courses to meet degree requirements and elective MA (WS) and MA (SDMP) courses. Specific defence studies elective courses that may be available are:

- DS584: The Role of Culture in Whole-of-Government Approaches
- DS594: Strategic Art

Additional Defence Studies Credits

Students requiring additional DS courses to complete the requirements for the MDS are invited to register for the following courses related to their professional duties, under appropriate supervision assigned by the Department of Defence Studies.

The following courses may be available by arrangement with faculty of the Department of Defence Studies.

- DS501: Analysis of Contemporary Conflict
- DS503: Field Research on Contemporary Conflict
- DS505: Analysis of Defence Headquarters Issues
- DS507: Field Research on Defence Headquarters Issues
- DS509: Analysis of Doctrinal Questions
- DS511: Empirical Research on Doctrinal Questions
- DS513: Special Topics: Readings In Security Studies
- DS515: Independent Study
- DS519: Military Law in Comparative perspective

Course Descriptions

DS501 Analysis of Contemporary Conflict
DS503 Field Research on Contemporary Conflict
DS505 Analysis of Defence Headquarters Issues
DS507 Field Research on Defence Headquarters Issues
DS509 Analysis of Doctrinal Questions
DS511 Empirical Research on Doctrinal Questions
DS513 Special Topics: Readings In Security Studies
DS515 Independent Study
DS519 Military Law in Comparative Perspective
DS541 Leadership and Ethics
DS542 Command and Management
DS543 War and Society
DS544 Basic Joint Operational Planning
DS545 Component Capabilities
DS546 Advanced Joint Operational Planning
DS547 National Security and International Affairs
DS571 Canada in the Global Strategic Environment
DS572 Canadian Governance in Comparative Context
DS581 Executive Leadership
DS582 Strategic Resource Management
DS584 The Role of Culture in Whole-of-Government Approaches
DS591 The Theory and Practice of High Command
DS592 Comprehensive Operations
DS594 Strategic Art
DS597 Contemporary Security Studies
PR500 Research Project

DS501 Analysis of Contemporary Conflict

Students learn techniques for conflict analysis from a reading package and apply those techniques to analyze a recent or contemporary conflict drawing on primary and secondary sources. Students provide an assessment and critique of the utility of various analytical tools for the purposes of the research problem they have chosen.

Credit(s): 1

DS503 Field Research on Contemporary Conflict

Drawing on primary and secondary sources, students map a conflict and identify researchable questions, consider ethical and safety issues, and deploy for a period of field research using Rapid Assessment Procedure (RAP) or a comparable technique. Research involving human subjects requires prior approval by a university Research Ethics Board. Supervisors may request evidence of competence in analytical techniques before permitting the field research to proceed. DS501: Analysis of Contemporary Conflict, is recommended as a companion course.

Credit(s): 1

DS505 Analysis of Defence Headquarters Issues

Students survey from a reading package analytical techniques drawing on various disciplines (organizational psychology, sociology, anthropology, and management science) appropriate to research in a complex headquarters environment. They then apply an appropriate technique to the study of a professional problem within a defence headquarters or similar organization. Students provide an assessment and critique of the utility of various analytical tools for the purposes of the research problem they have chosen.

Credit(s): 1

DS507 Field Research on Defence Headquarters Issues

Drawing on primary and secondary sources, students identify researchable questions related to the functioning of a headquarters or staff organization, consider ethical and safety issues, and deploy for a period of research in the organization using an appropriate research technique. Research involving human subjects requires prior approval by a university Research Ethics Board and notification of the appropriate supervisors (including DHRRE). Supervisors may request evidence of competence in analytical techniques before permitting the research to proceed. DS507: Analysis of Analysis of Defence Headquarters Issues, is recommended as companion course.

Credit(s): 1

DS509 Analysis of Doctrinal Questions

Students survey historical debates on questions of military or related security doctrine from a study package, and identify techniques for analysis and resolution of doctrinal differences. They then apply appropriate techniques to the analysis of a recent or evolving doctrinal debate. Students provide an assessment and critique of the utility of various analytical tools for the purposes of the research problem they have chosen.

Credit(s): 1

DS511 Empirical Research on Doctrinal Questions

Drawing on primary and secondary sources, students identify a question of military or security doctrine for which there is expected to be an empirical answer. They identify research and analytical techniques that will yield empirical data from which to answer the doctrinal question. These may include gaming, simulation, field experimentation, observation, or case comparison. Research involving human subjects requires prior approval by a university Research Ethics Board and notification of the appropriate supervisors (including DHRRE). Supervisors may request evidence of competence in analytical techniques before permitting the research to proceed. DS509 Analysis of Doctrinal Questions, is recommended as a companion course.

Credit(s): 1

DS513 Special Topics: Readings In Security Studies

This course offers students the opportunity to examine selected topics in the various fields of security studies. The emphasis will be on security and defence with particular attention to Canada and North America. In any one year, topics chosen will include some of the following: defence analysis and policy making; intelligence and national security; evolution of strategic thought; the privatization of security and the role of non-state actors; homeland security; human security; science, technology and security; terrorism and counter-terrorism; environmental security. Students are welcome to suggest areas of personal interest. Course work includes a research paper of graduate seminar quality and/or presentations.

Credit(s): 1

DS515 Independent Study

This course provides an opportunity for students to design and execute an independent research project on a question that interests them in the general area of defence studies that is not covered by an existing course at CFC. Normally, this course is conducted as a directed studies course (i.e. reading course) and involves individual research under the direction of the instructor and the submission of a research paper of graduate seminar quality. Only one independent study can be taken for credit towards a single degree. All independent study proposals must be approved by the Head of the Department of Defence Studies. Before approval is granted, students must have sought out and gained the support of a faculty member with the relevant expertise, agreed with that expert on an appropriate plan of study, finalized a topic and question for research, and established a legitimate procedure for assessment.

Credit(s): 1

DS519 Military Law in Comparative Perspective

Military law in Canada has evolved historically, legally, and organizationally to meet the specific needs of the Canadian Forces and reflect broader changes in Canadian society. This course examines the state of Canadian military law from the past to the present day, with

particular emphasis on the balance between operational requirements and the primacy of civilian control in a parliamentary democracy.

Credit(s): 1

DS541 Leadership and Ethics

The course uses lectures, practical exercises, case studies, and small group discussions to explore leadership theory, professional ethics, and cultural complexity, the profession of arms, critical thinking, and problem solving to enhance students' leadership effectiveness. Participants apply decision-making tools to resolve leadership scenarios, and subject matter experts provide evaluation and feedback based on experience and published research. Assessment is by participation in seminars and discussions, practical exercises and simulation and written essays.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS542 Command and Management

The course uses lectures, practical exercises, case studies, and small group discussions to explore the theory of command, the command environment, principle-based decision making including negotiating and alternative perspectives, law of armed conflict, and Canadian Defence Management to enhance students' overall capacity to command. Participants apply decision-making tools to resolve command challenges, and subject matter experts provide evaluation and feedback based on experience and published research. Assessment is by participation in seminars and discussions, practical exercises and simulation and a written essay.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS543 War and Society

This course examines the shifts in the practise of warfare as a product of society. Topics to be addressed are Warfare and the Ancients, Early and Late Industrialism, Emergence of Operational Art and Into the Future - Informationalism. Assessment is by a participation in seminars and discussions, practical exercises and simulation and a written essay.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS544 Basic Joint Operational Planning

This course develops the basic knowledge and skills essential for the planning and conduct of joint and combined operations at the operational level. The first module consists of practical exercises during which students work in teams to produce operational designs and Concept of Operations (CONOP) documents for operations in the contemporary operating environment. The second module examines the significance of the operational functions in the conduct of contemporary warfare. Assessment is by oral presentations, synopses, tutorials and a course confirmatory exam.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS545 Component Capabilities

This course focuses on the functions and fundamentals of the Maritime, Land, Aerospace and Special Operations components which form the combat power in joint and combined operations. Study will look at the historic development of each of the CF components, their characteristics and finally their role in joint and combined operations. Assessment is by oral presentations, case studies and course confirmatory activities involving five written synopses.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS546 Advanced Joint Operational Planning

This course develops the advanced knowledge and skills for the planning and conduct of joint and combined operations across the spectrum of conflict at the operational level. The first module examines domestic operations, including a study of counter-terrorism and consideration of other governmental departments involved in domestic and continental operations. The second examines expeditionary operations, involving a study of stability, peace support and counter-insurgency operations. It includes consideration of the joint and multinational military forces available to a joint force commander to achieve effects across the spectrum of conflict, as well as the coordination required with other government departments and non-government organizations. The third module involves practical exercises requiring the students to work in teams to produce the Concept of Operations (CONOP) documents for domestic operations and expeditionary operations. Assessment is by oral presentations, case studies and a course confirmatory activity involving two practical exercises.

Seminar - 3 periods a week (one term)

Credit(s): 2

DS547 National Security and International Affairs

This course analyzes domestic and international factors that affect Canada and influence its policies. The first module provides the theoretical foundations for analyzing and understanding state power, strategic studies and international relations. Later modules focus on the socio-cultural factors, institutional processes, values, interests and issues that influence Canadian strategic decision making; Canada's relationship with the United States; and Canada's role in various international organizations and the global power environment within which Canadian policies are shaped and implemented. Assessment is by presentations, participation in seminars, discussions and a written essay.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS571 Canada in the Global Strategic Environment

This course examines Canada's place in the post-Cold War international political, strategic and economic environment. It begins with a review of traditional international relations theories and their applicability in understanding contemporary global affairs. The course then turns to an examination of trends in inter-state relations, the role of non-state actors including international governmental and non-governmental institutions, failed and fragile states as well as clandestine transnational political and religious movements. The course also considers characteristics of national power, their determinants, and the constraints on the use of military power in order to enable participants to distinguish the elements of national power and the impact of the constraints on the formulation of defence policy and military strategy in Canada.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS572 Canadian Governance in Comparative Context

This course examines contemporary political systems comparing their formal institutions and decision making processes. The course covers western, liberal democracies with market economies, newly emerging democratic states, various kinds of authoritarian regimes as well as the differing impact of history, geography, religion and ideology in how governments operate and the place of civil-society in the political process. The course will also assess the impact of differing domestic systems on the conduct of foreign and defence policy for Canada and Canada's allies.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS581 Executive Leadership

This course combines formal presentations, case studies and seminar discussions to enable participants to integrate theories, doctrine and practical experiences of leadership at the strategic level. The course will draw on a primary text and current Canadian Forces leadership manuals to provide the conceptual and doctrinal basis for understanding leadership.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS582 Strategic Resource Management

This course combines formal presentations, case studies and seminar discussions to refine participants understanding of strategic and institutional level resource management including policy formulation and to evaluate the functioning of the resource management system with emphasis on defence. The course will examine a range of financial, material, infrastructure and human resource topics in the context of federal government policies and programmes.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS584 The Role of Culture in Whole-of-Government Approaches

This course is designed to allow senior decision makers, both military and civilian, to study the role of culture in contexts involving Whole-of-Government approaches, at the strategic and operational levels. The course will focus on those theories and concepts of culture that are the most applicable to contexts involving Whole-of-Government approaches, at the strategic and operational levels. The course will also examine the practical dimensions of leading and managing in multicultural contexts. Topics covered include anthropological, sociological and psychological understandings of cultural realities; culture and inter-agency collaboration in domestic and international contexts; and dealing with organizational and ethnic cultural otherness. Assessment is by essay, case study report and participation in seminars and discussions.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS591 The Theory and Practice of High Command

This course is designed to allow senior decision makers, both military and civilian, to study command at the strategic and operational levels. The course will focus on those theories and concepts of command that are most applicable to the strategic and operational levels. The course will also examine the practise of high command in the 20th and early 21st centuries. Topics to be covered include the comprehensive interrelationships at the strategic level as well as interconnections with the operational level; the evolution of the practise of high command throughout the 20th century, particularly the evolution of Canada's high command system since the end of the Cold War.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS592 Comprehensive Operations

This course is designed to examine the concept of integrated operations as it applies in the current and future defence and security environment. The course will focus on the processes involved in the formulation of strategic objectives and the resultant linkages among ends, ways and means, in joint, combined, coalition, alliance and integrated (inter-agency) environments. The course will also examine the impact of modern theories of conflict, concepts and doctrine on these processes and the resultant campaign plans.

Seminar - 3 periods a week (one term)

Credit(s): 1

DS594 Strategic Art

This course is designed to examine military support to national and grand strategy. This course will focus on military support to strategy. The military instrument of power is normally employed for diplomatic purposes as part of a larger strategy. This has led to its use as a means to influence allies, neutral parties or adversaries in the attainment of non-military ends. Phenomena such as strategic coercion, nation building and even peace support operations need to be examined in this light to separate the political logic for engaging in such tasks from the military judgement of how such tasks ought to be conducted. This course will rely on historical and contemporary applications of a number of activities to illustrate the theme of the course

Seminar - 3 periods a week (one term)

Credit(s): 1

DS597 Contemporary Security Studies

This course consists of field research in which participants gather information and make analyses based on the theoretical and practical knowledge gained during the conduct of the six core courses of the NSP. Participants must use this theoretical knowledge as a basis for gathering field data and then conducting a comparative analysis of an issue related to strategic security, leadership and resource management. Using written analyses participants demonstrate their comprehension of the material taught during the core courses as well as their cognitive capacities in gathering and analyzing appropriate data and in presenting their findings in a clear and effective manner. This course consists of approximately 120 hours of field research during which participants visit strategic and operational level organizations and facilities in a variety of world regions.

Seminar - 3 periods a week (one term)

Credit(s): 1

PR500 Research Project

The aim of the Individual Research Project is to develop the participants' ability to think critically and communicate effectively in writing. This aim is accomplished by requiring the students to prepare a properly documented, persuasive essay on a topic of military significance over the course of their year at the College. Students pursuing the MDS are required to produce a paper of between 14,000 and 20,000 words in length. Those pursuing either the MA WS or MASDMP will be required to meet the requirements of their respective programme. Credits: 1 or 2 depending on the degree programme

Credits: 1 or 2 depending on the degree programme

Credit(s):

Interdepartmental Programme in War Studies

General Information
Programme Requirements
Course Descriptions

General Information

Contact Information

Programme Chair - Dr. D. Delaney, CD

Programme Associate Chair - Dr. J. Boulden

Programme Associate Chair for Military and Strategic Studies - Maj. B.J. Brister, CD, PhD

Programme Representative: 613-541-6000 ext. 6862

Fax: 613-541-6219

Email: warstudies@rmc.ca

Web page: War Studies Programme

Programme Offered

The degree Master of Arts in War Studies is awarded to officers and civilians who successfully complete a programme of studies comprised of either a Course pattern, a Thesis pattern, or a Directed Research Project (DRP) pattern. A Master of Arts Degree in War Studies through part-time registration in the Distance Learning Programme was initiated in 1992. This Programme is aimed at allowing officers and a number of civilians to continue their full-time employment while simultaneously pursuing an upper-level degree. To this end, a number of courses taught by RMC are available on the Internet.

The PhD in War Studies is awarded to officers and civilians who successfully complete the programme of study, as discussed in the following sections. The four areas of research are:

- International Relations,
- Defence Policy,
- Military History, and
- Intelligence Studies.

Admission

Candidates are admitted under the General Admission Requirements. Entry to the PhD Programme is competitive. Applicants must have completed Masters degree or equivalent. A thesis-route Masters degree is desirable but not a requirement for admission. Details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this Calendar.

Programme Requirements

Master of Arts in War Studies

The degree of Master of Arts in War Studies will be awarded to students who successfully complete a programme of studies comprised of either of the following patterns:

- Course Pattern - Ten (10) graduate course credits
- Thesis Pattern - Six (6) graduate course credits plus a thesis.
- Directed Research Project (DRP) Pattern- Eight (8) graduate course credits plus a DRP (PR500)

There is one (1) two-credit required core course (WS500) for all the degree patterns.

The MA in War Studies, when pursued full-time normally requires four (4) academic terms or two (2) academic years to complete. No MA program may exceed five (5) years.

PhD in War Studies Programme

The doctoral programme of study is comprised of the following:

- Six (6) 600-level course credits (covering a major field of study and two minor fields of study);
- One (1) 600-level methodology course (WS607);
- Three (3) field examinations (covering a major field of study and two minor fields of study). **Students must register in CP600 course code every term until completion of examinations;**
- Successful defence of a dissertation: **Students register in TH600 course code every term until defence and corrections are made to the dissertation;**
- A second language requirement.

The PhD in War Studies normally requires five (5) years to complete. Students must register as full-time students for a period of two (2) years to undertake course work and complete comprehensive examinations, followed by three (3) years to research, write and defend the dissertation.

Language Requirement

Doctoral candidates are required to show competence in one language other than their mother tongue (English or French). They must pass a language test before being permitted to write the field examinations, or they must show proof that the requirement has been met at the graduate level elsewhere.

Other Credits

The following courses in **Security and Defence Management and Policy** are acceptable for credit toward a Masters of Arts in War Studies:

- DM523: Defence Decision Making
- DM529: Canadian Defence and Foreign Policy
- DM539: Economics of Defence
- DM549: Economics of National Security
- DM565: Conflict Analysis and Management
- DM567: Managing and Resolving Violent Conflicts
- DM575: Human Security: Theory and Practise

Course Descriptions

Note: Any 500 series course, when taken at the Doctoral level, will require additional work and will be assigned a corresponding 600 series code.

WS500 The Theories of War from the Eighteenth Century to the Present
WS501 Civil-Military Relations in Canada
WS502 War, Politics and International Relations
WS504 Contemporary Warfare
WS506 Civil and Military Relations Since 1815
WS507 Methodology
WS509 Evolution and Theory of International Peacekeeping
WS510 War in the Mediterranean, 1939-1945
WS511 Contemporary Peace and Stabilization Operations
WS512 Canadian Defence Studies: Historical and Contemporary Dimensions
WS513 The Vietnam War
WS515 The United States and Small Wars
WS516 Modern Warfare and Technological Development
WS517 Canadian Political Parties, Public Opinion and Foreign Policy
WS518 War, Revolution and Peace in Modern East Asia
WS519 Studies of Genocide
WS520 Maritime Strategy and Canadian Naval Policy
WS521 Gendered Dimensions of War
WS522 The Foreign Policies of Russia Since 1917
WS524 The Impact of Total War in the Twentieth Century
WS525 British Military History from the Eighteenth Century to the Present
WS527 Military Ethics
WS528 Advanced Directed Studies
WS529 Special Topics
WS530 Psychological Factors in Warfare and Human Conflict
WS531 American Foreign Policy 1776 to the Present
WS533 Studies in American Defence Policy
WS534 Religion and Modern War
WS536 War, Man and Literature
WS537 Intelligence Studies
WS538 Intelligence: Historical and Contemporary Dimensions
WS539 Signals Intelligence
WS540 The Development of Aerospace Power: Theory and Practice
WS541 The Development of Aerospace Power: Theory and Practice
WS542 The Colonization and Decolonization of Maghreb and West Africa: from Colonial Origins to Single-Party States
WS543 First World War
WS545 History of Canadian-American Relations, 1783-present
WS547 Military History of Canada's First Nations, 1500-present
WS549 Aerospace Law and Policy
WS550 Great Powers in the Pacific: 1870 to the Present
WS551 Evolution of Cold War Nuclear Strategy
WS552 Leadership
WS553 The Art of Testimony and the Experience of War
WS554 Selected Topics on the Third World
WS555 Aspects of International History 1919-1945
WS559 Aspects of International History 1919-1945
WS561 Aspects of International History since 1945
WS562 Competitive and Economic Intelligence
WS564 Intelligence: Methodologies and Operational Case Studies
WS566 The International Security Environment
WS568 Case Studies in Regional Analysis
WS570 Great Powers and Intelligence
WS572 Issues in Canadian-American Intelligence Since Second World War
WS574 Asymmetric Threats
WS582 Profession of Arms
WS584 Canadian Foreign Policy
WS586 Special Operations
WS589 Issues of National and International Security in International Relations: Theories and Practice Since 1945
WS590 Canada and War
WS591 Issues of International and National Security in International Relations: Changing Definitions
WS593 The News Media and the Military
WS595 Armed Forces in Society
WS597 Post-Cold War Nuclear Policy

PR500 Directed Research Project
TH500 Thesis/Dissertation

EN500 Canadian Poetry: 1750-1914
EN502 Nineteenth-Century Canadian Authors
EN506 Canadian Poetry: 1915 to Present
EN518 Advanced Studies in British and American Literature
EN520 Advanced Studies in Specific Canadian Authors and Themes
FR500 Conflits dans la littérature de langue française
HI510 La société canadienne à l'ère de la guerre totale
HI518 Aspects of International History since 1919
HI522 Modern Canada: 1870 to the Present
HI524 Women, War and Society

WS500 The Theories of War from the Eighteenth Century to the Present

This course is an in-depth study of the modern interpretations of warfare, including Clausewitz, Jomini, Hamley, Moltke, Schlieffen, and Foch.There will be course work on geopolitical and maritime doctrines of war by Mackinder, Haushofer, Mahan, and Corbett. The course examines doctrines of armoured and air warfare such as Fuller, Hart, and Douhet. Developments of military technology since 1945 and their impact on strategic thinking, the theories of deterrence, revolutionary and guerrilla war, disarmament and arms controls, and the international law of war, are also examined.

Note: A core course for the Master's programme and normally a core course for the PhD programme.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS501 Civil-Military Relations in Canada

The course examines the evolution and state of civil-military relations in Canada, with a particular emphasis on contemporary trends and issues. The course explores the mechanisms of civil control of the military to develop an understanding of the shared responsibility between civilian leaders and military officers. The evolution of civil-military relations in Canada is reviewed, as well as an examination of the complex structure of decision making for defence issues. The last part is devoted to the unique relationship between the Canadian military, the government and society in a post 9/11 world.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS502 War, Politics and International Relations

This course examines the interlocking patterns of international politics and war. The traditional approach to international relations will be studied, as well as systems analysis. The topics considered will include existing international organizations, problems of disarmament, arms control and peacekeeping, and governmental co-operation in wartime.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS504 Contemporary Warfare

An analytical look at selected aspects of modern warfare, studying the evolution of warfare in the Twentieth Century and the changing nature of military requirements of warfare.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS506 Civil and Military Relations Since 1815

This Seminar course examines the civil-military relationship of selected major Powers since 1815. Reading and discussion will probe the influence of political control over the size, disposition, and strategic use of armed forces, the influence of the military in making national policies, legal and constitutional questions arising out of the relationship of the armed forces to civil authority, and the bureaucratic structure of defence organizations and their relationship to the domestic and foreign policies of the governments they serve. In this, the changing economic, political, social and technological milieu, which affected the civil-military dynamic, will be an important consideration. Each year the course will be structured around a unifying theme. Some of these include the development of national strategy, the rise and fall of states, strategic studies and the problem of power and war planning in peacetime.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS507 Methodology

The course introduces the study of war in a multi-disciplinary perspective. Various research methodologies and resources, including archival work, are introduced. Major trends and interpretations in the examination of war are explored, as are issues and problems of contemporary research.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS509 Evolution and Theory of International Peacekeeping

This course examines the evolution of international peacekeeping, and the theory of third party intervention as a mechanism for conflict management. The evolution of interventions is traced from 19th century imperial policing and small wars to League of Nations Mandates, peace observation, and the UN system. Conflict resolution theory has some impact on peacekeeping after 1956, and new forms of post-colonial peacekeeping and stabilisation missions characterize the Cold War period. These are examined from an interdisciplinary perspective.

Seminar - 3 periods a week (one term)

Credit(s): 1

WS510 War in the Mediterranean, 1939-1945

This course examines the Mediterranean theatre of war, 1939-1945, from the tactical level to that of grand strategy. It analyses in depth the campaigns conducted around, on and above the Mediterranean Ocean during the Second World War. Particular emphasis will be placed on land campaigns in North Africa, Crete, Sicily and Italy; however some seminars will address the issues of the Mediterranean theatre in alliance diplomacy as well as naval and air operations.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS511 Contemporary Peace and Stabilisation Operations

This course considers peacekeeping and international stabilisation operations since the 1980s, with a focus on operations mounted by the UN and regional organizations. The political, strategic and tactical dimensions of peacekeeping are considered, drawing on the academic disciplines of history, political science, and social psychology. The course reviews efforts to improve and reform the conduct of international peacekeeping in light of recent experience, and the normative biases of peace studies, conflict resolution, and strategic studies.

Seminar - 3 periods a week (one term)

Credit(s): 1

WS512 Canadian Defence Studies: Historical and Contemporary Dimensions

This course is a study of the interaction of military, domestic and foreign politics in Canada since the colonial regimes. This course consists of specialized reading and the preparation of working papers for Seminar discussion.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS513 The Vietnam War

This course allows students to examine the US experience of the Vietnam War, chronologically and through a number of perspectives. Topics include the origins of the war and the subsequent US escalation, the role of Vietnam in the Cold War, media coverage, presidential decision making, public opinion and domestic politics, and the fall of Saigon. The US combat infantryman's experience in Vietnam will also be examined. Analysis will also be devoted to the Vietnamese experience. The War's legacy, as well as the debate about the parallels between the Vietnam War and the current US intervention in Iraq, will be discussed as well.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS515 The United States and Small Wars

This course will examine the role of small wars in shaping both the American military and American power. Seminar topics will include political, military and public perceptions of small wars, the affect of small wars on the US military, the specialized skills and training that soldiers require to fight small wars, and the evolution of Special Forces and their role in prosecuting America's small wars. The 1940 USMC "Small Wars Manual" and 2007 "The U.S. Army/Marine Corps Counterinsurgency Field Manual" will be core texts for this course.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS516 Modern Warfare and Technological Development

This course deals with an examination of the relationships that exist between technology and the military. Military doctrine, tactics, strategy, logistics and organization will be investigated to determine the influence and effect that technological growth and innovation exerts in peace and war.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS517 Canadian Political Parties, Public Opinion, and Foreign Policy

Drawing upon both political history and political sociology, this course will explore the history, ideology, organization and social composition of parties to study

how these factors influence the different parties' perspectives on Canadian foreign policy. The contours of Canadian public opinion and party positions will be explored in an effort to map the terrain that frames debate on Canadian foreign policy. Considerable emphasis will be on the comments of party activists, MPs, and leaders; the contents of party's manifestoes and platforms in elections, and parties' voting patterns in Parliament.

Seminar - 3 hours per week (one term)

Credit(s): 1

WS518 War, Revolution and Peace in Modern East Asia

This course examines in detail, the impact of war, revolution and peace on the modern transformation of China, Japan and Korea from the late eighteenth century to the present.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS519 Studies of Genocide

This course will explore the different disciplinary approaches to genocide, the different theories of genocide, the challenging methodological issues of genocide, and the scope and magnitude of genocide. Amongst the themes to be explored are the common features of genocide, the stages in genocide, and the backdrop of ethnic violence. The course will offer case studies of the most cited examples of genocide, drawing upon insights from the Armenian genocide, the Holocaust, the Cambodian genocide and the Rwandan genocide, while also looking briefly at other examples to see how well they fit the analytical frameworks. The course will conclude on the issue of future prospects and prevention. Readings will draw from both analytical works and case studies.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS520 Maritime Strategy and Naval Policy

This course examines naval strategic theory and policy development in the nineteenth and twentieth century's. Generally, the seminar will examine the nature of sea power, its use as an instrument of international relations in war and peace, and the effects of technological, social, economic and political change upon policy formulation by the major maritime powers.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS521 Gendered Dimensions of War

This course examines gender issues and gender relations in the context of conflict and war. Drawing on literature in anthropology, sociology, international relations, development studies and women's studies, this course analyses the institution of war as a gendered phenomenon, the impact of war on gender relations and societal norms, what/who constitutes the warrior/war hero, and feminist approaches to peacekeeping and peacemaking.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS522 The Foreign Policies of Russia Since 1917

This course is a study of Russian foreign policies since the Revolution of 1917. The course will examine: Soviet relations with capitalist states, developing nations and members of the Socialist camps; the history of the Comintern and the Cominform; the role of the Communist Party in decision-making; the ideological formulation of foreign policy making as well as Soviet theories of international relations; and the changing constellation of international power since the end of the Cold War.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS524 The Impact of Total War in the Twentieth Century

This course examines the military, political, social and economic influences of total war on European society in the twentieth century. Special consideration will be given to the development of machinery for the higher direction of total wars, the problems of peacetime diplomacy and military preparation, the relationship between domestic and foreign policies, and the difficulties faced by democratic and totalitarian states in waging total war. The major emphasis will be on Germany, Britain, Russia, and France, although reference will be made to other European countries and to the United States.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS525 British Military History from the Eighteenth Century to the Present

This course is an examination of the British way in warfare from the Seven Years War to the present. Due to its particular geographical location and peculiar circumstances, Britain has pursued its military affairs in a unique fashion, quite different from the way in which the major European states have conducted their military affairs. For the British, national security has rested on the

pillars of naval supremacy, economic strength and financial power. Underpinning these strengths was a commitment to the maintenance and expansion of the British Empire, something tied intimately to Britain's financial and economic well-being. British participation in European continental wars has tended to reflect the realities of the British strategic position, with London providing financial subsidies and material aid to her allies, while confining her own efforts to naval matters as much as possible. The exceptions to this general rule were, of course, the two world wars of the twentieth century, anomalies for Britain that will be explored thoroughly in this course. Given the world-wide nature of Britain's concerns, this course will provide a case study of global defence of both historical interest and contemporary relevance.

Seminar - 3 periods a week (two terms)

Credit(s): 2

WS527 Military Ethics

This course is devoted to the study of ethics in the military profession. Topics include ethical theory, ethical decision-making, the professional military ethic, just war theory, moral development, and ethical failure. Throughout the course, students will be encouraged to apply ethical concepts to the Canadian military profession.

Seminar - 3 periods a week (one term)

Credit(s): 1

WS528 Advanced Directed Studies

In this course, the format and content vary to meet specific requirements of candidates. Normally, it involves extensive individual research under the direction of the instructor as well as submission of substantial research papers of graduate seminar quality.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS529 Special Topics

This course affords students the opportunity to examine a specific topic in war and peace not available through other courses offered. Normally, this course is conducted as a directed studies course (i.e., reading course) and involves individual research under the direction of the instructor and submission of research papers of graduate seminar quality.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS530 Psychological Factors in Warfare and Human Conflict

This course examines the application of behavioural science findings to situations of conflict between human beings. Psychological and sociological approaches to conflict between individuals and groups are examined and integrated from a social-psychological perspective. Special consideration will be given to the role of individual processes (perceptions, attitudes, motivation and morale, stress reactions, human limitations) as well as group processes (values, ideology, group cohesion, leadership, psychological warfare) in understanding both the sources of conflict and the behaviour of individuals during times of conflict.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS531 American Foreign and Defence Policy: 1776 to the Present

This course covers American foreign policy from the early days of the Republic to the present with an emphasis on the post-1968 period. In addition to examining trends and events, the course also considers the major intellectual debates about U.S. foreign relations as well as the institutions and policies processes associated with U.S. foreign policy.

Seminar - 3 periods a week (one term)

Credit(s): 1

WS533 Studies in American Defence Policy

This course examines contemporary American defence policy from a strategic, political, economic and bureaucratic perspective. It begins with a discussion of various concepts and ideas about U.S. defence policy, looks at the post-Cold War era and the War on Terrorism and moves on to consideration of the institutions and processes associated with the making and implementation of defence policy in the United States.

Seminar - 3 periods a week (one term)

Credit(s): 1

WS534 Religion and Modern War

Religion has played a crucial role in many of the conflicts found in the history of humanity, in every part of the world. Wars and other kinds of hostilities have been started, conducted and ended for religious reasons. The term "religion" itself, however, is a problematic one, and scholars have had little success developing a comprehensive definition for a term used in so many contexts and situations. Yet it is also clear that without an

understanding of the facets of religion and religious experience, our ability to understand any conflict with a religious element is severely undercut. This course begins by examining the nature of religion from social scientific and philosophical perspectives, giving students some of the key concepts and approaches required. In the remainder of the course, the role religion has played in specific historical conflicts in the 20th century is explored, illuminating the different ways in which religion has been used to identify the antagonists and justify their positions.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS536 War, Man and Literature

The phenomenon of war is explored through literature. Wars and conflicts are examined using literature source material, covering different historical periods. The course requirements and texts can be adjusted to meet the specific interests of the candidates.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS537 Intelligence Studies

This course will address intelligence from the perspective of history, theory and public policy. It will assess the different sources of intelligence, their power and limitations, the nature of assessment and acceptance, and the influence of intelligence on policy and action. It will address several cases studies of intelligence, varying by historical period and topic (including diplomatic and military issues, and matters of war and peace). It will consider such issues as intelligence and politics, intelligence failures, strategic surprise and deception. It will conclude by examining efforts to reform intelligence since the end of the cold war, ranging from ideas about a revolution in military intelligence, stemming from changes in information technology and precision guided munitions, to arguments about the need to restructure western intelligence services to handle new threats which emerged after 2001.

Seminar - 3 periods a week (one term)

Credit(s): 1

WS538 Intelligence: Historical and Contemporary Dimensions

This course offers a comparative study of the organizations which compose the Western intelligence community. Historical examinations facilitate an understanding of intelligence in national security policy. The contemporary dimension serves to explore those domestic processes and external factors which drive national intelligence efforts.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS539 Signals Intelligence

This seminar investigates the history, nature and role of signals intelligence, a discipline that involves the collection and processing of data from various signals by many means, whether by monitoring patterns of communication networks (traffic analysis) or reading the messages of foreign states (communications intelligence), especially through code-breaking. This seminar will assess the literature on the topic, and its influence on war and peace, from a multinational perspective, tracing the discipline from its infancy until the present day.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS540 The Development of Aerospace Power: Theory and Practice

This course will examine the development of air power and aerospace power with a particular focus on theories of air and aerospace power and their effect on the conduct of war throughout the century. Seminars will study the nature of air power and aerospace power, its use in war and peace, and the effects of technological, social, economic, and political change on the application of air and aerospace power. The course will develop a framework for understanding the interplay between strategy, military innovation, defence policy, and technology.

Seminar - 3 hours per week (two terms)

Credit(s): 2

WS541 Discourses of the Extreme: from the reactionaries to the end of the 2nd World War

This course aims to analyze discourses, ideologies and organizations that, since the beginning of the 19th Century, have opposed themselves radically and violently to the world order and the social evolution that stem from the philosophy of the Enlightenment. Lectures, punctuated by text analysis and oral presentations, aim to examine the factors that motivated the emergence of such thinking, the nature of the numerous demands as well as their influence on society. The reactionaries' discourse (Burke, Maistre, Bonald) will be analyzed, as well as those of anti-egalitarians, antidemocrats and anti-state propagandists (Gobineau, Renan, Spencer). The appearance, at the end of the 19th Century, of the anarchist movement (Proudhon, Bakounine, Kropotkine),

of violent trade unionism (Sorel) as well as of proto fascist ideology (Barrès, Psichari, Drumont) will also be studied in order to better understand the origin of large mass movements typical of the 20th Century. Students will then reflect on the nature of the different political discourses of the extreme produced during the Interwar period (Maurras, Schmitt, Spengler, Drieu La Rochelle, and Strauss) in order to better understand the particularities of totalitarian systems. The main question that will be raised during this course is the place occupied by the anti-moderns in the political and ideological history of the two last centuries. The studies of Isaiah Berlin, Zeev Sternhell, Albert O Hirschman and Antoine Compagnon will be presented and criticized in order to better understand their different hypotheses.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS542 The colonization and decolonization of Maghreb and West Africa: from colonial origins to single party states

The aim of this course is, through text analysis, lectures and oral presentations, to give the student a thorough knowledge of the history of the period extending from the colonization to the decolonization of Maghreb and West Africa, from the expeditions of Bugeaud, Faidherbe, Gallieni, Lyautey and Archinard, to independence and the establishment of single-party states. Beyond historical knowledge, basic concepts typical to the discursive analysis of colonial wars and asymmetrical wars will be studied. The reading of essays, newspapers, treaties, memories, pamphlets, novels, from France, Maghreb and West Africa, will help students to understand the arguments that justified colonization (Tocqueville, Bugeaud, Lyautey, etc.) as well as those who favoured rebellion and colonial wars (Fanon, Césaire, Senghor, Ben Bella, etc.). The goal is to understand the unwinding of colonization over a period of more than a century and a half, what compromises were made with local populations, as well as the mistakes and reciprocal misunderstandings that led to the wars of independence. The last part of this course will concentrate on the notion of single-party in order to understand how colonization ended, shortly after obtaining freedom, with the instalment of dictators (Boumediene, Bokassa, Houphouët-Boigny, Gnassingbé Eyadema, Ahmed Sékou Touré, etc.). At the end of the course, through a focus on a variety of literary and other texts students will have acquired an excellent knowledge of what is at stake in different countries that have suffered colonization and, above all, a greater ability to analyze complex subjects: asymmetrical wars, irreducible heterogeneity of certain values, justification of colonial practices, plurality of beliefs and dictatorial systems.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS543 First World War

This seminar examines the history of the First World War from a global perspective. Issues explored will include military operations in all the major European and non-European theatres, from the Western Front to the war at sea and the campaigns in Africa, Asia, and the Middle East. Political and social upheavals caused by the war will receive detailed attention, as will the economic and industrial mobilization of the European and North American home fronts. From this course, students will gain an in-depth knowledge of the military, social, political, and economic aspects of a catastrophic war that shattered four empires and brought to an end the era of European dominance in world history.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS545 History of Canadian-American Relations, 1783-present

This course explores selected issues in the history of Canadian-American relations from the American Revolution to the 1990s. Topics to be explored include diplomatic and military relations, continental defence, the evolution of national and continental cultures and economies, the movement of peoples and ideas across the border, cross-border environmental issues, and how Canadians and Americans have viewed one another over time.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS547Military History of Canada's First Nations, 1500-present

This course explores selected issues in the military history of Canada's First Nations and Métis people from the 1500s to the late twentieth century. Topics to be explored include approaches to warfare and diplomacy in the pre and post-Contact period, conflict and alliances with European colonial powers in North America in the period 1600-1867, conflict in the northwest in the late nineteenth century, participation in the World Wars, and the role of Native peoples in the Canadian Forces in the twentieth century.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS549 Aerospace Law and Policy

A comprehensive study of the international laws and policies regulating air, space, and cyber military operations. The first part of the course will review principles of public international law. Topics covered in the first part are: the formation of international law, subjects of international law, the UN system, the use of force. The second part of the course will concentrate on the laws applicable to military air operations. Topics covered in the second part are: the definition of national air space, international air space, the issue of Canadian northern sovereignty, the legal status of military aircraft, air operations ROE, UN air operations, reconnaissance flights, and interception of aircraft. The third part of the course will concentrate on military space operations. Topics studied in the third part are: space law treaties, UNCOPUOS, remote sensing, US commercial regulations on remote sensing, the RADARSAT projects, the projection of force to, in, and from space, and the military/commercial interface. The fourth part of the course will cover the topic of information and cyber military operations.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS550 Great Powers in the Pacific: 1870 to the Present

This course will provide students with a detailed examination of the Far Eastern balance of power that existed between China, Japan, Russia, Britain and the United States from 1870 to present day. Military, economic, political, naval and social factors will be woven into a comprehensive analysis of the inter-related Far Eastern interests of these powers. Minor powers, such as France, Germany, and Holland, will also be discussed where appropriate, as will American involvement in Korea and Vietnam. The object of the course is to provide the historical context, which will allow a full understanding of the development of the Pacific region and its relationship with Western Powers.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS551 Evolution of Cold War Nuclear Strategy

This course will examine the evolution of nuclear strategy during the Cold War. It will concentrate mainly on strategic doctrine as it was developed by the two superpowers, the USA and the USSR. It will also consider doctrinal developments of the other Cold War nuclear powers' the Peoples' Republic of China, France and the United Kingdom. A central part of the course will involve students becoming knowledgeable about the core military technologies of the Cold War era, that is, strategic ballistic missiles and nuclear weapons. As part of this process, students will be introduced to some of the important analytical approaches in the development of Cold War strategy such as the theory of games, force exchange modelling and correlation of forces analysis.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS552 Leadership

This course examines leadership and related concepts, primarily from a psychological perspective, but topics may be explored from a broader, social science approach where the literature permits such integration. The first part of the course will examine employee motivation and then focus on leadership topics such as problems in defining and measuring leadership, different theoretical approaches to leadership, transformational leadership, substitutes for leadership, gender and leadership, leadership training, command and control, ethics and leadership, and executive leadership.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS553 The Art of Testimony and the Experience of War

This seminar aims, through lectures and oral presentations, to study the testimony of war. An overview of the first theorists will examine testimonies, providing an image of war from those who have seen it. Testimonies will be studied according to the different ways in which war is talked about (narrative techniques, memories, coherence efforts, effects of reality). A comprehensive examination of discursive laws that question truth and plausibility will serve as a basis to study the testimony of war as a genre and confront modern theories questioning the finality of testimony as truth (Certeau, Bourdieux, Honneth, Ricoeur, and Mesnard). The student will gain a better understanding of testimonies themselves and their scope.

Seminar - 3 periods per week (one term)

Credit(s): 1

WS554 Selected Topics on the Third World

This course deals with a range of issues related to the experiences and future directions of countries in the "South" or the "Third World". Topics include, but are not limited to, the study of major theories that have sought to understand and to guide political, social, and economic changes during and since the great decolonization beginning in 1945; the question of the relation between

politics and economics, the construction of political identities, the myths, and realities of globalisation, the meaning and value of development, the ecological dimension, and the scope for political action.

Seminar - 3 periods per week (two terms)

Credit(s): 2

ECG555 La gloire et le bûcher: la représentation de l'héroïsme guerrier et du sacrifice sanglant dans l'Antiquité

Available in French Only

This seminar aims to study the representation of war and sacrifice in Antiquity and Late Antiquity. An overview of Greek and Latin historians, thinkers and poets of the period from the Persian wars to the establishment of the kingdom of the Francs will allow for an analysis of the morality of these heroes and their relationship to the sacred. War and sacrifice are topics that have been addressed from Herodotus to Gregory of Tours to promulgate the ethics of the warrior and of the act of sacrifice. The study of heroes from Antiquity will allow an approach to each of their representations as a pretext, a way of promulgating an ethic of violence and self-offering. By studying which specific heroic acts the authors chose to emulate or condemn, students will acquire a better knowledge of the authors from Greek and Roman Antiquity and a more thorough understanding of the impact of this specific construction of wartime heroism and bloody sacrifices.

Seminar- 3 hours per week (one term)

Credit(s): 1

WS559 Aspects of International History 1919 - 1945

This course will examine selected topics in international history from the Paris Peace Conference of 1919 until the end of the Second World War . Although the fundamental connection between personality and policy will be emphasized, the seminars and course readings will integrate into this the diplomatic, economic, social, and strategic elements of modern international history by looking at such diverse issues as the inter-war search for stability in Europe and the Fast East, disarmament discussions, reparations and war debts, appeasement of, and the origins and course of the Second World War.

Seminar- 3 hours per week (one term)

Credit(s): 1

WS561 Aspects of International History Since 1945

This course will examine selected topics in international history from the end of the Second World War until the recent past. Although the fundamental connection between personality and policy will be emphasized, the seminars and course readings will integrate into this the diplomatic, economic, social and strategic elements of modern international history by looking at such diverse issues as the origins and course of the Cold War, decolonisation, alliance diplomacy, international organization, and the evolution of foreign policy and strategic doctrine.

Seminar - 3 hours per week (one term)

Credit(s): 1

WS562 Competitive and Economic Intelligence

This course examines both corporate competitive intelligence methods and practices and national economic intelligence requirements. The separation of these activities within the Canadian intelligence community is not necessarily shared by our competitors. The United States and Britain agreed not to employ national agencies in competitive intelligence only in 1946, while other countries tie their collection of corporate competitive intelligence to national economic intelligence. This course considers the disparate methodologies employed in both fields.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS564 Intelligence Methodologies and Operational Case Studies

This course examines the methodologies of intelligence operations, including issues of deception, human and technical intelligence gathering, counter-intelligence, and more. Case studies will include the operations of a number of countries including the United States, Great Britain, France, Germany and Israel.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS566 The International Security Environment

This course brings diverse analytical methodologies to bear in evaluating the evolving international security environment. It will examine the ways by which both individual states and alliances assess security threats, devise policy, and implement this policy. The connection between the intelligence services (individually and by intra-service and extra-service co-operation) and the

governmental decision-making apparatuses will be emphasised. In addition, through case study analysis, both intelligence successes and failures will be studied.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS568 Case Studies in Regional Analysis

This course takes a crisis-centred approach to introduce students to the May-Neustadt model of analysis (the Harvard model). This time-line technique is now widely used throughout the United States government. Regional case studies (for instance, Central America, South America, north, central or southern Africa, the Middle East, and south, south-east, or east Asia) will be chosen for each student to work through and present analysis based on open sources.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS570 Great Powers and Intelligence

This course addresses three broad historical areas. First, it identifies the differing intelligence cultures within the so-called `Great' and `Super' Powers since 1815: France, Great Britain, Japan, Prussia/Germany, Russia, and the United States. Second, it addresses the utilisation of intelligence within both these powers and any alliances in which they entered. Finally, it addresses the impact of intelligence on foreign policy formulation in war and peace over the past almost two hundred years.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS572 Issues in Canadian American Intelligence Since the Second World War

The history of Canadian-American intelligence relations has evolved in the larger context of the North Atlantic triangle. The Second World War is the modern turning point for Canadian intelligence because, for the first time, Canada began foreign military intelligence operations and also adopted new technologies. This course will look at the Canadian-American intelligence relationship; the structure and functions of Canadian intelligence agencies, which were based originally on a British model; the transition from the British to the Canadian model; some unique questions relating to domestic operations; and how the two North American powers, in terms of intelligence, have become more closely integrated. After examining historical issues relating to the relationship during Cold War, more contemporary topics can be explored.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS574 Asymmetric Threats

The burgeoning literature on Asymmetric Warfare and the events of 9/11 have sparked wide interest in Asymmetric Warfare. This course offers an introduction to the topic with particular attention paid to the forms of asymmetric threats, primarily via Weapons of Mass Destruction (Nuclear, Chemical, and Biological), and threats to critical infrastructure through weapons of mass disruption. Discussion focuses on the theory and practice by first situating the discussion within the wider framework of strategic theory and literature, particularly that on terrorism and low intensity war theory. The course proceeds through an extended review of the nature of chemical, biological and nuclear threats, and emerging threats to critical infrastructure. The central focus of the initial weeks of the course is the introduction and incorporation of some advanced qualitative analytical models. As well, control regimes (Arms Control), and consequence management are explored within the context of the various threats.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS582 The Profession of Arms

This course will examine the military profession from a multi-disciplinary perspective. Students will study relevant theory and research from the disciplines of philosophy, psychology, sociology, politics and history. A significant portion of the course will be devoted to the study of ethics in the military profession. Specific topics will include: ethical decision-processes, the professional military ethic, just war theory, moral development, ethical failure, military culture and ethos, diversity in the military, civil-military relations, the non-commissioned officer corps, and the general officer corps.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS584 Canadian Foreign Policy

This course examines the origins, evolution, context, and intellectual content of Canadian foreign policy and diplomatic practices.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS586 Special Operations

The objective of this course is to garner an appreciation of the principles, roles, and operations of special forces in

the Twentieth and Twenty-First Centuries. The course examines the evolution of British, American, German, French, Canadian and other special forces and studies operations conducted from WWI to the present by these various special forces units.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS588 The Second World War

This seminar examines the Second World War from the tactical level to that of grand strategy. Issues of diplomacy, coalition warfare, national mobilization, campaign planning and battle will be examined from the perspectives of all the major powers. Particular emphasis will be placed on the war efforts of Great Britain, the United States, Germany, the Soviet Union, Japan, Italy, France and Canada.

Seminar - 3 periods per week (two terms)

Credit(s): 2

WS589 Issues of National and International Security in International Relations: Theories and Practice Since 1945

This course will examine the changing way in which states have addressed international security issues since 1945. This will involve an examination of the primary theoretical approaches to explaining international relations. The theoretical discussion will be accompanied by study of the practical efforts that have been taken by states, such as the development of international organizations and laws, to deal with security issues, and the changes that have occurred in the nature of the state system during that same time.

Seminar - 3 periods a week (one term)

Credit(s): 1

WS590 Canada and War

This seminar examines the military, social, and political dimensions of Canada's war experience since 1860, with particular emphasis on the Boer War, the Great War, the Second World War, the Korean Conflict, and peace support operations. Specific themes will include imperial and coalition warfare, national mobilization, battle doctrine, naval and air operations, the home-front, the memory of war, and the individual soldier's war.

Seminar - 3 periods a week (two terms)

Credit(s): 2

WS591 Issues of International and National Security in International Relations: Changing Definitions

This course will focus on the changing definitions of security. This will include an examination of the development of international norms relating to intervention, the affect of non-state actors in the system, and the changes in the concept of national security at the state level that have occurred as a result.

Seminar - 3 periods a week (one term)

Credit(s): 1

WS593 The News Media and the Military

This course examines the relationship between the news media and the military within the broader context of the pervasive presence of mass media of communication in the political and cultural realms. A critical personal inventory of the students- habits as mass media consumers forms the basis for the course and for each class. The course studies the rhetoric of mass media communication from Plato to today before shifting focus to an investigation of the newsroom, the business and marketing pressures affecting its operation, and the constitutional and legal rights and responsibilities related to freedom of the press. Students will survey and examine in detail examples and case studies of the evolving relationship between the news media and the military in Canada and elsewhere. The aim of this course is to enable students to critically analyze various print and electronic news products, including their modes and styles of presentation, and to evaluate their relationship to the military.

Seminar - 3 hours per week (one term)

Credit(s): 1

WS595 Armed Forces in Society

This course examines the relationship between Armed Forces and society in a contemporary and comparative perspective. Beginning with an analysis of the classic and recent literature on civil-military relations, the course looks at trends in the United States, Canada, Western Europe, the newly emerging democracies of Eastern Europe and the former Soviet Union. It also examines the relationship amongst the military, government and civil society in Asia and the Middle East.

Seminar - 3 hours per week (one term)

Credit(s): 1

WS597 Post-Cold War Nuclear Policy

This course will examine the role of nuclear weapons in the overall security policy of nuclear and near-nuclear states in the post-Cold War (Second Nuclear) era. The potential strategic uses of nuclear weapons in this era will be markedly different than those seen in the Cold War. Indeed, it is already clear that the central nuclear security paradigm of the Cold War (retaliatory deterrence) is no longer viable. An increase in the number of nuclear states; changes in delivery technology; changes in warhead technology and substantial changes in the overall security environment are examples of the new strategic imperatives that have combined to create novel nuclear security challenges for post-Cold War states. That this new strategic context will be shaped mainly by the strategic policy postures of old and new nuclear states and possibly non-state actors is the undeniable reality of the Second Nuclear Era. It is this interplay of nuclear strategy, nuclear weapon technology and changed perspectives on the utility of strategic nuclear war that is the central focus of this course. Examples of the issues that students will analyse in the course are the strategic implications of vertical and horizontal proliferation, the Nth + 1 country problem, the shift in the structure of deterrence, nuclear terrorism and the possible move to nuclear war-fighting strategies. As part of the analytical component of the course students will be introduced to strategic analytical methods such as nuclear pre-attack static indicators, strategic correlation of forces analysis, theory of games, conflict analysis and some force targeting models.

Seminar - 3 Periods per week (one term)

Credit(s): 1

PR500 Directed Research Project

Students who choose the Directed Research Pattern MA must complete a directed research project (DRP), which demonstrates graduate-level ability to research, analyze, and write. The DRP will be 40-50 pages in length and should include some primary source research.

No equivalent for Ph.D Students

Credit(s):

TH500 Thesis/Dissertation

TH500: Thesis/Dissertation when done at the Masters Level or TH600: Thesis/Dissertation when done at the Doctoral Level

CP600: Comprehensive Examination (Doctoral Level)

Credit(s):

EN500 Canadian Poetry: 1750-1914

A study of the development of verse in 18th and 19th Century Canada, with particular attention to regional development before Confederation and the efforts of poets to identify a national perspective after Confederation.

Seminar - 3 periods per week (two terms)

Credit(s): 2

EN502 Selected Nineteenth Century Canadian authors

A detailed study of the literary achievements of one or more Canadian authors who have made a significant contribution to Canadian Literature.

Seminar - 3 periods per week (two terms)

Credit(s): 2

EN506 Canadian Poetry: 1915 to Present

This course will examine selected Canadian poets, beginning with E.J. Pratt. Approaches to the texts will include the cultural background, critical viewpoints, and the examination of techniques and themes.

Seminar - 3 periods per week (two terms)

Credit(s): 2

EN518 Advanced Studies in British and American Literature

In this course, the format and content vary to meet the specific requirements of candidates. Normally, it involves extensive individual research under the direction of the instructor as well as submission of substantial research papers.

Seminar - 3 periods per week (two terms)

Credit(s): 2

EN520 Advanced Studies in Specific Canadian Authors and Themes

This course will explore and critically evaluate the works of an individual author or of a group of authors who are concerned with similar subject matter and/or themes.

Seminar - 3 periods per week (two terms)

Credit(s): 2

FR500 Les conflits dans la littérature de langue française

This course will deal with the way in which French literary works present various expressions of conflict

(wars, uprisings, collective or individual rebellions, for example) and their consequences, both on an individual level and on a social level. Students will be expected to carry out extensive research and to produce detailed analyses.

Seminar - 3 periods per week (two terms)

Credit(s): 2

HI510 Canadian Society in the Age of Total War

This course will examine selected themes concerning the impact of the First and Second World Wars on Canadian society and politics. Among themes dealt with will be the impact of total war on government, party politics, civil-military relations, external policies, human rights, popular culture, social and sectional conflicts, demographic development, women and ethnic groups, industrial and urban growth.

Seminar - 3 periods per week (two terms)

Credit(s): 2

HI518 Aspects of International History Since 1919

This course will examine selected topics in international history from the Paris Peace Conference of 1919 until the recent past. Although the fundamental connection between personality and policy will be emphasised, the seminars and course of readings will integrate into this the diplomatic, economic, social, and strategic elements of modern international history by looking at such diverse issues as interwar disarmament discussions, appeasement, the origins and course of the Cold War, alliance diplomacy, international organisation, and strategic doctrine.

Seminar - 3 periods per week (two terms)

Credit(s): 2

HI520 Developing Societies in North America to the Mid-Nineteenth Century

This course examines the economic, social, political and cultural history of Canada and the United States from the early colonial period to the mid-19th century. Themes to be considered will include the nature of the European people who settled the continent; their relations with Amerindians; the development of community leading to eventual political autonomy, and the emergence of the nation state.

Seminar - 3 periods per week (two terms)

Credit(s): 2

HI522 Modern Canada: 1870 to the Present

A seminar course that will consider selected topics in the development of modern Canada: Discussion will revolve around issues arising from industrialisation, immigration, urbanisation and growing regionalisation and the impact of ethnic, racial, social and economic diversity on the development of the Canadian community.

Seminar - 3 periods per week (two terms)

Credit(s): 2

HI524 Women, War and Society

An exploration of selected themes in the history of women, war and society from the early modern period to the present Topics will include changing understandings of the woman warrior; the impact of war on women and their place in the social, economic and political order; understandings of gender as they relate both to war and military institutions; and the intricate relationships of women and war in a "post-modern" world.

Seminar - 3 periods per week (two terms)

Credit(s): 2

RMCC - CFC Joint Programmes

General Information

Contact Information

RMC - CFC joint Programmes (Royal Military College of Canada - Canadian Forces College Joint Programmes)

Web page: Canadian Forces College

Introduction

The Royal Military College of Canada (RMC) has offered academic courses at the Canadian Forces College (CFC) since 1992. Over the years, joint efforts to grant academic credits for portions of the Joint Command and Staff Programme (JCSP) and the National Security Programme (NSP) have been recognized at the university level.

Admission

Career officers admitted to CFC courses by competitive selection are deemed to be RMC special category students and will receive RMC credits for the equivalent courses, whether admitted to a program or not. However they must apply to be admitted to a degree programme. Students will be admitted to degree programmes under the general regulations. Officers taking the JCSP or NSP may obtain credits toward various RMC degree programmes as described in this calendar. The normal minimum requirement for entry into RMC graduate studies degree programmes is a four-year undergraduate degree with a B- average from a recognized University. Some departments impose additional requirements. Please see the various admission requirements by department.

Entry into the graduate programmes is by application and subject to the approval of the Dean of Graduate Studies. Details of specific programmes can be found in the RMC Graduate Studies Calendar and Continuing Studies information pamphlets. The admission form and corresponding instructions can be found at: Division of Graduate Studies - Forms

Course Credits and Programme Patterns

Courses offered at CFC under the control of the Department of Defence Studies may be awarded Defence Studies (DS) credits. Not all of the content of these courses is applicable to other degree programmes.

Table of Credits

The following table indicates the number of credits each CFC course taken since 2005 (in its entirety) may contribute toward each degree programme at RMC:

	MDS	MA(SDMP)	MA(WS)	MBA
JCSP	8	4	4	0
AMSP[1]	No Longer Eligible			
NSSP[1]	No Longer Eligible			
NSP		7		
JRCSP[2]	No Longer Eligible			

Notes:

1. AMSP and NSSP were replaced in 2008 by the 10 month NSP.
2. NSP is designed to be a special stream in the MASDMP degree programme. Graduates of NSP will receive 7 credits towards the degree. Credit towards the other programmes will be granted based on a case by case review of the student file and the degree requirements.

RMC transcripts will show CFC course registrations as DS credits, then the appropriate number of transfer credits toward the program to which a student has been admitted. For example, an NSSP graduate applying credits toward the MA(SDMP) will have a transcript showing four (4) courses completed under the NSSP, then two (2) transfer credits for the NSSP under the MA(SDMP) registration. Courses used toward one degree cannot be applied toward another.

Programme Patterns

Students must also be aware of the requirements of the programme patterns for each degree. Please refer to the appropriate Interdepartmental Programme or Department in this calendar for information on the corresponding programme patterns.

- Master of Arts in War Studies

- Master of Arts in Security and Defence Management and Policy
- Master of Business Administration
- Master of Defence Studies

Academic Information

Tuition Fees

Students will pay RMC tuition fees for those courses for which they register through RMC. The current RMC fee structure is published by the Office of the Registrar and can be viewed at the RMCC Academic Fees web page.

Academic Counselling

Students at CFC should consult with CFC Academic Staff. Information on course offerings is found in the Graduate Studies Calendar and other RMC Continuing Studies information pamphlets as well as the Division of Continuing Studies website.

Chairs of programmes should be consulted for advice on appropriate course and programme pattern selection.

Special Regulations

Those wishing to take advantage of the RMC-CFC joint programme must apply for admission to the RMC graduate programmes within three years of completion of the CFC course, that would give the credits listed in this guide. This date is based on the officially promulgated end date of the applicable CFC course. The CFC will retain all relevant student documents for each course for a minimum period of three years to support this application process. Registration in any course will be provisional until the Graduate Studies Committee has approved the student's admission into a particular programme. Should the student not complete his studies while at CFC, it is the student's responsibility to ensure he registers every term thereafter and pay appropriate fees. Student's wishing to elect the delayed mode must be accepted into a RMC graduate programme and have commenced their top-up work within the three year time limit noted above, otherwise no credits will be given for the CFC course work.

Governing Bodies

The RMC Senate is the governing body for academic regulations for the RMC-CFC Joint Programmes. The RMC-CFC Inter College Committee (ICC) will govern the application of the regulations of this programme. The Graduate Studies Committee with the assistance of the War Studies Committee, the Security and Defence Management and Policy Committee, the Defence Studies Department and the Business Administration Department are responsible for the administration, course approval, and management of their respective degree programmes.

Appraisal

For the purposes of these academic programmes, CFC is considered a campus of RMC. Therefore, as part of the RMC academic offerings the joint RMC-CFC programmes are subject to periodic review by the Ontario Council of Graduate Studies (OCGS).

Faculty of Science

* Faculty members with complete privileges

Department of Mathematics and Computer Science
Department of Physics
Department of Chemistry and Chemical Engineering

Department of Mathematics and Computer Science

Head of Department

* Associate Professor - G.E. Simons, BMath, MSc, PhD

Deputy Head of the Department

* Assistant Professor - A. Gosselin, CD, cmr, BSc, MSc, PhD

Professor Emeritus

* A.J. Barrett, CD, rmc, BSc, MSc, PhD

* R. Benesch, BSc, MSc, PhD

* R. Gervais, ndc, BA, BSc, MSc, PhD

* R. Godard, Lic ès Sci, Dr 3rd Cycle, PhD

* S.D. Jog, BSc, MSc, MSc, PhD

* M. A. Labbé, BSc, MSc, PhD

Professor

* J. Brimberg, BEng, MEng, PEng, MBA, PhD

* M.L. Chaudhry, BA, MA, PhD

* B.J. Fugère, BSc, MSc, PhD - Vice Principal (Research), Dean of Graduate Studies and Research

* P. Gravel, ndc, BMath, MMath, PhD

* L.E. Haddad, Lic ès Sci, MSc, PhD

* R.E. Johnson, BSc, MS, PhD

* G. Labonté, BSc, MS, PhD

* R.M. Shoucri, BSc, MSc, MSc, PhD, PEng

* C. Tardif, BSc, MSc, PhD

* D.L. Wehlau, BSc, MA, PhD

Professor (Adjunct)

* M. Krajecki, PhD

* L.E. Magee, BSc, MA, PhD

* D.B. Skillicorn, BSc, PhD

* R. Tremblay, BSc, PhD

Associate Professor

* D. Kelly, BSc, BEd, MEng, PhD

* G.S. Knight, CD, rmc, BEng, MEng, PhD, PEng (cross-appointed from Electrical & Computer Engineering)

* Y. Liang, BSc, MSc, PhD

S. Mainville, PhD (cross-appointed from RMC St-Jean)

Assistant Professor

* P. Baille, Lic ès Sci, Dr 3rd Cycle, PhD

Major L. Cordeau, CD, rmc, BEng, MSc(Eng)

* L. Massey, BSc, MSc, PhD

* B.G. Ong, BSc, SM, PhD, PEng

* F. Rivest, BSc, MSc, PhD

* A. Zouaq, Analyste Inf., MSc, PhD

Assistant Professor (Adjunct)

*G. Fusina, BASc, PhD

F. Jetzer (RMC St-Jean)

D. Lavigne (RMC St-Jean)

R. Saad (RMC St-Jean)

C. Selkirk, BEng, MEng, PhD, PEng

Department of Physics

Head of Department

* Professor - M.W. Stacey, BSc, PhD

Professor Emeritus

D.C. Baird, BSc, PhD

M.H. Edwards, ndc, BA, MA, PhD

* R. Favreau, BSc, MSc, PhD

* N. Gauthier, BA, BSc, MSc, PhD

R.F. Harris-Lowe, rmc, BSc, PhD

* A.R. Lachaîne, BSc, MSc, PhD

* R.F. Marsden, rmc, BSc, PhD

S.L. McBride, BSc, PhD

* B.K. Mukherjee, BSc, PhD

* S. Ranganathan, ndc, BSc, MSc, MTech, PhD

* P.L. Rochon, BSc, PhD, PEng

D.H. Rogers, BSc, MSc, PhD

* P.J. Schurer, BSc, MSc, PhD

D.E. Tilley, BSc, PhD

R.R. Turkington, BSc, MSc, PhD

L.S. Wright, BSc, MAT, PhD

Professor

* G. Akhras, DipIng, MScA, PhD, PEng, FCSCE, FASCE, FEIC - (cross appointed from Civil Engineering)

* J.R. Buckley, BSc, PhD

* T. Krause, BSc, MSc, PhD

* D. McGaughey, BSc, MSc, PEng, PhD - (cross appointed from Electrical and Computer Engineering)

* J-M.A. Noël, BSc, MSc, PhD

* T.J. Racey, BSc, BEd, MSc, PhD - Dean of The Faculty of Science

* G. Wade, BSc, MSc, PhD

Professor (Adjunct)

* J.J. Grodski, BASc, MSc, PEng, PhD* J.K.E. Tunaley, BSc, PhD

Associate Professor

* L. Levesque, BSc, MSc, PhD

* Captain A. Mac Giolla Chainnigh, CD, rmc, BEng, MSc, PhD

Associate Professor (Adjunct)

* A. Crawford, BSc, MSc, PhD

J.R. Gosselin, BScA, PhD

Assistant Professor

K. Kabin, PhD

*Major J. de Boer, PhD

Lt(N) S. Donohue, BSc, MSc

Major M. Labrecque, BSc, MSc

G. Sabat, BSc, MSc, PhD

L. Sangalli, MSc, PhD

* J. Shore, BMath, PhD

* K. Spekkens, BSc, MSc, PhD

* R. Vincent, BSc, MSc, PhD (Director of the Centre of Space Research)

Assistant Professor (Adjunct)

* Lieutenant Commander (Ret'd) D. Burrell, CD, BSc, MSc, PhD

P. Chandra, BSc, MSc, PhD

* Captain (Ret'd) S. Dubois, rmc, BEng, MASc, PhD

Lieutenant-Colonel (Ret'd) P.W. Somers, BSc, MSc

Research Associate

V. Babbar, PhD, PEng

Y. Shao, PhD

A. Tetervak, MSc, PhD

Research Assistant

A. Russell, BSc, MSc

J. Silvester, BSc, MSc

Department of Chemistry and Chemical Engineering

Head of the Department & Associate Professor

*J.Y.S.D. Pagé, CD, rmc, BEng, MEng, PEng, PhD

Professor Emeritus

*J.C. Amphlett, BSc, PhD

*L.G.I. Bennett, CD, rmc, BEng, MASc, PhD, PEng

*V.T. Bui, BScA, MScA, PhD, ing

*M.J.B. Evans, BSc, PhD, CChem, FRSC

*J.P. Laplante, BSc, MSc, PhD

*R.F. Mann, rmc, BSc, MSc, PhD, FCIC, PEng

*R.H. Pottier, BSc, PhD, CChem

*W.T. Thompson, BASc, MASc, PhD, PEng

Professor

*W.S. Andrews, CD, rmc, BEng, MEng, PhD, PEng

* P.J. Bates BSc, MEng, PhD, PEng - Canada Research Chair and Dean of Engineering

*H.W. Bonin, BA, BSc, BScA, MIng, PhD, ing, PEng, FCIC, FCNS

*P.K. Chan, BSc, MSc, PhD K.A.M. Creber, BSc, MSc, PhD

*K.A.M. Creber, BSc, MSc, PhD

*B.J. Lewis, BSc, MEng, PhD, PEng - Canada Research Chair

*K.J. Reimer, BSc, MSc, PhD, FCIC

*P.R. Roberge, BA, BSc, MChA, PhD, PEng

*G.M. Torrie, BSc, MSc, PhD

*R.D. Weir, CD, BSc, DIC, PhD, FCIC, FEIC, FIUPAC, FRSC, CChem, PEng

*B.A. Zeeb, BSc, PhD - Canada Research Chair

Professor (Adjunct)

W.R. Cullen, MSc, PhD

R. Morchat, PhD

Associate Professor

M. Greenwood, BSc, MSc, PhD

*K.M. Jaansalu, CD, rmc, BEng, MEng, PhD

*C.P. Thurgood, BSc, MSc, PhD, PEng

Associate Professor (Adjunct)

Colonel W.J. Lewis, CD, rmc, BEng, MBA, MEng, BEd, MEd, PhD

V.I. Titorenko, BSc, BSc, MSc, PhD

E.J. Waller, BSc, MScE, PhD

Assistant Professor

*J. Beltran, BEng, MEng, PhD

*E. Corcoran, BSc, PhD

Captain P.C. Hungler, BEng, MASc, rmc

*V. Langlois, BSc, PhD

*O. Lebel, BSc, PhD

*C. Malardier-Jugroot, BSc, PhD

*J.L. Scott, BSc, PhD

*K.P. Weber, BASc, MASc, PhD

F. S. Zeman, BSc, MSc, EngScD

Assistant Professor (Adjunct)

N. Chan, BSc, PhD

C.J.P. Cole, CD, rmc, BEng, MSc, MEng, PhD

G. Danialou, MSc, PhD

I. Koch, BSc, PhD

L. Knopper, BSc, MSc, PhD

G.L.P. Lord, BA, BSc, MSc, PhD

C. Ollson, BSc, MSc, PhD

A. Rutter, BSc, MSc, PhD

P. Smith, MSc, PhD

J. Wojtyk, BSc, PhD

Lecturer

Captain S.A. Milley, BSch, MASc

Lieutenant (N) S. Paquette, CD, BEng, MASc

Defence Scientist

*E.F.G. Dickson, BSc, PhD

*D.G. Kelly, BSc, PhD

Director Slowpoke Facility

K. Nielsen, BSc, MSc

ESG Program Manager

D.A. Reimer, BScH

Radiation Safety Officer

D. Ferguson, Chem Eng Tech

Department of Mathematics and Computer Science

General Information

Contact Information

Department Head - Dr. G. Simons

Telephone: 613-541-6000 ext 6458

Fax: 613-541-6584

Web Page: Department of Mathematics And Computer Science

Programmes Offered

The department of Mathematics and Computer Science offers the Master's and Doctoral degrees in Science, with specialty fields of Mathematics and Computer Science.

Graduate research may be pursued in the following areas:

- artificial intelligence
- constraint programming
- data base
- intelligent tutoring systems
- numerical simulation
- signal and image processing
- user modelling
- mathematical physics
- mathematical modelling
- neural networks
- operations research
- optimisation
- statistics
- stochastic processes

Admission

Candidates for the degrees Master of Science and Doctor of Philosophy will be admitted under the General Admission Requirements. Details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this Calendar

Programme Requirements

The Master of Science degree with a specialty in either Mathematics or Computer Science, will be awarded to candidates who successfully complete a programme of studies normally comprised of six term courses plus a thesis. The Master's degree when pursued full-time in the residential programme normally requires two academic years plus the intervening summer to complete. The Doctoral degree will be awarded to candidates who successfully complete a programme of studies normally comprised of at least ten term courses at the graduate level in addition to a thesis.

Course Descriptions

MA501 Advanced Math Topics
MA503 Optimization Theory and Applications
MA505 Topics in Differential Geometry
MA511 Topics in Optimization
MA513 Game Theory
MA515 Interval Analysis
MA517 Mathematical Models for Combat
MA525 Deterministic Numerical Simulation
MA527 Prime Numbers and Cryptography
MA531 Logic and its Application to Computer Science
MA533 Probability and Discrete-time Processes
MA535 Stochastic Processes I
MA537 Stochastic Processes II
MA539 Multiobjective Optimization (Pareto Optimization)
MA543 Discrete-Time Stochastic Processes Modeling
CS501 Advanced Topics in Computer Science
CS503 Development of Scientific Software
CS551 Pattern Recognition and Image Processing
CS553 Modeling and Simulation
CS565 Data Base Management Systems
CS567 Applications of Artificial Intelligence in Command and Control
CS571 Computer Graphics
CS575 Computer Simulation for Guided Weapon Systems
CS581 Foundations of Artificial Intelligence
CS585 Software Engineering Mathematics
CS591 Algorithm and Analysis
CS595 Complexity Theory
CS597 Topics in Softcomputing with Emphasis on Neural Networks
CS599 Cryptology
PR500 Project
TH500 Thesis (Master's Level)
TH600 Thesis (Doctoral Level)
CP600 Comprehensive Exam (Doctoral Level)

MA501 Advanced Topics In Mathematics

This is a reading and tutorial course with topics in mathematics selected to complement the student's thesis research.

Tutorial - 3 periods per week (one term)

Credit(s): 1

MA503 Optimization Theory And Applications

In this course are presented the fundamental concepts, results and numerical methods of optimization. The content is: introduction, mathematical background, mathematical models for optimization, convexity in Rn (Convex sets, convex functions, separation and polarity, external structure of convex sets), linear programming (necessary and sufficient conditions of optimality, the duality theorem, the simple method), convexity and differentiability (gradients, subgradients, directional derivative), geometrical optimality conditions, analytical optimality conditions (Fritz-John optimality condition, Karush-Kuhn-Tucker optimality condition), Lagrangian duality and saddle point optimality conditions, numerical algorithms and their convergence (gradient methods, projected gradient methods, penalty-function methods, modified Lagrangian methods, relaxation methods).

Lectures - 3 periods per week (one term)

Credit(s): 1

MA505 Topics In Differential Geometry And Applications

Kinematic effects of Lorentz transformations, tensor analysis and the Lorentz group. Optical results, mechanics of particles, Maxwell's equations, Lienard-Wiechert potentials, equations of motion of charged particles, Lagrange, Hamilton and variational formulations, continuum cases, Maxwell tensor, conservation laws. Geometrization of Newton's theory of gravitation. Riemannian geometry, tensor analysis - co-ordinate-free and co-ordinate-dependent formulation. Geodesic equations, parallel displacement and covariant derivative. The Riemann curvature and the Ricci tensor. The Bianchi identity. Einstein's field equations. The Schwarzchild solution and classical tests of general relativity. Black holes.

Lectures - 3 periods per week (one term)

Credit(s): 1

MA511 Topics In Optimization

This course covers topics in optimization such as: Global optimization, Interval Analysis applied to optimization, Introduction to Optimal Control, Nondifferentiable optimization, etc.

Lectures - 3 periods per week (one term)

Credit(s): 1

MA513 Game Theory

The main purpose of this course is to present the basic mathematical machinery utilised in the theory of games. The content is: mathematical preliminaries, matrix games, infinite antagonistic games, non-cooperative games, cooperative games, introduction to differential games and applications.

Lectures - 3 periods per week (one term)

Credit(s): 1

MA515 Interval Analysis

The goal of this course is to present the fundamental notions of interval analysis and its applications to numerical methods used in applied mathematics. Content : The set I(R) of bounded real intervals. The set I(C) of complex intervals. Interval arithmetic. Interval evaluation and range of real functions. Machine interval arithmetic. Finite convergence. Metric, absolute value and width in I(R) and in I(C). Interval matrix operations. Computable sufficient conditions for existence and convergence. Interval analysis and zeros of polynomials. Interval analysis and linear equations. Interval analysis and fixed points theory. Interval analysis and differential equations. Interval analysis and non-linear equations. Interval analysis and optimisation problems.

Lectures - 3 periods per week (one term)

Credit(s): 1

MA517 Mathematical Models For Combat

The goal of this course is to present the most important mathematical models considered in defence analysis. Content: the importance of mathematical modelling for defence analysis. Principles of mathematical modelling. Defence planning, combat models and the scientific study of warfare. Differential equations and differential systems (background). Different types of combat models. Lanchester's classical combat models. Some simple models of battle termination. Lanchester attrition-rate coefficients. Modelling tactical engagements. Optimising tactical decisions. Mathematical models for combat and differential games. Mathematical models for combat and army race. Mathematical models for combat and dynamical systems. Numerical methods applicable to mathematical models for combat.

Lectures - 3 periods per week (one term)

Credit(s): 1

MA525 Deterministic Numerical Simulation

Review of numerical linear algebra with special emphasis on eigenvalue problems. Special matrices. Storage techniques for large matrices and algorithms for solution of large linear systems. Parallel algorithms. Computational techniques for ordinary differential equations. Classification of partial differential equations (PDE). Solution of first and second order PDE's by direct, spectral and iterative methods. Existence and uniqueness of solutions. Non-linear PDE's. Diffusion and convection problems.

Prerequisite: MA507 or its equivalent

Lectures - 3 periods per week (one term)

Credit(s): 1

MA527 Prime Numbers and Cryptography

Prime numbers play an important role in many cryptographic methods. This course studies some of the many algorithms linked to prime numbers: deterministic and probabilistic primality tests, generating large primes, factoring methods. Relevant results from theoretical and computational number theory are developed and discussed as needed. Applications of these algorithms in cryptographic methods are also considered.

Lectures - 3 periods per week (one term)

Laboratory - 1 period per week (one term)

Credit(s): 1

MA531 Logic And Its Application To Computer Science

This course is an introduction to the notion of formal theories and proofs. The propositional calculus and the predicate calculus will be revisited along these lines. First order theories will be discussed and some generalisations will also be considered, in particular those playing a role in computer science.

Lectures - 3 periods per week (one term)

Credit(s): 1

MA533 Probability And Discrete-time Processes

Advanced concepts in probability distributions and expectations; generating functions; compound distributions; discrete-time renewal theory; recurrent events, random walk and ruin problems.

Lectures - 3 periods per week (one term)

Credit(s): 1

MA535 Stochastic Processes - I

Counting processes and compound Poisson processes; continuous-time renewal theory; Markov chains in discrete and continuous time. Discussion of various queuing models.

Prerequisite: MA533 or its equivalent

Lectures - 3 periods per week (one term)

Credit(s): 1

MA537 Stochastic Processes - II

Advanced mathematical modelling of queues; Markov chains and processes, birth-and-death processes, continuous-time renewal theory; Poisson and non-Poisson queues; transient and steady-state solutions; bulk queues.

Prerequisite: MA533 or its equivalent

Lectures - 3 periods per week (one term)

Credit(s): 1

MA539 Multiobjective Optimization (Pareto Optimization)

Life inevitably involves decision making, choices, and searching for compromises. It is only natural to want all of these to be as good as possible, in other words, optimal. The difficulty in studying these kinds of problems lies in the conflict between our various objectives and goals. Multiobjective optimization is also called vector optimization.

In multiobjective optimization, one investigates optimal elements such as minimal, strongly minimal, properly minimal or weakly minimal elements of a non-empty subset of a partially ordered linear space. Multiobjective optimization problems can be found not only in mathematics but also in engineering, economics, and in military domains.

The goal of this course is to present the models and the mathematical methods used in multiobjective optimization

Lectures - 3 periods per week (one term)

Credit(s): 1

MA543 Discrete-time Stochastic Processes Modeling

Numerical inversion of generating functions and Laplace transforms. Discrete-time single-server and multi-server queuing models (finite and infinite space, Markov and non-Markov); complex models involving bulk arrivals or bulk service. Introduction to matrix-analytic methods.

Prerequisite: MA537 or its equivalent

Lectures - 3 periods per week (one term)

Credit(s): 1

CS501 Advanced Topics In Computer Science

This is a reading and tutorial course with topics in computer science selected to complement the student's thesis research.

Tutorial - 3 periods per week (one term)

Credit(s): 1

CS503 Development of Scientific Software

Scientific software is defined as software that is computationally intensive. This course looks at the topics dealing with the production of high quality scientific software. Topics will be examined both from the viewpoint of the computing specialist and from the viewpoint of the scientist. As such, this course is of interest to students in computing and students in other disciplines that depend on computationally intensive software. Topics include performance and resources, safety, trustworthiness and confidence, issues in validation and other types of testing, regulatory standards, architecture and design, data design, and long-term evolution and change.

Lectures - 3 periods per week (one term)

Credit(s): 1

CS551 Pattern Recognition And Image Processing

Introduction to the basic mathematical tools and algorithms for image processing by digital computers. Topics covered will include various aspects of image filtering, restoration and enhancement. Principles of deterministic, statistical and syntatic approaches to pattern recognition. Techniques of feature extraction and classification. Scene analysis. Expert system techniques and computer applications will be covered. Students will be expected to complete computer-based projects.

Lectures - 3 periods per week

Laboratory - 2 periods per week (one term)

Credit(s): 1

CS553 Modelling And Simulation

This course gives a comprehensive treatment of medel design and exesutin for simulation. It reviews the important aspects of a simulation study, including modelling, simulation software, model verification and validation. Study of input modelling , random-number generators, generating random variates and processes, statistical design and analysis of simulation experiments. Highlight of major application areas such as military defence.

Lectures - 2 periods per week

Laboratory - 2 periods per week (one term)

Credit(s): 1

CS565 Data Base Management Systems

Concepts, approaches and techniques in Data Base Management Systems (DBMS). Data as a model of reality, logical models of data bases. Theory of relational data bases. Query languages. Concurrency, transactions and distributed processes. Knowledge based system rules, logic programming and object-oriented data bases.

Lectures - 3 periods per week

Laboratory - 2 periods per week (one term)

Credit(s): 1

CS567 Applications Of Artificial Intelligence In Command And Control

In this course, the fundamentals aspects of command and control will be discussed with a view to using artificial intelligence. In particular, the following aspects will be considered: knowledge-based systems, knowledge representation, intelligent tutoring systems, planning, and constraint programming.

Lectures - 3 periods per week (one term)

Credit(s): 1

CS571 Computer Graphics

This course will cover various mathematical and computational aspects of computer graphics. Algorithms for representing and transforming lines, curves and surfaces. Display files and data structures. Students will be expected to complete computer-based projects.

Lectures - 3 periods per week

Laboratory - 2 periods per week (one term)

Credit(s): 1

CS575 Computer Simulation For Guided Weapon Systems

Topics discussed include a review of the basic concepts of classical mechanics and their application to describe flight trajectories. Fundamental problems of missile guidance, measurement of missile motion and analysis of different

laws governing the flight of a homing missile. Theory of inertial navigation and applications of inertial guidance. Attitude control, orbit transfer and optimal control of trajectories in space and in atmospheric flight. Pursuit evasion games.

Lectures - 3 periods per week

Laboratory - 2 periods per week (one term)

Credit(s): 1

CS581 Foundations Of Artificial Intelligence

This course covers topics in: LISP language: History, introduction to the language: Expressions, CONS, CAR, CDR, etc; production and matching: production system, methodology, pattern matching, examples; knowledge representation: definition, overview of knowledge representations, semantic networks, frames, inheritance, conceptual graphs; reasoning: inference, resolution, resolution strategies, nonmonotonic reasoning, knowledge and belief, metaknowledge and metareasoning; and planning: initial state, goals, actions, plans, conditional plans.

Lectures - 3 periods per week (one term)

Credit(s): 1

CS585 Software Engineering Mathematics

Propositional logic and predicate calculus. First order theories. Sets, relations and functions. The use of mathematics to specify software and to describe its properties. Hoare triples. The use of assertions in programming. Techniques for checking completeness and consistency. Small practical examples. Introduction to techniques such as Z and VDM.

Lectures - 3 periods per week (one term)

Credit(s): 1

CS591 Algorithm Analysis

This course covers advanced topics in the design and analysis of algorithms. In particular, algorithms for parallel computation will be investigated in more detail. The students are expected to read and discuss current material on these subjects. Prerequisite: CSE321A.

Lectures - 3 periods per week (one term)

Credit(s): 1

CS595 Complexity Theory

This course reviews important results in complexity theory and discusses the following topics: time complexity, space complexity, intractability. Some advanced topics will also be covered in some details: approximation algorithms, probability algorithms, parallel computation, and cryptography.

Lectures - 3 periods per week (one term)

Credit(s): 1

CS597 Topics In Softcomputing With Emphasis On Neural Networks

How nature computes with DNA and neural networks. The principles of artificial computing with DNA, genetic algorithms and neural networks. Artificial Neural Networks are studied in some depth; the topics discussed including: single and multi-layer perceptrons, backpropagation networks, self-organising maps, and some of their applications. This course has a practical computing dimension. Students will be introduced to LISP and possibly other computer languages so that they can write their own software implementing the course material. They will also use some commercially available software packages.

Lectures - 3 periods per week (one term)

Credit(s): 1

CS599 Cryptology

Topics covered include: classical cryptosystems; modern block and stream ciphers; Shannon's information theory; public key ciphers, primality testing, factoring algorithms; digital signatures; unkeyed hash functions and message authentication codes; key distribution and agreement; identification and authentication; pseudo random number generation. Each student will investigate an advanced topic using current research literature.

Lectures - 3 periods per week (one term)

Credit(s): 1

PR500: Project

TH500: Thesis; Master's Level

TH600: Thesis; Doctoral Level

CP600: Comprehensive Examination; Doctoral Level

Department of Physics

General Information

Contact Information

Department Head - Dr. M. Stacey

Telephone: 613-541-6000 ext 6414 or 6288

Fax: 613-541-6040

Web Page: Department of Physics

Programmes Offered

The Department of Physics offers programmes leading to the degrees of Master of Science and Doctor of Philosophy in Physics, with the following fields of specialization:

- Acoustics and Oceanography
- Space Science
- Materials Science

Admission

Candidates for the degrees of Master of Science and Doctor of Philosophy will be admitted under the General Admission Requirements. Details regarding admission to the Royal Military College as graduate student can be found in the Admissions section of this calendar

Programme Requirements

The Master of Science degree will be awarded to candidates who successfully complete a programme of studies comprised of a minimum of four term courses at the graduate level, plus a thesis, as approved by the Department of Physics. The number of courses may vary according to sponsor requirements, and up to half of the required courses may be taken outside the Department with the Department's approval.

The Master's degree when pursued full-time in the residential programme normally requires five academic terms or two academic years plus the intervening summer to complete.

The Doctoral of Philosophy degree will be awarded to candidates who successfully complete a programme of studies normally comprised of at least eight courses at the graduate level after the Bachelor's degree, in addition to a thesis.

For both the MSc and PhD degrees, project or thesis work can be integrated into sponsor-oriented projects that can be of direct benefit to the CF.

Course Descriptions

PH501 Acoustics Propagation and Modelling
PH503 Advanced Optics
PH505 Acoustic System Analysis
PH507 Remote Sensing
PH511 Electromagnetic Theory
PH513 Ferroelectric Transduction Materials: Properties and Applications
PH515 Thermal and Statistical Physics
PH517 Selected Topics in Physics
PH521 Synoptic Oceanography
PH531 Astrodynamics
PH535 Rocket Propulsion
PH537 Satellite Communication and Navigation
PH539 Spacecraft Mission Geometry
PH541 Surveillance of Space
PH543 Space Weather 1-Solar Physics and Activity
PH545 Space Weather II- the Near Earth Space Environment
PH547 Space Mission Analysis
PH549 Space Mission Design
PH551 Ocean Dynamics
PH553 Dynamic Oceanography

PH581 Space Systems
PH583 Surveillance of and from Space
PH585 Theory and Observation of Stellar Atmospheres
PH587 Physical Principles of Non-Destructive Evaluation
PH589 Radar Polarimetry
PH591 Galaxies in the Universe
PH593 Astronomical Instrumentation
PH601 Measurement and Modelling of Stellar Magnetic Fields
PR500 Project
TH500 Thesis (Master's Level)
TH600 Thesis (Doctoral Level)
CP600 Comprehensive Examination (Doctoral Level)

PH501 Acoustics Propagation And Modelling

A study of the fundamental equations used to describe acoustic propagation in the ocean is undertaken in the context of military acoustic requirements. The effect of oceanic variability in one, two and three dimensions on acoustic propagation forecasting is evaluated and discussed to better understand the limitations imposed by the environment upon prediction capabilities. The approximations inherent in such models for transmission

loss calculation as FACT, Generic Sonar Model, Ray Mode, and Parabolic Equation are studied to gain understanding of the physical principles behind these models and the implicit strengths and weaknesses of each. Through assignments and class projects the student will have an opportunity to work with some of these current acoustic models and to conduct numerical experiments to show some of the characteristics of each model tested. Oceanic factors affecting acoustic propagation which are discussed include temporal and spatial variability of sound speed profiles, interpolation and digitisation of sound speed profiles, calculation of sound speed without using salinity data, reflection characteristics of the ocean surface and bottom, fronts and various kinds of eddy structures. The student is expected to understand the implications of the course and to be able to describe the limitations imposed by the environment on the choice of particular model to predict transmission loss.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH503 Advanced Optics

This course will include material taken from the fields of both geometric and physical optics. Ray tracing, matrices, skew rays, optical cavities, gaussian beams and their optics; index of refraction, birefringence, polarisation, optical activity, non-linear optics; interference, coherence, diffraction, Fourier optics, image formation, optical processing.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH505 Acoustic System Analysis

Using a system approach, the student will learn the characteristics and limitations of a number of active and passive acoustic detection and tracking systems. The design, construction and deployment of passive and active acoustic transducers are discussed from the viewpoint of overall system performance. Fourier methods are introduced so that signal decomposition in frequency space and in wavenumber space can be described. This leads ultimately to a discussion of spatial beam forming using such systems as difar, vertical line arrays, and towed arrays. A study of correlation methods as applied to random noise lead to a discussion of oceanic ambient noise in both temperate and polar seas and the detection of signals in noisy environments.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH507 Remote Sensing

This course assesses sensors and platforms used in the remote sensing of the earth, and the use of data from them to describe the terrestrial and oceanic environments. The physics of passive and active sensors operating in the visible, infra-red and microwave is discussed, as are the algorithms necessary to transform sensor data into geophysically meaningful output, such as land elevation vegetation index, sea surface temperature, wave height and wind speed. Remote sensing of solid surfaces is discussed to illustrate the applicability of modern sensor systems or terrestrial environments. Processing and analysis of remotely sensed imagery is discussed to lead the students to an understanding of how to extract information on oceanic and terrestrial features and conditions using modern professional computational techniques. Emphasis is placed on the use of remotely sensed data for tactical and strategic purposes.

Lectures - 3 periods per week

Laboratory - 2 periods per week (one term)

Credit(s): 1

PH511 Electromagnetic Theory

Reviews of electrostatics, magnetostatics, and Maxwell’s equations in vacuum and in matter. Scalar and vector potentials. Charge conservation, momentum and angular momentum conservation. Constitutive relations, D(E) and H(B), for linear and non-linear systems, symmetries. Kramers-Kronig relations. Radiation from localised charges and currents, Green's function method, Poynting's theorem, radiated power, retarded potentials. Multipole moments of the scalar and vector potentials. Dipolar antenna. Motion of charges in electromagnetic fields, relativity and Maxwell's equations. Lorentz force law. Electromagnetic tensor. Covariant form of Maxwell's equations, 4-vectors. Analytical and computer-based solutions to electromagnetic boundary value problems: separation of variables, Bessel functions, and Fourier series and Finite Element methods.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH513 Ferroelectric Transduction Materials: Properties And Applications

This course presents an understanding of the behaviour of piezoelectric and electrostrictive ceramic materials with particular reference to their use in electromechanical transducers. The properties of other electromechanical transduction materials such as piezoelectric polymers and composites, magnetostrictive materials and shape memory alloys will also be discussed briefly. The use of these materials in acoustic transducers for particular applications such as underwater sonar for submarine detection and mine-hunting, underwater stealth, ceramic motors and actuators and smart structures will be reviewed. Other types of functional ceramic materials will be discussed briefly and these will include: conducting, dielectric, electro-optical, magnetic and superconducting ceramics.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH515 Thermal And Statistical Physics

Review of classical thermodynamics. Review of Maxwell-Boltzmann, Fermi-Dirac and Bose- Einstein statistics. Applications to Brownian motion, thermal properties of matter, superfluidity, and superconductivity. Irreversible flow processes, Onsager relations, thermoosmosis and thermoelectric phenomena.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH517 Selected Topics In Physics

The emphasis in this course will be placed on those areas of particular interest to the student as dictated by his or her research topic.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH521 Synoptic Oceanography

A detailed study of the nature and distribution of synoptic scale and mesoscale features of the oceans is made with particular emphasis on the waters contiguous with Canada, including the Arctic Ocean. Modern knowledge and theories of meandering currents, oceanic eddies and fronts are examined using recent scientific literature. Data and imagery from remote sensing satellites are used to identify and examine these features. Data analysis techniques required for such examinations are also presented.

Lectures - 3 periods per week (one term)

Credit(s):

PH531 Astrodynamics

A review of satellite orbital motion as a Keplerian motion, orbit determination, and orbital manoeuvring. Perturbations to the Keplerian motion-oblate earth (J2 and other terms), thirdbody perturbations (solar, lunar), atmospheric drag, solar-radiation pressure. Techniques to treat perturbations-SP (Special Perturbationsnumerical methods), GP-(General Perturbationsanalytical methods) and hybrid methods. Statistical orbit determination using least squares and Kalman filters.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH535 Rocket Propulsion

Introduction to rocket propulsion and vehicle dynamics. The basic laws of thermodynamics, thermochemistry and conservation are used to determine ideal motor performance. Effects of vibration, acoustic noise and acceleration on systems during launch are investigated. Emphasis is placed on describing the components and design criteria for liquid, solid and hybrid rockets. Electric, nuclear, and other advanced propulsion systems are also studied.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH537 Satellite Communication And Navigation

This course is an introduction to communication between spacecraft and ground stations. Students are introduced to antenna theory: dipole antenna, antenna gain, antenna patterns, directivity and signal strength. The theory is then applied to modulation, transmission, propagation, reception and demodulation of signals between the ground and a satellite. Fundamentals of ionospheric effects, frequency bands, communication lin equations and telemetry are covered. Space based navigation systems are examined. Topics include positioning using RF Doppler and GPS positioning. Precision navigation and surveying, personal communication systems as well as search and rescue systems are also examined. Satellite tracking is discussed.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH539 Spacecraft Mission Geometry

This course is an introduction to the factors affecting a spacecraft's mission. After a brief review of orbital mechanics with special emphasis on orbital manoeuvres

and satellite station keeping, the students are introduced to the theory of spacecraft attitude dynamics and kinematics. The theory is then applied to spacecraft attitude stabilization and control, including a brief introduction to the sensors used to measure the spacecraft position and attitude. Earth coverage, the relative motion of satellites, as well as viewing and lighting conditions are discussed in order to illustrate the effects of the spacecraft mission geometry on the overall mission. The process of orbit selection and design will be introduced with special emphasis on constellations, including constellation patterns, coverage, station keeping and collision avoidance. The Analytical Graphics software package, Satellite Tool Kit (STK) will be used to provide a simulation of the spacecraft orbits and mission geometry.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH541 Surveillance Of Space

The course presents an overview of factors involved in the tracking of objects in space. It examines the space environment and EM propagation effects that impact on ground based tracking. It surveys space-time co-ordinates, Keplerian orbits, orbit perturbations and ground track considerations. The course then examines in depth the Analytical Graphics software package STK/PRO and all its associated modules. Included in this are PODS, SKY, IRAF and Streak Detection Algorithms that are being presently used at the Space Surveillance Research and Analysis Laboratory at RMC. The course also examines current topics in space control using the proceedings of research conferences.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH543 Space Weather I - Solar Physics And Activity

This course provides a graduate-level introduction to the physics of the solar outer layers, with concentration on the generation, emergence and evolution of the magnetic field, and its interaction with the solar plasma. This course represents the first half of the space weather curriculum and serves as a basic introduction to the characteristics of stellar atmospheres. Topics: Basic properties of the sun and sun-like stars: bulk characteristics and interior structure; atmospheric structure: photosphere, chromosphere, transition region and corona. Solar magnetic activity: the 22-year cycle; emergence, structure and variability of the solar magnetic field. Solar dynamo: basic principles, mean field dynamo theory, alpha and omega effects. Active regions and sunspots, sunspot classification; field evolution in active regions, magnetic shear, field reconnection, current sheets; prominences, flares and CMEs. Origin, structure and variability of the solar wind. Recent solar observations from ground and space; predictions of solar activity and relation to space weather prediction; comparison of solar activity properties with those of other stars.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH545 Space Weather II - The Near Earth Space Environment

This course studies the interplanetary medium and the near-Earth environment from the rigorous perspective of plasma physics. Theoretical topics include: single particle motions in plasmas, plasmas as fluids, waves in plasmas, diffusion and resistivity (magnetohydrodynamics), equilibrium and stability, kinetic theory and nonlinear effects. Applications to the space environment include: the solar wind, the Earth's magnetic field, Van Allen belts, the South Atlantic Anomaly, aurorae, particles and currents in the magnetosphere, magnetospheric waves, and instabilities and shocks in the magnetosphere.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH547 Space Mission Analysis

This represents the first half of the space mission analysis and design curriculum. The course consists of lectures and case study assignments covering various aspects of space missions, including systems engineering, propulsion systems, launch vehicles, power systems, thermal control, communication and navigation, ground systems, mission operations, safety, tolerance, risk and failure management.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH549 Space Mission Design

This represents the second half of the space mission analysis and design curriculum. The students develop the preliminary design of the space and ground segment for a realistic space mission.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH551 Ocean Dynamics

The physics and mathematics of motion in the ocean will be examined at scales ranging from the microscale to basin scale. The hydrodynamic equations governing fluid motion will be developed from the fundamental laws of

physics and examined in various forms to study such phenomena as geostrophic currents, inertial currents, Ekman spirals, barotropic and baroclinic currents, the large-scale, wind-forced oceanic circulation, thermohaline circulation and western intensification. Wave theory for an unstratified ocean will also be covered and will include an investigation of the tides and Rossby, surface gravity, Poincaré and Kelvin waves.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH553 Dynamic Oceanography

Long waves such as shelf, Rossby, Poincaré and Kelvin waves will be studied for two-layer and continuously stratified fluids. The quasigeostrophic potential vorticity equation will be derived. Barotropic and baroclinic instability of mean flows will be investigated both by doing linear stability analysis and by examining eddy resolving numerical models. Modern theories of the ocean circulation that incorporate the ventilated thermocline and the homogenization of potential vorticity will be covered and compared with observations.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH581 Space Systems

This course is intended for MA students in Space Policy. Review of the history of space with emphasis on Canadian contributions typical satellite orbits: effects of the environment, satellite function considerations. Satellite systems and subsystems: structure, electrical power, thermal control, propulsion and attitude and altitude control. Systems: sensors, telemetry, surveillance, navigation ,meteorology, and remote sensing. Military and scientific satellite systems, launch systems.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH583 Surveillance Of And From Space

This course is intended for candidates for the MA in Space Policy. This course discusses the observation of the earth's solid and liquid surface from space, and the observation of the space environment from the earth's surface and from low earth orbit. Remote sensing systems operating in the visible, thermal infrared and microwave regions are examined. The fundamentals of the orbits of space objects and the methods of tracking them from the ground are presented. Historical, current and future observing systems will be discussed, with a focus on applications important to the Canadian Forces. Bi-weekly computer laboratory sessions will give the student hands-on experience in remote sensing image analysis and interpretation, and in satellite and spacecraft orbit determination and prediction using software tools currently in use within the CF.

Lectures - 3 periods per week (one term)

Credit(s): 1

PH585 Theory and Observation of Stellar Atmospheres

This course provides an introduction to the physics of stellar atmospheres, including bulk stellar properties, concepts of local thermodynamic equilibrium, excitation and ionization equilibria, radiative energy transport, convective instability, continuous opacity, model stellar atmospheres, and stellar continua. This is followed by a development of the basic tools of quantitative spectroscopy, including concepts of line opacity and line profiles, contribution functions, hydrogen line profiles, stellar abundance determinations, and microscopic and macroscopic velocity fields. The course concludes with a discussion of advanced topics such as stellar magnetic fields, non-LTE, stellar winds, stellar pulsation, and stellar activity including chromospheres and coronae.

Lectures - 3 periods per week (1 term)

Credit(s): 1

PH587 Physical Principles of Non-destructive Evaluation

Physical principles of Nondestructive Evaluation (NDE) techniques are examined. Including: Ultrasonics (stress waves in materials, wave types, beam characteristics), Eddy Current (equivalent circuit models, impedance plane, skin depth), Magnetic Techniques (magnetic fields, ferromagnetism, flux leakage), Radiography (sources, attenuation, shadowing), Liquid Penetrant (surface tension), Thermography (heat diffusion, infrared detection) and Probability of Detection (NDE reliability data analysis).

Lectures - 3 periods per week (1 term)

Credit(s): 1

PH589 Radar Polarimetry

This course is a thorough introduction to the remote sensing of the earth’s surface using polarimetric radar. Topics covered include: SAR processing from signal data to imagery, fundamental concepts in radar polarimetry, speckle statistics and their influence on magnitude and phase information, polarimetric speckle filtering, polarimetric decompositions for discrete and distributed target analysis, polarimetric classification and analysis of

natural phenomena and a comparison of polarimetric modes: full, dual, compact, hybrid.

The material will be covered through readings, assignments, seminars and laboratory exercises involving analysis of polarimetric radar imagery. Material from the assigned textbook will form the basis of the course, and will be supplemented by readings from reference books and current literature from international journals

Lectures - 3 periods per week (1 term)

Credit(s): 1

PH591 Galaxies in the Universe

This course will provide an overview of the physical properties of galaxies and their environments, as well as the observational techniques used to infer these properties. Topics covered include the orbits of stars, the local population of spiral and elliptical galaxies, groups and clusters of galaxies and galaxy formation. The course material will be put to practice in bi-weekly problem sets, and a term project will afford students an in-depth look at various aspects of local galaxy physics.

Lectures - 3 periods per week (1 term)

Credit(s): 1

PH593 Astronomical Instrumentation

This course provides a survey of instrumentation and techniques for astronomical observations. Topics covered include theory of measurement (statistics); detector technology and basic data reduction techniques; imaging and spectroscopy of electromagnetic radiation at radio, infrared, optical, and X-ray wavelengths; data analysis and numerical methods. This course will provide a working base for experimental astronomers and space scientists, as well as a comprehensive background for the more theoretically inclined.

Lectures - 3 periods per week (1 term)

Credit(s): 1

PH601 Measurement and Modelling of Stellar Magnetic Fields

This is a PhD-level course on the theory and practice of the diagnosis of stellar magnetic fields. The course is structured based on 5 topics of study: the physics of the Zeeman effect, polarised radiative transfer in stellar atmospheres, polarisation of light and polarimetric instrumentation, methods of measurement of stellar magnetic fields, and modeling and simulation techniques. Evaluation will be based on extensive topic reports, including thorough literature review, original calculations and computations, and well as group discussion.

Lectures - 3 periods per week (1 term)

Credit(s): 1

PR500: Project

TH500: Thesis (Master's Level)

TH600: Thesis (Doctoral Level)

CP600: Comprehensive Examination (Doctoral Level)

Department of Chemistry and Chemical Engineering

General Information

Contact Information

Department Head - Dr. J.Y.S.D. Pagé

Professor-in-Charge of the Chemical Engineering

Programme - Dr. P.J. Bates

Telephone: 613-541-6000 ext 6271

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Web Page: Department of Chemistry and Chemical Engineering

Programmes Offered

The Department of Chemistry and Chemical Engineering offers the Master's and PhD degree programmes with specialty fields in Chemical and Materials, Environmental, and Nuclear, in Engineering or Science.

The Master's and Doctoral Programmes with the specialty field of Environmental Engineering are offered jointly with the Department of Civil Engineering. A sub-committee of the two departmental graduate studies committees administers this programme.

The Department's graduate research programme is closely affiliated with and supported by numerous DND agencies and directorates. Many thesis topics are offered as a result of this collaboration and are arranged between the sponsor and the Department of Chemistry and Chemical Engineering.

Current areas of activity with associated sponsors include among others:

- testing of Nuclear Biological Chemical protective equipment (DSSPM, DRDC),
- investigating nuclear emergency response techniques, safety and radiation fields at high aircraft altitudes (DGNS, J3NBC, DCGEM, DRDC),
- studying integrated health monitoring techniques of aircraft engines and developing Expert Systems (DASEng, AMDU, DREA, DRDC),
- fuel cells (DRDM),
- electrochemical power sources including submarine work (DMEE, DRDA, DGIEM, DGMEM, DASP, DRDC),
- investigating corrosion resistance of coatings and nondestructive evaluation techniques (DASEng),
- characterizing armoured materials and silicon carbide ceramics (DRDC),
- developing dye penetrants for use in search and rescue operations (DRDC, Search and Rescue),
- developing new procedures for environmental site assessment and remediation (DGE, DIAND),
- developing novel analytical techniques to support environmental engineering studies (NWSO),
- applying biotechnology methods (bioremediation phytoremediation) for treatment of contaminated soils (DGE, DISU, DIPM, Env. Canada), and
- studying new approaches for ecological risk assessment (DGE, NWSO).

Other areas of activity may be arranged within the broad spectrum of expertise in the Department of Chemistry and Chemical Engineering. The specialty fields of research are Chemistry, Chemical and Materials Science, Environmental Science, Nuclear Science, Chemical and Materials Engineering, Environmental Engineering, and Nuclear Engineering.

Graduate research may be pursued in the following areas:

Chemical And Materials Science / Chemical And Materials Engineering

- carbons as adsorbents
- air quality control
- life support systems
- pigments for visible radiation therapy of diseases
- development and testing of NBC protective gear
- decontamination, detection and monitoring chemical agents
- electrochemical power sources and batteries
- hydrogen production, purification and storage
- fuel cell development for applications in submarines and military bases
- liquid fuels purification processes
- catalytic chemical reactions
- explosives, propellants and pyrotechnics
- aerosol and vapour dispersion
- terminal ballistics
- artificial intelligence applications
- corrosion of alloys in aircraft frames, marine systems and armoured materials
- calculation of phase diagrams from thermochemical data

- non destructive evaluation, materials management and expert systems
- polymer systems
- composite materials
- ceramics, high temperature superconductors, solid electrolytes and solid lubricants
- aircraft engine wear monitoring (quantitative filter debris analysis)
- analytical chemistry and radiochemistry
- chemical kinetics
- chemical thermodynamics of new materials and advanced technologies
- surface chemistry
- x-ray crystallography
- vibrational, absorption and fluorescence spectroscopy
- synthesis of therapeutic agents
- solid state chemistry of inorganic materials

Environmental Science / Environmental Engineering

- environmental assessment; impact and risk assessment
- remediation technologies
- environmental standards and guidelines
- monitoring programmes and pollution prevention
- environmental analytical chemistry - especially pertaining to effective field testing
- biotechnology - bioremediation and phytoremediation
- sanitary engineering
- toxic water management
- water resources management
- site remediation
- subsurface contaminant transport
- ecological risk assessments

Nuclear Science / Nuclear Engineering

- radiochemistry and neutron activation analysis
- radiation effects on materials
- neutron radiography and radioscopy
- nuclear reactor analysis and design
- fuel cycles and fuel management
- neutron and gamma bubble dosimetry
- nuclear fuel and fission product release behaviour response
- artificial intelligence applications to nuclear systems
- health physics and radiation protection
- nuclear accident response
- nuclear radiation detection and measurement

Admission

Candidates for the degrees; Master of Science, Master of Applied Science, Master of Engineering or Doctor of Philosophy will be admitted under the general admission requirements. Details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this calendar

Programme Requirements

The Master's of Engineering degree will be awarded to candidates who successfully complete a programme of studies normally comprised of eight (8) term courses at the graduate level plus a project.

Note: The academic portion of the Occupational Speciality Specification (OSS) AEXO, Advanced Ammunition Engineering qualification, is comprised of the following courses: CC508, CC510, CC512, CC514, CC551, CC561, CC577, CC579 and PR500. It is expected to be completed in one calendar year (12 months).

The Master of Science degree or the Master of Applied Science degree will be awarded to candidates who successfully complete a programme of studies normally comprised of five (5) lecture courses at the graduate level plus a thesis. The degree when pursued full-time in the residential programme normally requires five (5) academic terms or two (2) academic years plus the intervening summer to complete.

The Doctor of Philosophy in Environmental, Nuclear, and Chemical and Materials Science or Engineering, will be awarded to candidates who successfully complete a programme of studies normally comprised of at least eight (8) lecture courses, at the graduate level, plus a thesis.

Course Descriptions

CC501 Chemical and Nuclear Engineering Computations
CC502 Polymer Welding and Joining
CC503 Special Topics
CC504 Seminar
CC506 Molecular Modelling and Applications to Nanotechnology
CC508 Sea and Air-Launched Munitions
CC509 Nuclear Reactor Heat Transfer
CC510 Ammunition Management
CC511 Health Physics and Radiation Protection
CC512 Ground-Launched Munitions
CC513 Corrosion Engineering - Diagnosis of Corrosion and Corrosion Testing
CC514 Weapon Systems
CC515 Nuclear Detection and Measurement
CC516 Nanotechnology: Theory, Applications and Characterization Methods
CC517 Shielding for Nuclear Activities
CC518 Advanced Thermodynamics
CC521 Introduction to Non-Destructive Evaluation
CC523 Nuclear Reactor Engineering
CC525 Nuclear Reactor Safety
CC527 Nuclear Reactor Kinetics and Dynamics
CC531 Radiological Methods
CC533 Nuclear Fuels Engineering
CC537 Site Remediation
CC539 Applied Analytical Chemistry
CC541 Environmental Toxicology and Risk Assessment
CC543 Atmospheric Dispersion and Micrometeorology
CC545 Advanced Topics in Organic Chemistry
CC547 Engineering Applications of Artificial Intelligence
CC551 Propulsion in Guns and Rockets
CC553 Environmental Transport Processes
CC555 Environmental Issues
CC559 Terminal Ballistics 2 - Impact Mechanics
CC561 External Ballistics
CC563 Polymers in Engineering Applications
CC565 Nuclear and Radiochemistry
CC567 Nuclear Fuel Management
CC569 Nuclear Biological and Chemical Defence
CC571 Experimental Design, Model Development and Parameter Estimation
CC573 Nuclear Waste Management
CC575 Materials in the Space Environment
CC577 Explosives and Explosions
CC579 Chemistry of Energetic Materials
CC581 Purification and Storage of Fuels for Fuel Cells
CC583 Fuel Processing for Fuel Cells
CC585 Preparation and Characterization of Catalysts
CC587 Mechanism, Kinetics and Model Development
CC589 Materials and Manufacturing Methods for Fuel Cells
CC591 Ceramic Engineering
CC593 Advanced Nuclear Reactor Physics
CC595 Nuclear Materials
CC597 Thermalhydraulics and Two-Phased Flow
CC599 Advanced Topics in Analytical Chemistry
PR500 Project
TH500 Thesis (Master's Level)
TH600 Thesis (Doctoral)
CP600 Comprehensive Examination (Doctoral Level)

CC501 Chemical And Nuclear Engineering Computations

The topics of this course are selected to suit applications in Chemical and Nuclear Engineering. The central theme of the course is the mathematical formulation of various engineering problems. Ordinary and partial differential equations, boundary-value problems, matrix operations and various mathematical modelling and simulation techniques are covered. Numerical optimization techniques are introduced. Analytical and numerical methods of solution are used, both workstation and/or micro-computer being employed for the latter.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC502 Polymer Welding and Joining

Technologies used to weld and join thermoplastic and thermoset parts are reviewed. Topics include mechanical (self-taping screws, boss design, snap-fits), chemical (adhesives) and thermal (ultrasonic, vibration, hot-plate, resistance and laser welding) assembly techniques. Theoretical and practical aspects of these techniques are covered. The course consists of a series of lectures, class projects and laboratories using pilot scale welding equipment.

Lectures - 3 periods per week (one semester)

Credit(s): 1

CC503 Special Topics

The topics of this course are adjusted to the specific requirements of the candidates. For instance, typical complementary topics for Master of Nuclear Engineering candidates would include corrosion, electrochemistry, water chemistry, certain separation processes such as ion exchange, filtration, absorption, solvent extraction and water desalination, and, for certain candidates, chemical equilibria and nonequilibrium thermodynamics.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC504 Seminar

This is a required seminar course for candidates for a Masters degree. The seminar, presented by the candidate in either official language, is expected to relate to the research programme of the candidate. The seminar is to be primarily directed to members of the department, be approximately 35 minutes in duration, and include sufficient background to effectively communicate with non-specialists in the research area. The candidate will be expected to field a range of questions from the audience after the presentation. A complementary written version must accompany the seminar. This is expected to be approximately 30 pages and be prepared in the style of a submission to a refereed journal in the field of study. The date of the seminar and standards for the presentation of the written version will be decided in conjunction with the supervisor(s). Written versions of the seminar will be made available afterwards to those who so request. Candidates will be graded on their oral delivery and content by at least three graduate faculty members. The written version will be graded by the research supervisor(s). Candidates deemed to have not succeeded will have the opportunity to give a second seminar prior to a failing grade being submitted.

Credit(s): 1

CC506 Molecular Modelling and Applications to Nanotechnology

This course illustrates the concepts of molecular modelling from first principles. The first part of the course will include a detailed presentation of quantum chemistry and molecular mechanics as fundamental and essential theories for the development of molecular modelling models. The course will also describe the first principle based models such as Hartree-Fock, Density Functional Theory, Moller Plesset Perturbation Theory complemented by a description of the molecular mechanics based methods. The applications of molecular modelling will be discussed for novel fields such as nanotechnology for prediction of self-assembly of soft materials, semi-conductors properties and dynamical properties.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC508 Sea and Air-Launched Munitions

This course examines the design considerations for munitions to defeat a variety of targets, including the attack of aircraft by guns and missiles, the attack of surface and subsurface vessels by torpedoes, depth charges, missiles and guns, the attack of ground targets, fuse designs, explosive devices such as aircraft ejection seats and thermal decoys, and packaging requirements for storage and handling. Foreign CBRN munitions will also be discussed.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC509 Nuclear Reactor Heat Transfer

Advanced topics in conduction, forced convection, natural convection and boiling heat transfer applied to nuclear fuel and nuclear reactor design; heat transfer characteristics of various coolants, moderators, nuclear fuels and reactor materials; problems in thermal design of nuclear power reactors.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC510 Ammunition Management

This course discusses a variety of topics involved with the management of ammunition and explosives, such as probability and statistics (e.g., applied to lot acceptance and the analysis of proof firings), risk reduction analyses and approaches, inventory management, decision analysis, and the Canadian defence procurement and life cycle management systems.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC511 Health Physics and Radiation Protection

The radiation emitted from natural and manmade sources is reviewed and the units and terminology employed in radiation measurement and protection are outlined. The biological effects of radiation are covered by introducing elementary biology and reviewing studies and experience with radiation exposures. The risks of employing radiation are considered and the recommendations of various groups and reports on radiation standards are consulted. The exposure, absorbed dose, dose equivalent, and their rates are calculated for various situations and the principles employed in minimizing these levels are discussed. Present activities of organisations working with and responsible for radiation are reviewed.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC512 Ammunition Management

This course will examine the design of munitions launched from ground-based platforms. Specific topic areas to be covered will include the attack of heavy and light armoured vehicles by kinetic and chemical

warheads, armour designs to protect vehicles, the attack of aircraft (fixed and rotary wing) the attack of structures and bunkers and the attack of personnel, including body armour designs and wound ballistics. Other topics will include the design of grenades and fragmenting munitions, mines, demolitions, improvised explosive devices, precision munitions, fuse designs, pyrotechnic devices and packaging requirements for storage and handling. This course replaces CC549 Terminal Ballistics.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC513 Corrosion Engineering - Diagnosis of Corrosion and Corrosion Testing

The course consists of a review of corrosion related chemistry and electrochemistry with an introduction to corrosion-related failure. Diagnostic elements of corrosion phenomena, analysis of failures, dissection of observations and simple on-site tests are discussed. Laboratory corrosion testing, electrochemical techniques and corrosion monitoring are also covered.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC514 Weapons Systems

This course will involve the design considerations of navy, army and air force weapon systems. Specific topics will include navy gun and missile systems, army armoured vehicle gun and cannon systems, towed and vehicle-mounted indirect fire systems (including mortars), small arms (including machine guns) and guided weapons, and air force gun and missile systems. Gun systems will comprise the design and analysis of mounts, recoil systems, recuperators, breeches, manual and auto loading systems and sighting and fire control systems. Missile systems will comprise launch, guidance and control systems.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC515 Nuclear Detection and Measurement

This course is presented as a series of lectures and accompanying laboratory experiments. Radiation, their sources and interactions with materials, are reviewed. The principles employed in radiation detection are described with emphasis on survey techniques and nuclear electronics. Gas-filled detectors (ionisation, proportional, Geiger), scintillation and semiconductor detectors are discussed, followed by neutron detectors and gamma-ray spectroscopy. The principles of operation, characteristics, types and applications are indicated for each detector method. Factors affecting detectors such as statistics, background and shielding are included.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC516 Nanotechnology: Theory, Applications and Characterization Methods

This course presents the theory and different interactions leading to the organisation and precise assembly of molecules for nanotechnology applications. The concepts of layer-by-layer self-assembly, self-assembly of polymers and nanolithography are presented. The course also describes the different methods used for the characterisation of the nanostructures; Atomic Force Microscopy, Scanning/Transmission Electron Microscopy, X-Ray/Neutron scattering and diffraction, and Simulation. The concepts are discussed and illustrated using scientific literature.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC517 Shielding for Nuclear Activities

The shielding required for equipment employing radioisotopes likely to be encountered by military personnel (radiography, calibration sources, tritium lighting, nuclear reactors, weapons explosions, etc.) is examined. The principles of operation are outlined with emphasis on the radiations emitted, and thermal and blast effects on personnel and equipment in the case of weapons explosions. The safety measures taken in the design and operation of this equipment are also studied. Radiation shielding is covered by determining the radiations, source geometry, energy spectrum, build-up factors and shielding purpose encountered in typical applications. Shielding calculations are then made for specific situations by various methods, including the latest software codes.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC518 Advanced Thermodynamics

Postulates and calculus of classical thermodynamics. Fluid phase equilibria and phase stability. Equations of state and their use to determine fluid properties for pure components and mixtures. Selected topics in phase diagrams. Time permitting and depending on the class interests, specific advanced topics in advanced thermodynamics may be included in the course.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC521 Introduction to Nondestructive Evaluation

Principles, equipment, techniques and standards for various non-destructive tests will be covered. Radiography, magnetic penetrants, other penetrants, ultrasonics, eddy current and other more specialised techniques will be included. Lectures - 3 periods per week (one term)

Lectures - 3 periods per week (one term)

Credit(s): 1

CC523 Nuclear Reactor Engineering

The course is introduced by discussing future world energy requirements. The first part of the course then covers interaction of radiation with matter, detection and shielding, radiation safety and reactor classifications, components and materials. In the second part, operation and control of nuclear reactors are described, including reactor kinetics and dynamics, control devices, poisons and chemical shim. Reactor safety, risk analysis, reactor accidents, radiation from effluents and licensing are covered.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC525 Nuclear Reactor Safety

The following safety aspects of nuclear power reactors are discussed, including reactor licensing and regulation in Canada and in other countries, basic principles of reactor safety, engineered safety features in nuclear power reactors, reactor safety analysis, reliability and risk assessment; reactor accidents at civilian power plants (Chernobyl; Three Mile Island and elsewhere) and in nuclear-powered vessels, radiation dose calculations; nuclear emergency response, and fission product release and severe core damage phenomena.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC527 Nuclear Reactor Kinetics and Dynamics

The nuclear reactor at transient state is studied in this course, first through the point kinetics model for which solutions of the resulting equations for various reactivity variations are calculated. The feedback effects and the various reactivity coefficients due to the temperature and void fraction, among others, are then covered. This leads to the introduction of the control theory applied to feedback systems, and to the analysis of stability conditions. Advanced kinetics theory elements are presented, including non-point theory models, space-time models, adiabatic and quasistatic approaches, modal and nodal formalisms. Analytical and numerical solutions are introduced and applied in cases such as safety analyses.

Pre-requisite - CC523 Nuclear Reactor Engineering

Lectures - 3 periods per week (one term)

Credit(s): 1

CC531 Radiological Methods

Radiological techniques utilising X-ray, gamma ray and neutron radiation will be covered. Their sources, interactions and imaging will be studied. Light alloys such as found in aircraft and film imaging will be emphasised. Other techniques such as real-time imaging, data analysis and tomography will be compared and the evaluation of image quality and sensitivity will be studied. Radiometry, diffraction and X-ray fluorescent techniques will be briefly covered. Radiation safety will also be addressed.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC533 Nuclear Fuels Engineering

This course covers the physical, chemical, mechanical and nuclear properties of nuclear fuels. The fuel cycle is examined from mining, fabrication, and enrichment through to reprocessing and disposal. The behaviour of the fuel as it resides in the nuclear reactor is considered including its thermal and chemical characteristics. Fission product behaviour and fuel defect mechanisms are studied for normal reactor operation, and severe fuel damage phenomena are described for nuclear reactor accident conditions.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC537 Site Remediation

An introduction is given to the techniques available for removing chemical and nuclear contamination from polluted sites. The course will focus on currently available methods, but will also address techniques under development for the remediation of soil, air and groundwater. Topics will include bioremediation, phytoremediation, thermal remediation, containment and stabilisation, and chemical extraction methods. A study of the legislative framework and costs associated with site remediation will be an important part of the course. Emphasis will be placed on assessing the feasibility and relative advantages of the available methods for a given site. This course will be taught using a combination of lectures, case studies and seminars.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC539 Applied Analytical Chemistry

This course will cover environmental sampling methods, quality assurance principles and applications, and statistics as they pertain to analytical chemistry. Environmental sampling will include soil, water, and biota sampling applied to environmental assessment, risk assessment and research. Quality assurance and statistics topics complementing the environmental sampling methods, as well as from the perspective of a commercial laboratory setting will be discussed. Methods of analysis, both field and laboratory, will be described for the most common environmental contaminants, and this information will be used to discuss the applicability and limitations of data thus obtained. A hands-on training session with field equipment for the analysis of PCBs, TPH and inorganic elements will be included.

Lectures - 3 periods a week (one term)

Credit(s): 1

CC541 Environmental Toxicology and Risk Assessment

This course will review the environmental and human health effects of the major classes of environmental stressors, both proven and putative. Quantitative risk assessment, and prioritisation of action on its basis, will be key considerations, as will the development of abatement criteria and actual abatement strategies. The course will include technical aspects of risk assessment and will consider the practical realities facing the practitioner and policy maker.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC543 Atmospheric Dispersion and Micrometeorology

This course examines two major areas: the atmospheric boundary layer (ABL) and the behaviour of aerosols and gases within the ABL. Specific topics include the composition and structure of the earth's atmosphere within the ABL, transport processes and balances, temperature and moisture distributions, stability and turbulence, properties of atmospheric gases, boundary layer flows and similarity theory. General modelling approaches are also discussed. The second area, aerosols, includes the transport of chemicals in the ABL, size distributions and removal processes of atmospheric aerosols, and aerosol dynamics. Specific aerosol systems will also be considered, and can be adjusted somewhat to meet students' interests, such as the possible aerosol release during nuclear reactor accidents or the dispersion of military aerosols. Use will be made of appropriate computer models.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC545 Advanced Topics in Organic Chemistry

This course will examine the application of structural elucidation and synthetic methods to organic chemistry and the fundamental mechanistic concepts of organic reactions. The functions of enolate chemistry, functional group interconversions and pericyclic reactions in multi-step synthetic schemes will be introduced, as well as, the effects of the physical and electronic properties of the reactants and the solvent on reaction mechanisms. Case studies involving detailed studies of organic reactions and processes of industrial and economic importance will be used throughout this course. All of the concepts that are introduced in this course have been selected for students with prior knowledge of the structure and reactivity of organic compounds.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC547 Artificial Neural Network Modelling

This course will cover a range of artificial intelligence topics with examples of how they may be applied to engineering problems. Specific topics may be tailored to meet students' needs, but will be drawn from artificial neural networks, fuzzy logic, genetic algorithms, knowledge-based systems, case-based reasoning and expert systems. Applications will cover such areas as prediction, classification and control problems as well as knowledge elicitation and representation for improved knowledge reuse. Students will be required to solve problems using either commercial software packages or

their own code. Although the mathematical foundations of the various topics will be covered, emphasis will be placed on their applications to engineering problems (especially within a chemical, nuclear or materials engineering environment).

Lectures - 3 periods per week (one term)

Credit(s): 1

CC551 Propulsion in Guns and Rockets

This course discusses the characteristics and design considerations of solid rocket fuels and gun propellants. Specific topics include grain design, composition and additives to control burning rates, the chemistry and thermodynamics of primers, igniters and propellants, generation and distribution of chamber and bore pressures, form factors and equations of state, barrel wear and heat transfer, pressure waves, liquid gun propellants, light gas and electric guns, combustible cartridge cases, and muzzle gases. Use will be made of appropriate computer models.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC553 Environmental Transport Processes

This course will examine the transport of vapour, liquid and particulate contaminants in the environment, with special emphasis on transport within the atmosphere and soil. Specific topics will include diffusive transport, advective-dispersive transport, the constitutive transport equation, mass transport coefficients, dispersion modelling, transport in porous media, and the development and assessment of transport models.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC555 Environmental Issues

This course will examine current, and specific, environmental issues in both science and engineering. Topics will be drawn from the areas of contamination, site remediation, ecological risk assessment, landfill techniques, groundwater contamination, human health and the environment. The course will be co-taught by professors from RMC and Queen's University and will also feature speakers who are experts in the topic areas. Students will be required to develop specific topics in both written and oral format and will also be required to, participate fully in all discussions. It is anticipated that all students will benefit from the multidisciplinary content of the course and will be better prepared to appreciate environmental problems from a broad perspective. It should be stressed that, although a broad range of topics will be covered, students will be expected to demonstrate specific knowledge of their area of focus.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC559 Terminal Ballistics 2 - Impact Mechanics

This course will examine the mechanics and dynamics of the impact of armour materials (steel, aluminum, ceramics, glass and composites) in various geometric configurations by long rod and spin stabilised penetrators, shaped charge jets and explosively-formed projectiles. The course material will expand upon subject matter covered in CC549 Terminal Ballistics. Specific topics include physical and material considerations for penetrators and targets, non-penetrating impacts, the attack of semi-infinite targets, plate penetration and perforation, and behind armour effects. Use will be made of appropriate computer codes.

Lectures: 3 periods per week (one term)

Credit(s): 1

CC561 External Ballistics

This course will examine the flight of projectiles and missiles. Specific topics will include compressible flow and the generation of shock waves, projectile stability for finned and spun projectiles, range enhancements, such as base bleed and rocket assist, vacuum trajectories and aerodynamic drag, the effects of wind, rotation of the earth and coriolis forces. The point mass, modified point mass and six degree of freedom models will also be addressed in the context of small and large calibre rounds. Use will be made of appropriate computer codes.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC563 Polymers in Engineering Applications

The course consists of the following topics: polymer thermodynamics, viscoelasticity, yield and fracture, reinforced polymers and polymer processing. Engineering applications will be illustrated throughout the course.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC565 Nuclear and Radiochemistry

The following topics on the theory and applications of nuclear and radiochemistry are studied: atomic structure and nuclear models, the mass energy relationship, nuclear transformations and reactions, natural and artificial radioisotopes, interaction of radiation with matter, and

radiation detection and measurement. Research industrial and medical applications and safety considerations of radioisotopes are discussed including radiotracers, activation analysis, radiometric analysis and radiation processing.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC567 Nuclear Fuel Management

The nuclear fuel cycles are studied from the mining to the ultimate disposal of the spent fuel, including the enrichment processes and the reprocessing techniques, from a point of view of the decision-making processes and the evaluation of the operational and economical consequences of these decisions. For the steps within the fuel cycles, the methods of determining the associated costs, in particular those relevant to the disposal of nuclear wastes, and the overall fuel cycle costs are described. Burn-up calculations are performed for the dwelling time of the fuel within the reactor core. The objectives and merits of in-core and out-of core fuel management are presented. In-core fuel management for Light Water Reactors (LWR) and for CANDU Pressurised Heavy Water Reactors (PHWR) is analysed in detail, for the refuelling equilibrium as well as for the approach to refuelling equilibrium. The course also covers fuel management for thorium-fuelled CANDU reactors and other advanced fuels such as MOX containing plutonium from discarded nuclear warheads, and DUPIC (Direct Use of PWR fuel in CANDU reactors). Optimisation methods used in fuel management are examined along with the most important computer codes.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC569 Nuclear, Biological and Chemical Defence

The principles and characteristics of nuclear weapons will be discussed and related to the physical (thermal, blast) and nuclear radiation (initial, residual, TREE, EMP) effects on humans, structures and equipment. Particular attention will be paid to distance-yield relationships, the distribution of fallout, the characteristics and pathology of acute whole-body radiation, physical and biological dosimetry and radiological survey. The course will include an examination of the composition and biological action of classical nerve, blood, choking and blister agents, as well as detection and decontamination methods and antidotes available. Individual and collective protection measures will also be covered. Such biological agents as bacteria, viruses and rickettsia as well as mid-spectrum agents to include toxins, venom and bioregulators will be addressed.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC571 Experimental Design, Model Development and Parameter Estimation

The methodology for developing efficient experimental plans for accurate model development will be studied. Multi-variable linear models will be used to illustrate the fundamental concepts of regression analysis including parameter estimation, parameter significance, estimating the error in predictions, residual variance and other general concepts in the analysis of variance. The extension of regression analysis from linear models to non-linear models will then be examined. Model transformations and the effect on error will be presented. Special problems associated with non-linear regression such as parameter correlation, and error estimation will then be discussed using concrete examples.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC573 Nuclear Waste Management

The course begins with a review of the radiations, their interactions with matter and the health effects from acute and chronic doses, and follows with a brief coverage of basic dosimetry and regulations. Radiation shielding is then introduced with examples and problems solved with the software Microshield. The origins and classification of nuclear waste into low-level, medium-level and high-level waste are studied, with emphasis given to the back end of the nuclear fuel cycle (inpool storage and reprocessing). The course also covers topics such as labelling, packaging and transportation of nuclear materials. The various methods presently used and in development for the safe disposal of nuclear waste are then covered, both for the low-level and medium-level waste, and, in particular, for the high-level waste and the spent nuclear fuel. In the latter case, the associated engineering problems are presented in terms of heat transport, radiation shielding and long-term integrity of the containers (corrosion resistance). The deep inground ultimate disposal of high-level waste (salt deposits and the Canadian concept of burial inside granitic plutons within the Canadian Shield) is given special attention, along with other potential methods such as disposal at the bottom of abyssal trenches in oceans, transmutation with fusion reactors and even outer space disposal. In contrast, the retrievable and the surface storage technologies are covered, with emphasis given to the Canadian approach presently implemented at various nuclear sites. The course concludes with a discussion of economical, political and sociological aspects of the nuclear waste management

question, including aspects such as ethics and public perception.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC575 Materials in the Space Environment

The dynamical nature of the space environment is examined. The environmental factors of vacuum, temperature, radiation, atomic oxygen, micrometeoroids and space debris are discussed. The impact of this environment on materials (i.e. metals, ceramics, polymers and composites) is considered including an examination of the requirements, design and comparison of various materials used in space. A research project typically involving laboratory experiments and related to materials effects in the space environment also complements this course.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC577 Explosives and Explosions

The course examines the chemistry and parameters of explosives, historical and modern explosives, future development, initiation and propagation of explosions; effects of explosions in gaseous, liquid and solid media; manufacturing aspects and military applications of explosives. The thermodynamic analysis of gas mixtures at elevated temperatures using advanced computer techniques is also covered.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC579 Chemistry of Energetic Materials

This course examines the production processes, chemical properties and reactions of energetic materials, including primary and secondary explosives, propellants and pyrotechnic formulations used in military applications. The topics of safety in handling and transportation, as well as appropriate classifications and regulations will also be discussed. Criteria for sensitivity, and techniques for predicting and measuring the thermal yields and stability are examined. The course will afford a brief review of thermochemistry for those students who might require it.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC581 Purification And Storage of Fuels For Fuel Cells

This course reviews the current state of the art in the purification and storage of fuels for fuel cell power systems. Purification by both chemical and physical methods is covered. Storage techniques include; cryogenic, high-pressure, adsorption on solids such as carbon and nano-materials, chemical and metal hydrides and newer novel methods such as micro spheres. The course will normally be adjusted to the specific requirements of the students.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC583 Fuel Processing For Fuel Cells

This course will review the current state-of-the-art in hydrogen production from hydrocarbons, biomass and alcohols. Topics will cover the design of fuel processing systems for fuel cell power systems. The key technical knowledge required for the design and modeling of fuel processors will be described. The technical challenges and criteria for evaluating the performance of fuel processor systems will be examined.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC585 Preparation And Characterization Of Catalysts

This course will cover the different methods of producing catalysts using traditional techniques (thermal degradation and calcination) as well as advanced techniques (ball milling, Pulsed Laser Deposition (PLD)), PECVD). Different strategies used to effectively disperse the catalysts onto commercial supports will be discussed briefly. The second part of the course will cover techniques used to characterize catalysts such as granulometry, porosimetry and X-ray diffraction (XRD). Surface characterization of catalysts using electron beams (SEM, EDX and XPS) and ions beams (SIMS, RBS) will also be studied. More emphasis will be placed on either the preparation or characterization of catalysts according to the student needs in their thesis projects. Lectures - 3 periods per week (one term)

Lectures - 3 periods per week (one term)

Credit(s): 1

CC587 Mechanism, Kinetics And Model Development

The rational design of chemical reactors requires not only a means to calculate rates of species

production/consumption but also, a qualitative understanding of the fundamentals of the reaction. The course examines classical methodologies for inferring mechanism from kinetic data (Langmuir-Hinshelwood approach) and the generation of corresponding rate expressions for calculating reaction velocities. The limitations of the Langmuir-Hinshelwood approach are discussed. Other methodologies are presented for deriving rate expressions based upon experimental kinetic data. The tools of surface science, as a means to elucidate reaction mechanism, are reviewed.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC589 Materials And Manufacturing Methods For Fuel Cells

This course reviews the current state-of-the-art of fuel cell development in terms of material developments and manufacturing methods. Students will become familiar with the key components of a fuel cell, the function of each component, and the key material properties required for the component.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC591 Ceramic Engineering

The classification of ceramic materials is first presented, followed by bonding and common crystal structures, which are related to the physical and mechanical properties of these various classes of ceramics. Various processing methods, including powder processing, consolidation, sintering and densification, are covered. The application topics will be adjusted to suit the needs and interests of the candidates. The course includes a small project and laboratory work.

Lectures and laboratories - 3 periods per week (one term)

Credit(s): 1

CC593 Advanced Nuclear Reactor Physics

This course continues the neutronics for the nuclear reactor at steady state seen in course CC523 Nuclear Reactor Engineering with the coverage of the multi-neutron energy group diffusion equation, then covers the multi-region models including the unit cell calculations. Transport theory is then explained and the integrodifferential Boltzmann equation is solved analytically and numerically. The integral transport equation is then studied, and the first collision probability methods (such as PN) are seen. The adjoint equations are seen, followed by the perturbation theory applied to the neutronics calculations. The course concludes with the Monte-Carlo probabilistic techniques applied to the reactor calculations.

Prerequisite: CC523

Lectures - 3 periods per week (one term)

Credit(s): 1

CC595 Nuclear Materials

This course describes the use of materials in nuclear reactors and covers topics in: nuclear energy and materials; material properties; material thermodynamics; primary components and reactor materials (fuel, structural, pressure tubes, control and safety system materials); fundamental effects of radiation damage on materials; engineering implications (creep, corrosion, hydriding and aging phenomena).

Lectures - 3 periods per week (one term)

Credit(s): 1

CC597 Thermal Hydraulics and Two Phased Flow

This course describes the thermalhydraulics of nuclear reactors and covers topics in: reactor neutronics; heat generation and production; thermal conduction; convective heat transfer in single phase; heat transfer (liquid metals, gases, fins); heat transfer with phase change; fluid flow; physics of two-phase flow; pressure drop in nuclear reactors; hydrodynamics; heat transport system; safety aspects of CANDU reactors.

Lectures - 3 periods per week (one term)

Credit(s): 1

CC599 Advanced Topics in Analytical Chemistry

The explosion of applied analytical chemistry has quietly revolutionized society over the past decades. Advances in medical diagnosis and treatment, forensics, environmental management, electronics, and most forms of production quality control rely heavily on analytical chemistry. In the present course, the fundamental principles of core analytical techniques will be examined, including atomic and molecular spectroscopy and spectrometry, electrochemistry, chromatography and other separation methods.

Lectures and laboratory exercises - 3 periods per week (one term)

Credit(s): 1

CC604 Seminar

This is a required seminar course for candidates for a Doctorate. The seminar, presented by the candidate in either official language, is expected to relate to the research programme of the candidate. The seminar although primarily directed to members of the department may include invited visitors and is expected to be of approximately 45 minutes duration. Sufficient background is to be included to effectively communicate with non-specialists in the research area. The candidate will be expected to field a broad range of questions from the audience after the presentation to demonstrate an advanced level of knowledge in the research area. A complementary written version must accompany the seminar. This is expected to be approximately 40 pages and be prepared in the style of a submission to a refereed journal in the field of study. The date of the seminar and standards for the presentation of the written version will be decided in conjunction with the supervisor(s). Written versions of the seminar will be made available to those who so request. Candidates will be graded on their oral delivery and content by at least three graduate faculty members. The written version will be graded by the research supervisor(s). Candidates deemed to have not succeeded will have the opportunity to give a second seminar prior to a failing grade being submitted.

Credit(s): 1

PR500: Project

TH500: Thesis (Master's Level)

TH600: Thesis (Doctoral Level)

CP600: Comprehensive Examination (Doctoral Level)

Faculty of Engineering

* Faculty members with complete privileges

Department of Civil Engineering
Department of Electrical and Computer Engineering
Department of Mechanical Engineering
Department of Applied Military Science

Department of Civil Engineering

Head of Department

* Associate Professor - R.G. Wight, CD, rmc, BEng, MEng, PhD

Professor

* J.A. Stewart, CD, rmc, BEng, MASc, PhD, PEng

* G. Akhras, DipIng, MScA, PhD, PEng, FCSCE, FASCE, FEIC

* R.J. Bathurst, BSc, MSc, PhD, PEng, FEIC, FCAE

* M.A. Erki, BASc, MASc, PhD, PEng, FIIFC, FIABSE, FCSCE

Professor (Adjunct)

* R.P. Chapuis, BEng, DEA, DScA, PEng, FEIC

* M. Green, BSc, PhD, PEng

I.D. Moore, B.E., PhD, FCAE, FEIC, PEng

R.K. Rowe, BSc, B.E., PhD, DEng, FRSC, FCAE, FEIC, PEng

Associate Professor

P. Heffernan, CD, rmc, plsc, BEng, MASc, PhD, PEng

* R. Tanovic, BSc, MSc, PhD, PEng

Associate Professor (Adjunct)

R.W.I. Brachman, BESc, PhD, PEng

* D. Chenaf, BEng, MScA, PhD

* C.W. Greer, BSc, PhD

Assistant Professor

J.A. Héroux, BEng, MIng, PEng

* P. Lamarche, BASc, MASc, PhD, PEng

G.A. Siemens, BSc, PhD, EIT

F. Sigouin-Allan, CD, rmc, BEng, MEng, PEng

* M. Tétreault, BIng, MScA, PhD, PEng

Major N. Vlachopoulos, CD, rmc, BEng, MEng, PhD Candidate, PEng

Captain M.C.G. Lehoux, CD, BEng, MASc

Assistant Professor (Adjunct)

W.A. Take, BSc, MSc, PhD

Technical Officer

D.A. Young, CET

Department of Electrical and Computer Engineering

Head of Department

* Associate Professor -G.S. Knight, CD, rmc, BEng, MEng, PhD, PEng

Professor Emeritus

* P.E. Allard, BSc, BASc, MSc, PhD, FEIC, PEng

* Y.T. Chan, BSc, MSc, PhD, PEng

* J. Plant, OMM, CD, mde, Phd(MIT), FEIC, FIEEE, PEng

* C.N. Rozon, BSc, MSc, PhD, PEng

* C.D. Shepard, BSc, MA, PhD, PEng

J.D. Wilson, BSc, PhD, PEng

Professor

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* S. Amari, DES, MSEE, PhD

* Y.M.M. Antar, BSc, MSc, PhD

D. Bouchard, CD, rmc, BEng, MEng, PhD, PEng

D. McGaughey, BSc, MSc, PEng, PhD

Professor (Adjunct)

J. Shaker, PhD

Associate Professor

R. Beguenane, BSc, MSc, PhD

J. Bray, BASc, MASc, PhD

* N. Chabini, BSc, MSc, PhD

* F. Chan, BEng, MScA, PhD
* G. Drolet, BSc, MSc, PhD, PEng
* M. Hefnawi, BSc, MSc, PhD
* A.M. Noureldin, BSc, MSc, PhD
* W.G. Phillips, CD, rmc, BEng, MEng, PEng, PhD
* M.H. Rahman, BSc, MSc, PhD, PEng
* M. Tarbouchi, BSc, MSc, PhD

Associate Professor (Adjunct)

J. Dingel, PhD
J. Morelli, PhD
R. Smith, CD, rmc, BEng, MSc, Phd

Assistant Professor

Capt F. Allaire, CD, rmc, BEng
* A. Beaulieu, CD, BEng, MEng, PhD
S.N. Givigi, BSc, MSc, PhD
LCdr D. Morrissey, CD1, MASc
J.P.S. Leblanc, CD, cmr, plsc, BSc, MEng, PEng
* F.A. Okou, BIng, MIng, PhD

Lecturer

Capt V. Roberge, CD, rmc, BEng
Capt G. Vigeant, CD, rmc, BEng
Maj G. Wolfman, CD, rmc, BEng

Department of Mechanical Engineering

Head of Department

* Professor - S.H. Benabdallah, BEng, MScA, PhD, PEng

Professor Emeritus

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* W.C. Moffatt, rmc, ndc, BSc, MSc, ScD, PEng
* J.G. Pike, rmc, BSc, MSc, PhD

Professor

* D.L. DuQuesnay, BASc, MASc, PhD, PEng

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* A. Benaïssa, BSc, MSc, PhD, PEng
* I.E. Boros, Dipl Ing, MASc, PhD, PEng
* M. Ferchichi, BASc, MASc, PhD, PEng
* A. Jnifene, BASc, MASc, PhD, PEng.
* M. LaViolette, BScA, PhD, PEng
* D.C.M. Poirel, CD, rmc, BEng, MEng, PhD, PEng.
* X. Wu, BSc, PhD, PEng

Assistant Professor

M. Arsenault, BScA, MScA, PhD, PEng
K. Goni Boulama, BEng, PhD, PEng
M. Jugroot, Lic ès Sci, Maîtrise/DEA, Doctorat
K. Khayati, Eng. Dipl., D.E.S.A., ing, jr, (OIQ)
C. Marsden, BEng, MEng, PhD
K. Moglo, BScA, MScA, PhD, ing, jr (OIQ)
R.E. Perez, BEng, MScA, PhD
Major G. Werner, CD, rmc, BEng, MEng, PEng
D.L. Wowk, BEng, MASc, PhD, Eng

Assistant Professor (Adjunct) and Research Associate

P.R. Underhill, BSc, PhD

Lecturer

Major T. Chalovich, CD, rmc, BEng, MEng, PEng
Lieutenant (N) T. Davies, CD, rmc, BEng, MASc, PEng
Captain C.E. Kotzer, CD, rmc, BEng, MASc, PEng
Lieutenant (N) S. Lachance, CD, BEng, MASc

Department of Applied Military Science

Head of Department

Colonel B. Lewis, OMM, CD, BEng, MBA, MEng, MEd, PhD

Assistant Professor

Lieutenant-Colonel J.S.J Beauséjour CD, BSc, MaMSc

Maj B. Mills, CD, BA, MA

Lieutenant-Colonel (Ret'd) K.E. Less CD, BEng, MSc, PEng

Maj (Ret'd) R. Sasha CD, BSc, MaMSc

Assistant Professor (Adjunct)

Maj G.A. Dyck CD, BSc, MaMSc

Directing Staff

Lieutenant- Colonel D. Gosselin, CD, BSc

Maj S. Dominico CD, BEng

Maj M. McNeil CD, BSc, MaMSc

CWO (MGnr) R.E. Fillier CD

MWO (MGnr) M. Barrigan CD

Department of Civil Engineering

General Information

Contact Information

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Programmes Offered

The Department of Civil Engineering offers the Master's and PhD degree programmes in Engineering, with specialty fields in Structures and Geotechnical Engineering. The Master's and Doctoral Programmes with the specialty field of Environmental Engineering are offered jointly with the Department of Chemistry and Chemical Engineering. A sub-committee of the two departmental graduate studies committees administers this programme. The details are contained in the calendar entry of the Department of Chemistry and Chemical Engineering.

Graduate research may be pursued in the following areas:

- Structural Engineering
- Geotechnical Engineering

Admission

Candidates for the degrees Master of Engineering and Doctor of Philosophy will be admitted under the general admission requirements. Details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this Calendar

Programme Requirements

The Master of Engineering degree is comprised of eight term courses at the graduate level plus a project.

The Master of Applied Science degree will be awarded to candidates who successfully complete a programme of studies normally comprised of five term courses at the graduate level plus a thesis. Depending upon the mathematical background of the candidate, a course in mathematics may be required. The Master's degree when pursued full-time in the residential programme normally requires two academic years plus the intervening summer to complete.

The Doctor of Philosophy will be awarded to candidates who successfully complete a programme of studies normally comprised of at least three lecture courses at the graduate level, in addition to those taken at the Master's degree, plus a thesis.

Six copies of the candidate's thesis are required by this department.

Course Descriptions

CE501 Advanced Geotechnical Engineering
CE503 Principles of Structural Stability
CE505 Strengthening and Repair of Concrete Structures
CE507 Advanced Reinforced Concrete Design
CE509 The Design of Multistory Buildings
CE511 Structural Timber Design
CE513 Laboratory Testing of Geomaterials
CE515 Reliability-based Design in Civil Engineering
CE517 Connections for Timber Structures
CE519 Numerical Methods in Environmental Engineering
CE525 Bridge Engineering
CE527 Advanced Numerical Methods used in Civil Engineering
CE531 Principles of Soil Mechanics
CE535 Advanced Foundation Engineering
CE537 Slope Stability and Earth-Retaining Structures
CE539 Geosynthetics in Geotechnical Engineering
CE541 Advanced Topics in Civil Engineering
CE551 Finite Element Method
CE571 Water and Waste Water Treatment Processes
CE577 Environmental Monitoring
CE583 Environmental Impact Assessment
CE585 Waste Management
CE587 Water Chemistry
CE589 Environmental Management
CE591 Arctic Construction Engineering
CE593 Analysis in Contaminant Hydrogeology
CE595 Design and Analysis for Blast Effect on Structures
CE599 Introduction to Unsaturated Soils
PR500 Project
TH500 Thesis (Master's Level)
TH600 Thesis (Doctoral Level)
CP600 Comprehensive Examination (Doctoral)

CE501 Advanced Geotechnical Engineering

An advanced study using a combination of case-histories and numerical modeling to explore geotechnical

engineering practice. The course covers advanced design and modeling topics in geotechnical engineering using a wide range of examples from the literature. The relationship between predicted and observed behaviour is explored using numerical methods as well as traditional prediction methods.

Lectures and Laboratory - 3 periods per week (one term)

Credit(s): 1

CE503 Principles Of Structural Stability

Topics include:

1. for frames: torsion constant, geometric Stiffness matrix, eigenvalues and eigenvectors, stability stiffness matrix, bowing stiffness matrix, superposition for axially loaded members having transverse loads, total potential energy and frame instability.
2. for plates: bending stiffness matrix, geometric stiffness matrix, critical loads in plate structures.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE505 Strengthening And Repair Of Concrete Structures

This course provides an overview of methods that can be applied to assess, rehabilitate or strengthen damaged or under strength concrete structures. Deterioration mechanisms that affect concrete structures will be covered, including severe environmental and loading conditions. Approaches and test methods to inspect and assess existing concrete structures will be investigated. Repair strategies and techniques will be considered for concrete as a construction material and for reinforced and prestressed concrete structures. Strengthening techniques will include the application of fibre reinforced polymer materials. Protective measures suitable for extending the life of concrete structures and structural health monitoring will also be discussed.

Lectures and Laboratory - 3 periods per week (one term)

Credit(s): 1

CE507 Advanced Reinforced Concrete Design

Topics include concrete technology; a review of ultimate strength design procedures; ultimate strength of concrete frame and slab structures; ultimate strength of concrete bridges; concrete members subjected to combined loadings; precast, pretensioned-concrete structures; current research in reinforced concrete.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE509 The Design And Analysis Of Multi-storey Buildings

The basic methods and computational techniques used to design multi-storey buildings will be discussed using case studies where appropriate. Topics will include classification, history and social-environmental implications of tall buildings, structural systems; architectural and structural design processes; analysis and design of components in the conceptual, preliminary and final design stages; use of computers in multi-storey building design.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE511 Structural Timber Design

The course content focuses on the behaviour and design of timber structures. Topics included: wood as a material, design of members (bending, tension, compression), connections, new manufactured wood products, glulam beams and arches, shearwalls and diaphragms, timber bridge decks, inspection and problems encountered in timber structures.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE513 Laboratory Testing of Geomaterials

A laboratory course for testing of geomaterials. This is a hands-on course to give students the opportunity to gain experience performing laboratory tests on geomaterials as well as interpretation of the results. Tests to be covered include index tests as well as higher level tests.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE517 Connections For Timber Structures

This course includes the study of the ductile and brittle failure modes of connections in timber structures for the various fasteners and direction of loading. Specific topics covered are: European Yield Model, Lantos group effect theory, proposed wood brittle failure mode design equations. The analysis and design of both timber and steel components in a connection are presented.

Prerequisite: CE511 or an equivalent

Lectures - 3 periods per week (one term)

Credit(s): 1

CE519 Numerical Methods in Environmental Engineering

The primary objective of this course is to familiarize the student with advanced numerical methods of importance to environmental engineering. An overview of numerical methods commonly applied to solve problems in environmental engineering and water resources will be provided. Both deterministic and stochastic approaches will be addressed. The fundamentals of finite difference and finite element solutions, linear-systems approaches, and neural network solutions will be examined using practical examples. Illustrative differential equations in environmental engineering, such as the advective-dispersive solute transport equation, will be derived and solved using numerical approaches covered in the course. Numerical models commonly used to solve environmental engineering problems in surface water and groundwater will be covered. Finally, recent case-studies will be presented and discussed. Some experience with a programming language (such as FORTRAN, DELPHI, C++, or Visual Basic), knowledge of water quality parameters of concern, an understanding of basic hydrodynamics of rivers, and a basic understanding of hydrogeology, although not essential, would be assets.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE525 Bridge Engineering

This course is intended to give the basic knowledge in bridge engineering including bridge design, construction and management. Topics in the introduction will cover problems of basic bridge conception and selection of bridge micro location, environmental consequences of bridge construction and aesthetics of bridges. Design loads, load factors and load combinations based on actual Codes will also be included. The main part of the course will focus on important topics in superstructure and substructure design and analysis, including concrete, steel, timber and composite bridges of short, medium and long span. Some topics in design and construction of special bridges (military bridges, movable bridges, etc.) will also be given. Recent developments in bridges (continuous and integral bridges, bridges which include modern FRP materials, etc.) will be given. Finally, basic topics in bridge management including bridge maintenance, capacity rating, evaluation and rehabilitation of existing bridges will be introduced. Throughout the course examples will be given including those of good design and those that failed. Students will be expected to work on a term design project.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE527 Advanced Numerical Methods In Civil Engineering

The course is a follow up of two undergraduate courses of numerical analysis (CEE317 & CEE319) and is intended to upgrade the learning of modelling civil engineering applications using numerical procedures. Topics will cover the solutions of systems of equations, the finite difference and finite element method. Lectures will be supplemented with student presentations and computer work. Students are expected to perform spreadsheet programming Lectures - 4 periods per week (one term)

Lectures - 4 periods per week (one term)

Credit(s): 1

CE531 Principles Of Soil Mechanics

This course examines the physio-chemical properties of soils and the effect of these factors on such soil properties as plasticity, compaction, swelling and permeability. Concepts of shear strength and volume change in soils and their application to a range of engineering problems. The course will also study of the origin, formation and special problems of the natural soil deposits of Canada. An advanced study of the laboratory testing of soils.

Lectures - 4 periods per week (one term)

Credit(s): 1

CE535 Advanced Foundation Engineering

Advanced studies of the following topics: Site investigation; principles of foundation design, shallow and deep foundations; soil dynamics and machinery bases; tunnels; instrumentation and construction techniques.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE537 Slope Stability And Earth Retaining Structures

This course focuses on the study of natural slopes, cut slopes and constructed embankments; classification of earth and rock movements; field investigations and instrumentation; corrective and control measures. Also studied is the design of earth retaining structures and excavations.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE539 Geosynthetics In Geotechnical Engineering

Topics include: types of geosynthetics and manufacturing processes; properties and test methods; methods of analysis and design for geosynthetics used for separation, filtration, soil reinforcement, erosion control and liquid/hazardous waste containment.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE541 Advanced Topics In Civil Engineering

The topics of this course are adjusted to the specific requirements of the candidates. Typical complementary topics for this course would include, but are not be limited to, advanced composite materials, fracture mechanics of wood structures, bridge engineering, advanced treatment and environmental remediation processes, seismic design of earth structures, the effects of blast material behaviour on structures, advanced topics in groundwater modelling.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE551 Finite Element Method

This course is an introduction to engineering and finite element analysis. Topics include: direct approach and variational formulation; displacement functions and the equilibrium method; outline of some aspects of physical and geometrical non linear problems. The course will introduce applications to different problems depending on student interest and research work. Lectures - 3 periods per week (one term)

Lectures - 3 periods per week (one term)

Credit(s): 1

CE571 Water And Wastewater Treatment Processes

The course examines the principles and application of the physical, chemical and biological treatment of wastewater including aspects of soil systems, stabilization ponds, the activated sludge process, anaerobic and aerobic digestion, oxygen transfer, the treatment and disposal of sludge, quantity and quality analysis, sedimentation, thickening flotation, centrifugation, filtration, coagulation and flocculation, porous membrane techniques, ion exchange, absorption and disinfection. Laboratory exercises designed to illustrate some of the basic fundamentals will also be carried out. Lectures - 3 periods per week; Laboratory - 2 periods per week (one term)

Laboratory exercises designed to illustrate some of the basic fundamentals will also be carried out.

Lectures - 3 periods per week; Laboratory - 2 periods per week (one term)

Credit(s): 1

CE577 Environmental Characterisation And Monitoring

This course provides an overview of current practice in environmental characterization and monitoring. Lectures presenting the material are augmented by equipment demonstrations and field exercises when opportunities arise from current research projects. Topics covered include: Statistical considerations of environmental sampling and monitoring; subsurface characterization protocols and technologies; sampling and monitoring of surface water, storm/sewer water and atmospheric environments and; health and safety considerations at contaminated sites.

Lectures - 3 periods per week; Laboratory - 2 periods per week (one term)

Credit(s): 1

CE583 Environmental Impact Assessment

The course will cover the following subjects: General concepts of the environmental impact of engineering projects, laws and regulations, ecological parameter evaluations and weighting factors, assessment techniques such as Batelle, McHarg and Corridor, case studies.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE585 Waste Management

This course deals with the generation, transport and treatment of solid and hazardous wastes in industrialized communities. Problems associated with waste disposed of by traditional means will be investigated. The design of engineered landfills for both domestic and hazardous material will be covered. Alternatives to landfill will be studied and discussed in terms of their social and environmental impact.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE587 Water Chemistry

Topics include: aspects of chemical kinetics; rate laws and reaction mechanisms; chemical thermodynamics; equilibrium of single and multiprotic acids; pC pH diagrams; the carbonate system; coordination chemistry,

inorganic and organic complexes; redox reactions; heavy metals and other pollutants' behaviour in the environment At the end of the course, the student should be able to calculate or to estimate the equilibrium concentration of various inorganic and some organic chemicals in water exposed to reagents in solid, liquid, and gaseous forms (e.g., soils, atmosphere). The student should also be able to understand the operating principles and data requirements of chemical equilibrium calculation programs.

Lectures - 3 periods per week (one term)

Credit(s):

CE589 Environmental Management

This course examines selected engineering approaches to management and planning of physical systems. Topics covered include: standards and criteria; indices as measures of performance; mathematical structure and aggregation of sub-indices proposed for air, water, noise and quality of life; environmental damage functions; introduction to systems planning; multiobjective planning and location of optimalities; linear and dynamic programming.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE591 Arctic Construction Engineering

Topics include an introduction to the northern climate and permafrost; the design of roads, runways, building foundations and housing for the arctic; and the provision of municipal services including water treatment and supply, wastewater collection, treatment and disposal, and solid waste disposal.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE593 Analysis In Hydrogeology

This course will cover topics of applied hydrogeology oriented towards analysis techniques in the area of groundwater flow and contaminant transport. Aspects covered include practical and theoretical responses to concerns encountered in typical geological settings. Available simulation models are applied in case study settings, encompassing flow problems and solute transport in saturated and unsaturated homogenous media.

Lectures - 3 periods per week (one term)

Credit(s): 1

CE599 Introduction to Unsaturated Soils

This course examines current theories of unsaturated soils. Topics include: Fundamental principles of unsaturated soils, unsaturated stress and flow phenomena, laboratory measurement of unsaturated parameters including suction, suction-water content relationships, shear strength and hydraulic conductivity, and numerical modeling of unsaturated soils applications. Course work includes assignments, design projects and seminars.

3 periods per week (one term)

Credit(s): 1

PR500: Project

TH500: Thesis (Master's Level)

TH600: Thesis (Doctoral Level)

CP600: Comprehensive Examination (Doctoral Level)

Department of Electrical and Computer Engineering

General Information

Contact Information

Department Head - Dr. Derrick Bouchard

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Web Page: Department of Electrical and Computer Engineering

Programmes Offered

The department of Electrical and Computer Engineering offers the Master's and Doctoral degree programmes in Engineering, with specialty fields of Electrical Engineering, Computer Engineering, and Software Engineering.

This Department's graduate research programme is closely affiliated with and supported by DND research labs, directorates and agencies. There is also ongoing collaboration with government laboratories, private companies, and other universities in various research areas.

Graduate research may be pursued in the following areas:

Electrical Engineering:

- Radar Studies and Polarimetry, Electromagnetic Interference and Compatibility
- New Antennas and Microwave Circuits for Radar
- Wireless Communication Systems
- Automatic Control Systems
- Electric Power Systems and Power Electronics
- Electric Machines
- Robotics
- VLSI and Microelectronics
- Vehicular Navigation Systems
- Digital Signal Processing and Image Processing
- Target Detection and Classification

Computer Engineering/Software Engineering:

- VLSI Architecture and Design Automation
- Embedded Computer Systems
- Computer Communications
- Computer Security
- Human-Computer Interaction
- Object-Oriented Analysis and Design
- Real-Time Software Design
- Software Development and Maintenance
- Software Quality and Process Improvement

Admission

Candidates for the degrees Master of Engineering and Doctor of Philosophy will be admitted under the General Admission Requirements. Details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this Calendar

Programme Requirements

The Master of Engineering is comprised of at least ten lecture courses plus a project. The Master of Applied Science degree will be awarded to candidates who successfully complete a programme of studies normally comprised of six lecture courses at the graduate level in addition to a thesis. The Master's degree when pursued full-time in the residential programme normally requires two academic years plus the intervening summer to complete. The Doctoral degree will be awarded to candidates who successfully complete a programme of studies normally comprised of ten lecture courses at the graduate level in addition to a final thesis.

Course Descriptions

EE501 An Introduction to the Theory of Statistical Communications
EE502 Applied Research in Electrical and Computer Engineering
EE503 Wheeled Mobile Robots: Modelling, Control and Instrumentation
EE505 Satellite Communications
EE511 Digital Signal Processing
EE513 Topics in Electrical Engineering
EE515 Numerical Methods for Electromagnetics
EE517 Adaptive Filtering Theory
EE519 Synthesis of Digital Systems
EE521 Secure Communications
EE523 Integrated Navigation Systems
EE525 Power Quality in Electric Power Systems
EE527 Engineering Human-Computer Interaction
EE529 Microwave Engineering and Systems
EE533 Hardware Implementation of Digital Signal

Processing
EE535 Advanced Control Systems
EE537 Antenna Engineering
EE539 Variable Speed Control of Electric Machines
EE541 Real-Time Digital Computer Control Systems
EE543 Radar Basics and Applications
EE545 Microcomputers: Architecture and Applications
EE549 Digital Communications
EE551 Real-Time Operating Systems
EE553 VLSI Design
EE555 Electromagnetic Compatibility
EE557 Test Methodologies for VLSI
EE559 Digital VLSI Architecture
EE561 Power Electronics
EE563 Topics in Computer Engineering
EE565 Computer Networks and Protocols
EE571 Advanced Topics in Power Engineering
EE573 Object-oriented Analysis and Design
EE575 Introduction to the Theory of Neural Networks
EE577 Neural Networks Applications To Power Systems
EE579 Computer Systems and Network Security
EE583 Software Requirements Engineering
EE585 Real-Time Software Design and Implementation
EE587 Topics in Software Engineering
EE591 Software Engineering
EE599 Computer System Verification and Validation
PR500 Project
TH500 Thesis (Master's Level)
TH600 Thesis (Doctoral Level)
CP600 Comprehensive Examination (Doctoral Level)

EE501 An Introduction To The Theory Of Statistical Communications

Formulation of the communications problem as a stochastic process; probability and random variables; expectations; moments; characteristic function; multi-variate distributions; stationarity and the ergodic theorem; ensemble and time averages. An introduction to optimum detection; the sampling theorem and efficient transmission of message sequences.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE502 Applied Research in Electrical and Computer Engineering

This course is normally taken by students in the Master of Applied Science Programme in Electrical, Computer or Software Engineering. The course provides an introduction to the primary and secondary sources of information in the literature of the associated disciplines. The students will also be exposed to the specific applied research groups within the Department, their techniques, and their specific application of the scientific method. The students will conduct in-depth research in a specific topic area related to their field of study. A member of the Department Faculty will supervise this investigation through directed study. The Student will be required to communicate research ideas in writing though academic papers and proposals, and verbally through presentations and seminars. Standards for academic discourse and publication will be emphasised in the assigned papers and presentations.

Lectures/Seminars/Directed Study (two terms): Equivalent to a course of 3 periods per week for one term.

Credit(s): 1

EE503 Wheeled Mobile Robots: Control and Instrumentation

The goal of the course is to provide an introduction to mobile wheeled robots (MWR), pertaining to distinct classes/topologies. The material is divided in three sections. The nonholonomy, a typical property of WMR is treated first: mathematical definition, examples, tools from nonlinear control theory and impact on control and instrumentation are covered. Then, two classes of WMR are studied: car-like robots and mobile wheeled pendulums. For each class, modeling, nonholonomy test, controllability and control are covered. Finally, the instrumentation on-board of MWR is investigated, namely inertial and vision sensors.

Lectures/Seminars/Directed Study (two terms): Equivalent to a course of 3 periods per week for one term.

Credit(s): 1

EE505 Satellite Communications

Satellite orbital mechanics, spacecraft technology, satellite antennas, link design and budgets, transmission engineering, propagation effect and modelling, earth station technology, VSAT, multiple access techniques, spread spectrum, coding, specific applications.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE511 Digital Signal Processing

The fast Fourier transform and its computer implementation; spectral estimation; analytic signal; multi-dimensional signal processing; digital filters, signal detection and estimation; Kalman filters; linear predictive coding; adaptive receivers.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE513 Topics In Electrical Engineering

The course consists of formal lectures and the study and discussion of research papers appearing in the current literature. Students will be expected to participate in the presentation of the lecture material. Topics chosen will be by arrangement with the department.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE515 Numerical Methods For Electromagnetics

Numerical methods for solutions of problems in Electromagnetics with application to static, quasistatic, and high frequency fields. Introduction to essential features of method of moments, finiteelement method, finite-difference method, method of lines, field-matching and modematching techniques, transmission-line matrix method and spectral-domain approach: Fourier and Hankel transforms, Green's functions in multilayered media. Applications to problems in Microwave Circuits and Antennas.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE517 Adaptive Filtering Theory

This course covers the fundamentals of adaptive filtering including performance objectives, optimal filtering and estimation. The Wiener solution and the orthogonality principle are also introduced. Analysis of the different Adaptation algorithms, MSE performance surface, gradient search methods, the Widro-Holf LMS algorithm, convergence speed and the deviation from the absolute minimum MSE are studied. This course will discuss several advanced adaptive filtering techniques including recursive least-squares algorithms, gradient and least-squares lattice filter. Applications will include system identification, channel equalization, echo cancellation, linear prediction and noise cancellation.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE519 Synthesis Of Digital Systems

Hardware-software co-design. Hardware description languages. Graph optimization problems and basic algorithms to solve them. Behavioural synthesis: scheduling, binding, allocation, data-path and control synthesis. Logic synthesis: combinational circuit optimizations, sequential circuit optimizations, optimizations targeting finite state machines. Transformations to a specific technology.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE521 Secure Communications

Direct sequence and frequency hopping spread spectrum systems and their evaluation in the presence of various types of jammer noise. The use of error correcting codes to improve the performance of spread spectrum systems. The study of classical and modern cryptosystems. Public key cryptography and the data encryption standard. Introduction to complexity theory as it pertains to cryptography.

Prerequisite: EE501

Lectures - 3 periods per week (one term)

Credit(s): 1

EE523 Integrated Navigation Systems

This course covers the fundamentals of inertial navigation systems (INS) and the integration with global positioning systems (GPS). The performance characteristics of different types of navigation sensors, their calibration procedures and the stochastic modeling of their errors are discussed. The computation of the position, velocity and attitude components of a moving platform in the 3D space with respect to certain reference frame is studied. The course also covers the INS/GPS integration using both Kalman filter and artificial intelligence techniques. Applications are mostly related to car navigation.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE525 Power Quality in Electric Power Systems

Power quality terms and definitions, voltage sags and interruptions and techniques to reduce their effects, fault clearing, transient overvoltages, long-duration voltage variations, power system harmonics, methods for reducing and controlling harmonics, power quality benchmarking and monitoring, wiring and grounding methods, and power quality in distributed generation.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE527 Engineering Human-Computer Interaction

State of the art and state of the practice in engineering approaches to the development of highly interactive software systems. Requirements modeling and specification. Psychological issues in interaction design; predictive models of human performance. Design approaches. Guidelines and standards. Software

architectures and design patterns. Verification and validation techniques.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE529 Microwave Engineering And Systems

Review of basics, transmission lines theory, other transmission media, matching, S-matrix, passive microwave components and devices, microstrip transmission media and circuits, CAD techniques for microwave devices design and optimisation, microstrip antennas, microwave generation, time and frequency domain measurements using modern network analysers, microwave communications systems and subsystems.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE533 Hardware Implementation of Digital Signal Processing

Design techniques and hardware implementation of digital signal processing (DSP) algorithms. Design flow from concept to bit true simulation to hardware implementation. DSP hardware technologies including FPGA technology; the fundamentals of DSP Arithmetic; FPGA elements for DSP algorithms; analysis and modeling of DSP algorithms; conversion of models to fixed-point blocks; high-level DSP optimizations; common DSP structures such as pipeline FFTs and finite/infinite impulse response filters; timing and synchronization issues.

Lectures: 3 periods per week plus laboratory and project (one term)

Credit(s): 1

EE535 Advanced Control Systems

This course covers the fundamentals of discrete-time systems. The identification and Parameter Estimation techniques will be discussed. Introduction to Adaptive Control of Linear Systems will be presented. Lyapunov stability theory and hyper-stability theory, Self-tuning Approach, and Model reference adaptive Control are covered. Introduction to nonlinear control and adaptive nonlinear control methods: Input-output linearization, input-state linearization and backstepping techniques. Applications are mostly related to electric motors and power systems.

A strong foundation in linear control theory is a recommended course pre-requisite.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE537 Antenna Engineering

The course addresses fundamental and advanced topics in Antennas. Contents include: Introduction to antenna basics. Fundamental parameters of antennas and radiation. Analysis methods. Wire, array antennas and synthesis, self and mutual impedance and coupling. Traveling wave, microstrip, dielectric and leaky wave antennas. Small antennas and fundamental limitations. Broad band, ultra wide band, frequency independent, fractal antennas. Reflector antennas and Fourier transform and apertures. Introduction to smart antennas system aspects. Measurement techniques.

Basic electronic theory is a recommended course pre-requisite.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE539 Variable Speed Control Of Electric Machines

DC machine control, Variable speed control, variable-voltage inverter drive, pulse-width modulated voltage/current source inverter drive. Motor drives: induction motor, permanent magnet motors, stepper motors and switched reluctance motors: Design of vector control systems. Flux and torque estimation methods, Rotor and stator flux oriented control, Sensitivity to parameter stat and parameter adaptation, PWM current control techniques, Direct Torque Control and Speed/position estimation.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE541 Real-time Digital Computer Control Systems

The design of feedback controllers for linear, discrete time system controlled by a digital computer, quadratic performance measures; pole placement; compensation; decoupling constrained control; methods for controller realization.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE543 Radar Basics And Applications

Review of electromagnetic waves basic concepts, antenna basics, linear antennas, arrays, computer aided analysis and design techniques application to antennas, radar

basics and fundamentals, radar antennas, polarization concepts in radar, radar cross section, weather effects on radars, radar techniques (SAR, MTI, etc.), applications (weather radars, SBR, OTHR).

Lectures - 3 periods per week (one term)

Credit(s): 1

EE545 Microcomputers: Architecture And Applications

Survey of available microprocessors; selection of components for specific applications; internal organization; memories, I/O ports; system requirements; programming considerations; interrupt structures; peripheral devices and controllers. Application to the designs of multiprocessor systems.

Lectures - 3 periods per week plus laboratory (one term)

Credit(s): 1

EE549 Digital Communications

Baseband transmission. Digital modulation techniques and performance. Block codes. Convolutional code. Trellis-coded modulation. Coding and modulation for fading channels.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE551 Real-time Operating Systems

Embedded systems. Nature of real-time constraints and mechanisms for handling them. Time as a critical resource; controlled responses to external events. Bare machine vs. higher level approaches. Examples and applications. Survey of existing real-time operating systems.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE553 VLSI Design

MOS transistors, modelling, second order effects, device fabrication, small geometry considerations, static and dynamic CMOS circuits, ESD structures, I/O buffers. Layout techniques, design for testability. Application Specific Integrated Circuits, overall IC design methodology, CAD/CAE tools.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE555 Electromagnetic Compatibility

Introduction to electromagnetic fields, circuits and signals, sources of electromagnetic interference and the E.M. environment, penetration through shields and apertures, shielding theory, principles of propagation and cross-talk, coupling from external fields, E.M. fields generated by transmission lines, prediction of EMI/RFI conditions in radio communications, simulation of E.M. coupling between systems, effects of electromagnetic interference on devices and systems, transients suppression, shielding and grounding, cable screening, filtering, general EMC design principles, EMC standards, EMC measurements and testing.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE557 Test Methodologies For VLSI

Manufacturing process and yield evaluation. Yield modelling and reliability evaluation. Failures and fault modelling. Testability analysis, test vectors, and fault coverage. Test pattern generation. Fault simulation methods. Testability measures and design for testability. Built-in test, self-test, and signature analysis. Boundary Scan architecture and standard.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE559 Digital Vlsi Architecture

System design methodology; digital hardware components and technologies, Application Specific Integrated Circuit (ASIC) design process; system timing: clocking strategies, timing analysis and clock distribution; arithmetic algorithms ad realization: speed and area considerations; regular structure architecture: Programmable Logic Devices (PLDs), Static RAMs, Dynamic RAMs, Contents Addressable Memories (CAMs) and systolic arrays; design for testability.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE561 Power Electronics

Characteristics of semiconductor power control devices; analysis and design of circuits and systems for energy control and conversion, with applications to converters, inverters, choppers and cycloconverters; closed-loop control of electromechanical systems.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE563 Topics In Computer Engineering

Consists of formal lectures and the study and discussion of research papers appearing in the current literature. Students will be expected to participate in the presentation of the lecture material. Topics chosen for discussion will be by arrangement with the department.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE565 Computer Networks And Protocols

Review of queuing theory as it applies to networks: capacity assignment. OSI model for computer networks. Analysis of protocol, routing and flow control. Multiple access techniques. Local area networks. The students may be asked to review recent papers and do small projects.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE571 Advanced Topics In Power Engineering

A course dealing with topics on power systems operation, control and protection. Topics include reaction power control: compensators, voltage regulation and power factor correction for symmetrical and asymmetrical loads; effects of reduced voltage on the operation and efficiency of electric loads; distribution loss evaluation and optimisation; fault current limiting and effects of reduced fault duration upon power system components; control of interconnected power systems.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE573 Object-oriented Analysis And Design

This course consists of an introduction to Object-Oriented Analysis (OOA) and Design (OOD). The course material covers managing complexity using data and procedural abstraction, encapsulation, hierarchies, and composition of problems into classes and objects. The concepts of overloading, multiple inheritance and polymorphism are introduced. The analysis, design and implementation phases of software development are considered in the context of an iterative object-oriented development methodology. Design patterns are introduced as context for higher-level reuse. Course assignments will provide an introduction to object-oriented modeling languages, and will provide experience with implementation using a standard object-oriented programming language.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE575 Introduction To The Theory Of Neural Networks

The course focuses on neural networks as trainable dynamical systems with self-organization properties. The most important classes of neural networks along with their respective learning paradigms are studied in detail. These include Hopfield nets, feed forward networks, recurrent networks and networks allowing for unsupervised Hebbian and competitive learning. Emphasis throughout the course is placed on applications to signal processing, pattern recognition and optimisation problems. The student will be required to complete at least two mini projects on specific topics dealing with the applications of neural networks to engineering problems.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE577 Neural Networks Applications To Power Systems

This course examines the state-of-the-art in artificial neural network technology for electric power systems. The course is composed of two parts. The first part provides an overview of artificial neural networks (including both supervised and unsupervised network models), their principles of operation learning rules, advantages and limitations. In the second part, specific applications of neural networks in power systems are examined, including system load forecasting, security assessment, power system planning, system fault diagnosis and control of power systems.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE579 Computer Systems And Network Security

Topics will include computer security concepts, terminology, seminal research, operating systems and issues of network administration related to computer security. Network attack, intrusion techniques and the detection of such attacks and intrusions are explored. Lectures: 3 periods per week plus laboratory and project (one term)

Lectures: 3 periods per week plus laboratory and project (one term)

Credit(s): 1

EE583 Software Requirements Engineering

The software Requirements phase within the Software Systems Lifecycle. The use of models. The Requirements Elicitation Process: Joint Application Design, Prototyping, Requirements Inspections, Quality Function

Deployment, Scenarios. Organizing and Analysing the problem. Software Behaviour Specification: State-oriented, Function-oriented, Object-oriented. Formal Methods. Documentation for Software Requirements Specification. Specifying Nonbehavioural Requirements. Refinement of requirements into preliminary design.
Lectures - 3 periods per week (one term)

Lectures - 3 periods per week (one term)

Credit(s): 1

EE585 Real-time Software Design And Implementation

The interaction between requirements and design. Alternative approaches to design. Domain specific design methods. Tools that support specific methods. Focus on a particular method in the real-time embedded software domain, and on a supporting tool intended to be used in a host/target development environment. Software structures and architectures. Techniques for the specification of module behaviour. Use of mathematical techniques. Concurrency, distribution and performance issues. Iteration and rapid prototyping. Reusable designs and components. Patterns and frameworks. Automatic code generation. Transferring models to targets. Controllability and observability of models on both host and target.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE587 Topics In Software Engineering

The study and discussion of research papers appearing in the current literature. Students will be expected to participate in the presentation of the material. Topics chosen for the course will be by arrangement with the Department.

Lecture and tutorial: 3 periods per week (one term)

Credit(s): 1

EE591 Software Engineering

Consideration and use of engineering principles to design and implement cost-effective, reliable software. Current software requirements methodologies and design practices, documentation standards, software project management, verification and validation techniques, software security considerations and computer human interfaces.

Lectures - 3 periods per week (one term)

Credit(s): 1

EE599 Computer System Verification And Validation

Formal techniques: proving systems correct, checking consistency and completeness. Inspections and reviews. Unit/module testing. White box and black box testing. System integration and testing. Tool support for testing. Faults vs. failures. Verification of implementation against both requirements and design. Techniques for safety critical and secure systems. Trustworthiness vs. reliability. Timing analysis and verification. Safety analysis. Fault tolerant systems. Quality assurance and reliability.

Lectures - 3 periods per week (one term)

Credit(s): 1

PR500: Project

TH500: Thesis (Master's Level)

TH600: Thesis (Doctoral Level)

CP600: Comprehensive Examination (Doctoral Level)

Department of Mechanical & Aerospace Engineering

General Information

Contact Information

Department Head - Dr William (Billy) Allan

Graduate Committee Chair - Dr Jnifene.

Telephone: 613-541-6000 ext 6369

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Web Page: Department of Mechanical Engineering

Programmes Offered

The department of Mechanical Engineering offers Master's and PhD degree programmes in Mechanical Engineering and a Master's degree programme Aeronautical Engineering. Specific research interests of faculty members are described in the department and faculty member's web pages.

Admission

Candidates for the degrees Master's of Engineering (MEng), Master's of Applied Sciences (MASc) and Doctor of Philosophy (PhD) will be admitted under the general admission requirements. Details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this calendar

Programme Requirements

The Master's of Engineering degree is comprised of eight term courses at the graduate level plus a project. The Master's of Applied Science degree will be awarded to candidates who successfully complete a programme of studies normally comprised of five term courses, at the graduate level, plus a thesis. Normally, at least one of the term courses will be in mathematics. However, for the Master's programme in Aeronautical Engineering, two of these courses must normally be of an Aeronautical Engineering subject (AE designation) or equivalent.

The Doctoral degree in Mechanical Engineering will be awarded to candidates who successfully complete a programme of studies normally comprised of eight courses at the graduate level in addition to a thesis. Graduate courses taken during a Master's degree programme may be included in the eight courses.

Course Descriptions

ME503 Advanced Design of Engineering Systems
ME511 Advanced Engineering Data Analysis and Experimental Design
ME513 Fluid Dynamics - Viscous Flow
ME519 Boundary Layer Theory
ME523 Biomechanics of Human Movement
ME529 Convective Heat Transfer
ME531 Stress Analysis of Composite Materials
ME533 Applied Elasticity
ME535 Fatigue and Fracture Behaviour of Materials
ME539 Mechanical Behaviour of Advanced Materials
ME541 Mechanical Vibration
ME547 Advanced Finite Element Analysis
ME549 Tribology
ME551 State-Space Control
ME553 Case Studies Of Optimal Control Applications
ME555 Combustion Processes
ME589 Advanced Instrumentation
ME591 Advanced Topics in Mechanical Engineering
ME593 Flow Stability Theory
ME595 Plasma Science and Engineering
ME597 Robot Mechanics
AE501 Robust Control
AE503 Fundamentals of Aeroelasticity
AE507 Gas Turbine Analysis
AE515 Advanced Plasma Spacecraft Propulsion
AE517 Fluid Dynamics - Compressible Flow
AE531 Composite Materials for Aerospace Applications
AE537 Aircraft Structures and Materials
AE561 Aerodynamics of Turbomachines
AE567 Aircraft Performance
AE591 Advanced Topics in Aeronautical Engineering
AE599 Turbulence Theory
PR500 Project
TH500 Thesis (Master's Level)
TH600 Thesis (Doctoral Level)
CP600 Comprehensive Examination (Doctoral Level)

ME503 Advanced Design of Engineering Systems

Approaches, procedures and attitudes for open-ended complex and novel engineering design problems, demanding innovation, creativity, and entrepreneurship, and defined in contexts of industry, society, economics, etc. Solutions must consider requirement specifications, properties of systems, candidate alternative solutions in

conceptual design, layout design and details, manufacturing plan, acceptance requirements, maintenance plan, etc., and define processes and products, components and machine elements. Advanced solution processes and methods and relationships to other methodologies and best industrial practices are established. Representative engineering problems from conception to drawings are assigned. Lectures - 3 periods per week (one term)

Lectures - 3 periods per week (one term)

Credit(s): 1

ME511 Advanced Engineering Data Analysis and Experimental Design

This course examines the practical use of a variety of statistical techniques, including least squares analysis, factor analysis, and analysis of variance to analyze engineering data. Emphasis is placed on how to use quantitative measures to design experiments to extract the maximum amount of information from the minimum number of experiments. Case studies relevant to the students will be examined.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME513 Fluid Dynamics - Viscous Flow

Advanced topics in fluid mechanics. Basic continuum mechanics, analysis of the stress and velocity gradient tensors, vorticity, introduction to the theory of transition and turbulence. Evaluation is based on assignments, one final exam and a student review (written and presented by student) of selected current scientific publications.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME519 Boundary Layer Theory

The main topics covered in this course are: (1) fundamental equations of viscous flow; continuity, Navier-Stokes equations (momentum), energy and vorticity; (2) Unsteady flows, suction flows and stagnation point flows; (3) Incompressible, laminar boundary layers; integral analysis, boundary-layer equations, approximate methods for boundary-layer equations, Karman-Pohlhausen method for flow over a flat plate, Karmen-Pohlhausen method for non-zero pressure gradient flows, laminar separation; (4) Transition to turbulence and hydrodynamic stability theory; (5) Incompressible, turbulent flow; Reynolds equations, turbulent boundary layers, turbulence modeling, pressure gradients and separation; (6) Shear flows; free jets, wakes and mixing layers; (7) Overview of the effects of compressibility on laminar and turbulent boundary layers and consequences in aerodynamics.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME523 Biomechanics of human movement

In this course, the biomechanics of human movement is defined as the mechanics and biophysics of the musculoskeletal system as it pertains to the performance of any movement skill. Among the topics covered, one finds the introduction to biomechanics, 2D kinematics of human body, anthropometry, 2D kinetics of the human body, mechanical work-energy-power, 3D kinematics and kinetics, human movement analysis, muscle mechanics and electromyography.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME529 Convective Heat Transfer

This course reviews the fundamental laws governing forced, natural and mixed convection heat transfer processes in laminar and turbulent flows. Both the macroscopic and the differential approaches are explored. The non-dimensional parameters controlling these transport processes are evidenced and their practical implications are discussed. Analytically derived exact solutions, semi-empirical correlations and numerically calculated solutions are presented for the momentum and heat transfer rates in different configurations. The course also introduces chemical species diffusion phenomena in flows, including the heat and mass transfer analogy and the calculation of non-dimensional mass transfer rates.

The lectures are supplemented by problems, laboratory experiments and projects that will involve mathematical hand derivations, literature research, as well as the use of CFD software.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME531 Stress Analysis of Composite Materials

This course considers a matrix approach to the macromechanical analysis of composite materials. Topics included are: properties of an orthotropic lamina, stress analysis of laminated composites, failure criteria and design of composite materials, buckling of laminated plates and shells. Lectures - 3 periods per week (one term)

Lectures - 3 periods per week (one term)

Credit(s): 1

ME533 Applied Elasticity

This course offers an in-depth exposure to the theory of elasticity with particular emphasis on metal fatigue. Additional topics include: rotating disks, torsion of non-circular bars, energy methods, failure theories.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME535 Fatigue and Fracture Behaviour of Materials

Stress-strain relationships, cyclic material behaviour, Masing's model and Neuber's rule are reviewed. Fatigue mechanisms, cumulative damage analysis, cycle counting techniques and fatigue life prediction are investigated with an emphasis on metals. Stress concentration and surface finish effects, computer simulation and analysis of fatigue behaviour are included. Principles of fracture mechanics including stress intensity factors, crack growth relationships, fracture toughness and failure mechanisms are studied. Many design applications and examples are given and commercial software is used for analysis. The lectures are supplemented with laboratory exercises and demonstrations.

Lectures - 3 periods per week (One Term)

Prerequisite(s): MEE331 and MEE333 or equivalents

Credit(s): 1

ME539 Mechanical Behaviour of Advanced Materials

This course covers the structure and mechanical behaviour of engineering materials with emphasis on plastics, ceramics, composites, specialty alloys, carbon and smart materials. The mechanical properties, uses, manufacturing and processing are outlined together with the effects of temperature, environment, failure mechanisms and prevention. The lecture material is supplemented by laboratory exercises and demonstrations.

Lectures - 3 periods per week (one term)
Prerequisite(s): MEE333 or equivalent

Credit(s): 1

ME541 Mechanical Vibration

A second course designed to follow-up an undergraduate course in Systems Dynamics and/or Mechanical Vibration. Systems with two degrees of freedom are used to review basic principles and methods. The concepts are then extended to multi-degree-of freedom systems, to continuous systems and to the use of numerical methods of solution. Lagrange's method is introduced (or reviewed, depending on the candidates) and used in formulating more complex problems. An introduction to finite elements completes the course.

Lectures are supplemented by problems, modelling assignments and computational assignments requiring the digital computer.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME547 Advanced Finite Element Analysis

This course covers linear and non-linear structural finite element analysis with the focus being on practical applications. Topics include element stiffness matrices, shape functions, geometric non-linearity, material plasticity, and contact. Practical finite element modeling will be taught using commercial software, lectures on practical modeling aspects, and case studies. The students will complete a series of linear and non-linear analyses covering additional topics such as modeling in different dimensions, symmetry, mesh convergence, model validation and parametric studies.

Lectures - 3 periods per week (one term)

Lab - 2 hour lab period per week

Credit(s): 1

ME549 Tribology

This course is concerned with the study of interacting surfaces in relative motion. Among the topics considered are: surface topography, contact mechanics, theories of friction, wear processes, surface coatings, boundary lubrication, hydrodynamic lubrication, elastohydrodynamic lubrication, bearing design, experimental methods. Emphasis is placed on the tribological solution of a wide range of engineering problems and applications.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME551 State-space Control

This course is an introduction to state-space analysis and control. The materials covered include the following topics: State-space representation of physical systems, relation between transfer function and state-space, controllability and observability, pole placement, optimal control, parameter estimation and observer design, and advanced topics in modern control applications. In this course the software MATLAB/SIMULINK is intensively used.

Prerequisites: Laplace transforms, System modelling, Stability analysis of closed loop feedback systems and control system design based on transfer function models.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME553 Case Studies of Optimal Control Applications

A reading course where the student will study the methods used, the results obtained and the gains achieved through the optimal control of certain applications. The readings are chosen to illustrate the following topics:

1. Liapunov's Stability Criteria;
2. Discrete form of the principle of optimality and dynamic programming;
3. Continuous form of the principle of optimality, Pontryagin's Maximum principle (minimum time and minimum energy);
4. Optimal Control of Linear Quadratic Regulators.

Prerequisite: ME551

Progress will be reviewed regularly.

Credit(s): 1

ME555 Combustion Processes

This course introduces the physical and chemical concepts involved in combustion systems. Among the topics considered are: chemical equilibrium, kinetics of combustion reactions, flame structure and propagation, ignition, stabilization and blowout, and explosion and fire hazards. The combustion characteristics of gas turbines, Diesel and spark-ignition engines are briefly examined to illustrate the basic concepts. The lectures are supplemented by problems and by laboratory exercises.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME589 Advanced Instrumentation

After developing the generalised transfer function for first, second and third-order sensors, specific transducers are studied. Applications of accelerometers, rate sensors, and different force transducers are emphasised. Hall-effect devices, laser techniques, x-rays and proximity sensors are utilised in various measurement scenarios together with the appropriate data acquisition system. The PG student will participate in seminars and develop a major design project.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME591 Advanced Topics in Mechanical Engineering

The course consists of the study and discussion of current research or an advanced topic available due to special circumstances. Topics are subject to change with requirements of the professors in the department.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME593 Flow Stability Theory

This course introduces the method used in analysing the stability of the fluid motion with respect to infinitesimal disturbances, together with some of the most representative experimental and analytical results. We will talk about the mathematical analysis and physical mechanism of thermal instability, centrifugal instability, and parallel shear flow instability. This course will start with brief reviews on linear systems, wave physics, and Fourier transform. After these preparations we will discuss the general aspects of linear stability theory using the example of Lorenz Equation. This introduction is followed by detailed analysis of the Benard problem, double diffusive free convection, the Taylor problem, and the Kelvin-Helmholtz instability. From there we proceed to discuss topics related to the problem of parallel shear flow instability such as Howard's semicircle theorem, Squire's theorem, the Orr-Sommerfeld equation, Rayleigh's theorem and Fjortoft's theorem. We will give concrete examples such as the stabilities of mixing layer, Poiseuille flow, and plane Couette flow. In the later part of the course we will place emphasis on discussing the stability and transition of the flat plate boundary layer, covering topics such as the Tollmien-Schlichting wave and related classical experimental work.

3 periods per week (one term)

Credit(s): 1

ME595 Plasma Science and Engineering

Plasmas are composed of a neutral fluid and charged particles and display unique properties as a result of external or induced fields and particle collisions. This course examines the fundamental processes and important mechanisms occurring in partially ionized plasmas. The particle evolution will be described by the Boltzmann equation and its moments and will explore both kinetic and fluid models of plasma behaviour. The course details how the unique and fundamental processes translate into existing and future engineering applications including material synthesis and modification, semiconductor and plasma-assisted microelectronics processing,

micro/nanotechnology and advanced electric propulsion for spacecraft.

Lectures - 3 periods per week (one term)

Credit(s): 1

ME597 Robot mechanics

This course covers some advanced topics in the area of robotics with an emphasis on kinematics. Topics covered include the representation of rotations, the solution of the forward and inverse kinematic problems as well as the singularity analysis of serial and parallel mechanisms, the computation of kinematic dexterity, workspace determination, the trajectory planning of redundant mechanisms, the kinematic and static analysis of variable topology mechanisms and an introduction to position, force and hybrid robot control.
The course is given in the form of weekly reading assignments followed by group discussions (2 periods per week reserved for discussions).

Credit(s): 1

AE501 Robust Control

This course presents a scope on the analysis and design of advanced techniques for optimal and robust control systems. It is a straightforward extension of classical control theory and shows how optimization-based control (robust control and optimal control) methods can be suited to actual engineering problems. Some Linear Matrix Inequality (LMI) based approaches; which are very popular in the study of control systems; are introduced. The LMI methods have deep connections with control aspects (state feedback vs. output feedback, stabilization, robustness and multi-objective optimization). Various examples involving aircraft, helicopter, and unmanned aerial vehicle (UAV) models as well as robotic systems will be the "key vehicle" for the implementation purposes (problems/projects) using MATLAB/SIMULINK software and a
2D flight simulator experiment consisting of a helicopter model mounted on a fixed base.

Lectures - 3 periods a week (one term)

Credit(s): 1

AE503 Fundamentals of Aeroelasticity

Aeroelasticity is the discipline that deals with the interaction of elastic structures and aerodynamic loads. The main objective of this course is to provide the student with knowledge of fundamental principles in aeroelasticity; some typical applications are also discussed. A short review of dynamical systems is first undertaken, followed by an introduction to basic aeroelastic concepts. Three archetypes of aeroelastic stability problems are then discussed in detail, namely divergence, classical or coupled flutter and stall flutter. As part of these discussions, unsteady aerodynamics and relevant nonlinear dynamics concepts are covered. In the last part of the course the aeroelastic response to gust and atmospheric turbulence is presented. Finally, aspects of vortex-induced vibrations are discussed. The understanding of the material is strengthened via the application by the students of a balanced mix of analytical work, numerical simulations and wind tunnel testing.

Lectures - 3 periods per week (one term)

Credit(s): 1

AE507 Gas Turbine Analysis

Building on earlier Thermodynamics and Gas Turbine studies, this course covers topics such as: off-design performance, component matching, variable geometry, and design optimisation. In this course, which applies to air, land and sea applications, students will analyse and model ideal and real engines and cycles. Depending on the particular interests and needs of the students, other topics may be addressed, e.g., engine controls, engine health monitoring, and materials. The lectures are typically supplemented by assigned problems, computer exercises, and laboratory experiments.

Lectures - 3 periods per week (one term)

Credit(s): 1

AE515 Advanced Plasma Spacecraft Propulsion

Advanced electric plasma-based engines offer several advantages compared to other systems and are extremely attractive for the growing number of space missions. The course will examine the fundamental processes and technological challenges involved in advanced spacecraft plasma propulsion systems. The course will review the fundamental principles and essential mechanisms of ionized gases and plasmas such as collisions and particle transport. Several classes of spacecraft engines will be detailed including electrothermal, electrostatic and electromagnetic systems. Numerical simulation techniques relevant to investigate the complex phenomena and technological optimization of these engines will also be presented. Current and future challenges, such as miniaturization, will be discussed both for near-earth and deep-space spacecraft propulsion.

Lectures - 3 periods per week (one term)

Credit(s): 1

AE517 Fluid Dynamics - Compressible Flow

One-dimensional flow, normal and oblique shocks, effects of friction and heat transfer; subsonic and supersonic two-dimensional flow, small perturbation theory; hodograph, method of characteristics, axially symmetric flow; unsteady one-dimensional flow; boundary layer interactions.
The lectures are supplemented by problems and laboratory exercises

Lectures - 3 periods per week (one term)

Credit(s): 1

AE531 Composite Materials for Aerospace Applications

An advanced course in composite materials for aerospace structural applications. Topics covered include material properties and selection, test methods, manufacturing processes and inspection techniques, fatigue and impact behaviour, joining, design and analysis methodologies, failure modes and mechanisms, airworthiness requirements and repair considerations. Lecture material is supplemented with laboratory experiments, analytical design-oriented assignments, and numerical exercises.

Lectures - 3 periods per week (one term)

Credit(s): 1

AE537 Aircraft Structures and Materials

The lecture and tutorial portion of this course exists only during the two week period of the AERE Structures Short Course offered biennially (odd numbered years) in May-June. The basic principles used in the design, use and maintenance of aircraft structures are discussed including the topics: manufacturing, loads, stress analysis, finite elements, metallic materials, composite materials, fatigue, fracture mechanics and corrosion. The requirement is to conduct independent studies on the topics and to complete an extensive problem set as the examination.

This course is part of the Aircraft Structures and Materials Course.

Credit(s): 1

AE561 Aerodynamics of Turbomachines

Principles of operation of radial, axial turbines and compressors and ramjets; cascade theories and their application to design; off-design performance estimation; matching of compressors, turbines and ducts; performance of integrated systems.
The lectures are supplemented by problems and laboratory exercises.

Lectures - 3 periods per week (one term)

Credit(s): 1

AE567 Aircraft Performance

This course continues the analysis and methods used in the evaluation of aircraft flight performance parameters from the aircraft design specifications. Topics covered will include the determination of flight ceiling, range and endurance, climbing and manoeuvring flight, takeoff and landing parameters for turbine powered aircraft. Velocity hodographic presentations and energy state methods, manoeuvre envelope and wind effects will be analysed.

Lectures - 3 periods per week (one term)

Credit(s): 1

AE591 Advanced Topics in Aeronautical Engineering

The course consists of the study and discussion of current research or an advanced topic available due to special circumstances. Topics are subject to change with requirements of the professors in the department.

Lectures - 3 periods per week (one term)

Credit(s): 1

AE599 Turbulence Theory

The statistical theory of isotropic turbulence will be presented first, which covers the kinematics and dynamics of isotropic turbulence. Specific topics include correlation function, scales, correlation coefficients between derivatives of the velocities, and between pressure and velocity, the propagation of correlation in time, the law of decay of isotropic turbulence, the spectrum of turbulence, dissipation of energy, the relation between spectrum and correlation, diffusion by continuous movements, and diffusion in isotropic turbulence. Following the statistical theory, data from Direct Numerical Simulation on the statistics and coherent structures of turbulent flat-plate boundary layer will be discussed. Semi-empirical turbulence models will be presented. Topics related to turbulence in stratified medium such as the Monin-Obukhov length will be discussed.

Lectures - 3 periods a week (one term)

Credit(s): 1

PR500: Project

TH500: Thesis; When done at the Master's Level

TH600: Thesis; When done at the Doctoral Level

CP600: Comprehensive Examination; Doctoral Level

Interdepartmental Programme in Defence Engineering and Management

General Information

Contact Information

Programme Chair - Dr. Scott Knight

Telephone: 613-541-6000 ext. 6194

Fax: 613-544-8107

Web Page: Interdepartmental Programme in Defence Engineering and Management

Interdepartmental Programme Information

The degree Master of Defence Engineering and Management (MDEM) is offered to students of the Land Forces Technical Staff Programme (LFTSP) offered through the Department of Applied Military Science. This is a "professional" one-year Master's Degree awarded by the Royal Military College of

The programme of professional studies and complementary academic activities are designed to educate officers in the analysis and definition of operational requirements, and the management of the acquisition and in-service support of Army equipment. Thus the area of specialization of the Master's programme is the application of technology to military systems, and effective and efficient means by which such systems can be procured and supported.

Synopsis of Programme Features:

- The MDEM uses as its foundation the Land Force Technical Staff Programme
- Select members of the LFTSP are admitted to graduate study for the MDEM degree
- Students admitted to MDEM are required to cover additional material and are assessed to a more stringent academic standard
- The completion of the MDEM is concurrent with the LFTSP programme and the entire period of study is normally one year

- The MDEM curriculum provides approximately 950 hours of curriculum activities
- 45 week academic year consisting of three terms
- The total academic course requirements are the equivalent of eight (8) half-course university credits to which is added the requirement to complete a major research project

Admission

Application to the programme is open to individuals who have been selected to be suitable for study in the LFTSP programme. Students wishing to read for the MDEM degree along with the LFTSP course must apply for admission to RMC in accordance with the procedures outlined in the General Admission Requirements defined in the RMC Graduate Calendar.

Students from LFTSP applying for the MDEM will normally require an Honours bachelor's degree in Science or Engineering, or an equivalent from a recognized university with at least B- (70%) average.

Details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this calendar

Programme Requirements

Students entering the MDEM programme will be expected to complete successfully the curriculum detailed for the LFTSP, and to undertake and to complete successfully additional graduate work specified by the interdisciplinary committee overseeing the MDEM programme.

In addition to study in the main topic areas, a major requirement for the degree is the completion of the MDEM research project on a subject relative to defence system engineering or engineering management.

All LFTSP students, including those enrolled in the MDEM programme, will submit an acceptable research paper and provide an acceptable oral presentation in accordance with the rules of the LFTSP programme. For students in the MDEM programme this project is a Master's program research project.

Students enrolled in the MDEM programme will have all written work marked in accordance with graduate standards that require they maintain a minimum acceptable grade of B- or 70 %.

Course Descriptions

DEM501 Military Communications Systems (MCS)

DEM503 Military Information Systems (MIS)

DEM505 Intelligence, Surveillance, Target Acquisition, Reconnaissance And (ISTAR)

DEM507 Modern Weapons Systems (MWS)

DEM509 Vehicle Systems, Survivability And Mobility (VSSM)

DEM511 Defence Management In Canada (DMC)

DEM513 Decision Analysis, Probability And Statistics (DAPS)

DEM515 Modelling And Simulation (MS)

DEM517 System Integration (SI)

DEM519 Engineering And Logistics Management (ELM)

PR500 Research Project

Areas of Study:

- Command Support Technologies (CST) Area: DEM501 to DEM505
- Weapons, Platforms and Survivability Systems (WPSS) Area: DEM507 to DEM509
- Defence Management (DM) Area: DEM511 to DEM515
- Systems Engineering (SE) Area: DEM517 to DEM519

DEM501 Military Communications Systems (MCS)

This course deals with the application of current and evolving communication systems technologies to military usage, in both operational and non-operational settings; with particular emphasis upon communications system requirements for the Land Forces. Students will be taught the fundamentals of communications systems and key parameters in wireless and wired communications. Students will be provided with information on current military systems, current research and development and ongoing staff work on future requirements. Students, through the forum of seminars and case studies, will examine the feasibility and suitability of different technologies for military use.

Credit(s): 0.5

DEM503 Military Information Systems (MIS)

This course provides a comprehensive grounding in the technologies employed in the development of information systems, particularly those that might be utilized by the military. Students are exposed to topics at progressively higher levels of abstraction, beginning at gate logic and

ranging up to distributed transactional databases. This knowledge is used as a foundation for a study of technologies and systems issues (e.g. information security). The lecture material is complemented by laboratory work and by case studies that apply material from across the course in a practical scenario.

Credit(s): 0.75

DEM505 Intelligence, Surveillance, Target Acquisition, Reconnaissance And (ISTAR)

This course examines the key scientific principles involved in military reconnaissance, surveillance, and target acquisition in the context of military operations. Included are optical devices, image intensification devices, thermal imagery systems, ground and airborne sensor platforms, and radar (ground, airborne, space borne, weapons locating). Surveillance and counter surveillance principles and applications are considered as well as data processing, data fusion and global positioning. Students will be provided with information on current military systems, as well as current research and development efforts. Students will investigate and analyse future military requirements in this area.

Credit(s): 0.75

DEM507 Modern Weapons Systems (MWS)

This course examines the key scientific and technological principles applicable to the design, development, production and employment of current, emerging and potential Weapon Systems. The weapon system is examined within a broad context, from research, development, production, usage and life cycle upgrades to disposal. Current research and development within the industry and defence establishments in Canada and abroad are introduced as well as management approaches to acquisition programmes. The study gives students the knowledge needed to optimize a weapon system in respect to the conflicting technical, tactical and doctrinal information. The material presented will also include: thermochemistry, blast, fragmentation, demolitions and the defeat of armour.

Credit(s): 1

DEM509 Vehicle Systems, Survivability And Mobility (VSSM)

The course examines the major technical elements contributing to the automotive performance of military vehicles. Engine torque and power, fuel consumption, transmission ratios/matching, mechanical efficiencies, rotary inertias, road loads (rolling, air, gradient resistances), terramechanics and other factors are examined in sufficient theoretical depth to understand their contributions to automotive performance. To simulate the translation of requirements into engineering specifications typical wheeled and tracked vehicle operational requirements (acceleration, speed, range, etc) and constraints (mission, weights, etc) are examined and, through calculations and trade-offs, major automotive sub-system characteristics are determined for various operational scenarios. Important interfaces with non-automotive mission equipment will also be examined.

Credit(s):

DEM511 Defence Management In Canada (DMC)

This course provides the student with an introduction to management in a military context. The course focuses on three broad areas: management theory; the economics of defence; and defence programme management. The Management Theory Module introduces the student to basic management theory and practice. Topics to be covered include organizational theory, management of change, negotiations, financial and management accounting and ethics. The Economics of Defence Module focuses on theory and issues relating to economic issues, both in DND and within the defence industrial base, as well as defence procurement. The final module, Defence Programme Management, introduces the student to selected aspects of the Defence Management System (DMS) and aspects of army strategic planning in support of their future duties as Programme Managers and Programme Directors.

Credit(s): 0.75

DEM513 Decision Analysis, Probability And Statistics (DAPS)

This course is in two parts. The first part provides an introduction to selected decision analysis techniques appropriate for defence procurement analysis including game theory, decision trees, multi-criteria decision analysis, and cost-performance trade-off analysis. The second part provides an introduction to the subject matter of probability and statistics relevant to defence procurement analysis. Topics include: conditional probability; renewal processes; distribution theory, including discussion of the binomial, normal, and exponential distributions; moments of random variables, including the mean and variance, sampling distributions; hypothesis testing, including resampling approaches; confidence intervals, regression analysis, forecasting and experimental design.

Credit(s): 1

DEM515 Modelling And Simulation (MS)

This course introduces students to modelling and simulation in the context of defence procurement. Topics include optimization (linear and integer programming), some queuing and inventory theory, Monte Carlo simulation, process simulation, and war gaming. The emphasis is on war gaming including the design and execution of war games and the interpretation of war-gaming outputs. Assessment will be through a combination of tests, assignments, and case studies.

Credit(s): 1

DEM517 System Integration (SI)

This course builds on the knowledge gained in the Courses in the Command Support Technologies (CST) and Weapons, Platforms and Soldier Systems (WPSS) Professional Knowledge Areas. It examines, through the extensive use of Case Studies how requirements are traded-off and technologies are integrated onto a platform to produce a viable weapon system. It also examines the Human Factors involved with such integration.

Credit(s): 0.5

DEM519 Engineering And Logistics Management (ELM)

This course deals with the management of complex System Engineering issues involved at the Project Manager/Project Director level. It examines the organizations involved, both governmental and in industry, the design process, system effectiveness, test and evaluation, and the development of Integrated Logistics Support systems. The course provides an overview of the analytical and management tools necessary to control effectively the equipment programmes of major crown projects and to support the Defence Management System. The material presented will concentrate on two major elements: Project Organization, and Test, Evaluation and Verification. The first element, Project Organization, will concentrate on coordinating project scheduling/milestones, task durations, resource allocation, and costs as well as interface issues such as external artificial constraints, deliverables, and imposed changes. The second element involves the design of a comprehensive T,E & V programme for an equipment project from initial Developmental testing, through engineering tests, compliance and verification testing (concentrating on System Effectiveness), quality assurance testing, to User Trials.

Credit(s): 0.75

PR500 Research Project

A major requirement of the MDEM degree is the completion of a research project on a relevant programme topic. Topic approval from academic and professional advisors is required and students are expected to submit acceptable periodic reports to both. The completion of the project, including the written report and oral examination, develops essential professional competencies. The research project also demonstrates post-graduate level research capability.

Credit(s): 2