Graduate Studies Calendar 2020-2021

Related links

Archived Calendars

Important Notices

Important Dates and Deadlines

Additional Dates and Deadlines (MBA Only)

Note: The information in the calendar web pages is approved by Faculty Council and is recognized as the official information with regards to programme requirements, course descriptions and academic regulations.

July 2020 - Dec 2020

Event	Date
Registration for Fall Term via "My Services" **(WS and MPA)**	20 July - 28 Aug
Registration for Fall Term via "My Services" **(MDS non-residential)**	27 July - 28 Aug
Registration for Fall Term **(Science, Engineering)**	10 Aug - 18 Sep
Graduate Studies Committee Meeting	26 Aug
End of Summer Term Graduate Studies	31 Aug
Marks Entry Deadline for Summer Courses via "My Services"	31 Aug
Release of Summer Marks on the "My Services"	31 Aug
Graduate Student Academic Orientation (**Location:** Currie Hall)	12 Sep **(TBC)**
Start of Fall Term Graduate Studies (except MBA)	14 Sep
Fall Registration Deadline **Late registration fees applied after this date**	18 Sep
Graduate Studies Committee Meeting	23 Sep
Deadline to Submit Application for Graduation ***(Fall Convocation)***	25 Sep
Deadline for Payment of Fall Tuition by Full-Time Students (Paying per term fees)	30 Sep
Deadline for Graduate Students to "Add" and/or "Withdraw" from a course without a "WD" **Fees forfeited after this date**	9 Oct
Thanksgiving (Statutory holiday)	12 Oct
Graduate Studies Committee Marks Meeting ***(Fall Convocation)***	28 Oct

Event	Date
Deadline for receipt of "Course Marks", "Project/Thesis Acceptances" **Graduands Only *(November Convocation)***	23 Oct
Last Date to "Withdraw" from a course with a "WD" **No refund (*courses dropped after this date will have a mark assigned*)**	30 Oct
Deadline to Register for Distance Learning Exams	6 Nov
Remembrance Day (Statutory holiday)	11 Nov
Fall Convocation	20 Nov
Registration for Winter Courses via "My Services" **(WS and MPA)**	23 Nov - 18 Dec
Graduate Studies Committee Meeting	25 Nov
Registration for Winter Courses via "My Services" **(MDS non-residential)**	30 Nov - 18 Dec
Registration Period for Winter Term **(Science, Engineering)**	7 Dec - 15 Jan
Fall Term Classes End	8 Dec
End of Fall Term	22 Dec

January 2021 - June 2021

Event	Date
Start of Winter Term	11 Jan
Winter Registration Deadline **Late registration fees applied after this date**	15 Jan
Marks Entry Deadline for Fall Term Courses via "My Services"	19 Jan
Release of Fall Term Marks on "My Services"	23 Jan
Graduate Studies Committee Meeting	27 Jan
Deadline for Payment of Winter Tuition by Full-Time Students (Paying per term fees)	31 Jan
Last Date for Graduate Students to "Add" and/or "Withdraw" from a course without a "WD" **Fees forfeited after this date**	5 Feb
Reading Week **(this does not apply to students taking courses via distance learning)**	15 - 19 Feb
Graduate Studies Committee Meeting	24 Feb
Last Date to "Withdraw" from a course with a "WD" **No refund (*courses dropped after this date will have a mark assigned*)**	26 Feb
Deadline to Register for Distance Learning Exams	14 Mar
Graduate Studies Committee Meeting	24 Mar
Deadline to Submit Application for Graduation ***(Spring Convocation)***	25 Mar
Good Friday (Statutory holiday)	2 Apr
Easter Monday (Statutory holiday)	5 Apr
Registration for Summer Courses via "My Services" **(WS and MPA)**	6 Apr - 14 May
Winter Term Classes End	9 Apr
Registration for Summer Courses via "My Services" **(MDS non-residential)**	13 Apr - 14 May
Deadline to Submit Application for Graduation ***(June Convocation)***	28 Apr

Event	Date
End of Winter Term	30 Apr
Deadline for Receipt of Course Marks, Project/Thesis Acceptances **Graduands Only *(May Convocation)***	3 May
Registration Period for Summer Term **(Science, Engineering)**	4 May - 28 May
Graduate Studies Committee Marks Meeting ***(Spring Convocation)***	7 May
Marks Entry Deadline for Winter Courses and Fall/Winter Courses via "My Services"	14 May
Release of Winter and Fall/Winter Marks on "My Services"	18 May
Convocation Rehearsal	19 May
Spring Convocation	20 May
Graduation Parade with Presentation of Commissions and Graduation Ball	21 May
Start of Summer Term	25 May
Deadline for Receipt of Course Marks, Project/Thesis Acceptances **Graduands Only *(June Convocation)***	26 May
Summer Registration Deadline **Late registration fees applied after this date**	28 May
Deadline for Payment of Summer Tuition by Full-Time Students (Paying per term fees)	31 May
Graduate Studies Committee Marks Meeting ***(Summer Convocation)***	4 Jun
Last Date for Graduate Students to "Add" and/or "Withdraw" from a course without a "WD" **Fees forfeited after this date**	12 Jun
Summer Convocation | CFC Toronto	23 Jun (TBC)

Additional Dates and Deadlines (MBA Only)

2019-2020

Blocks	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7
Corresponding Terms	Summer 2	Fall 1	Fall 2	Winter 1	Winter 2	Winter 3	Summer 1
Courses	MBA525 MBA531	MBA521 MBA595	MBA527 MBA569	MBA507 MBA529	MBA537 MBA593	MBA555 MBA561	MBA501 MBA503
Start of Registration [1]	10 Jun 19	29 Jul 19	29 Jul 19	18 Nov 19	18 Nov 19	18 Nov 19	13 Apr 20
Registration Deadline [2]	12 Jul 19	30 Aug 19	30 Aug 19	13 Dec 19	13 Dec 19	13 Dec 19	15 May 20
Start of Classes	29 Jul 19	16 Sep 19	4 Nov 19	6 Jan 20	24 Feb 20	13 Apr 20	01 Jun 20
Deregistration Deadline	16 Aug 19	4 Oct 19	22 Nov 19	24 Jan 20	13 Mar 20	13 May 20	19 Jun 20
End of Classes	6 Sep 19	25 Oct 19	13 Dec 19	14 Feb 20	3 Apr 20	22 May 20	10 Jul 20
Exams Start	9 Sep 19	28 Oct 19	16 Dec 19	17 Feb 20	6 Apr 20	25 May 20	13 Jul 20

Blocks	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7
Exams End	15 Sep 19	3 Nov 19	22 Dec 19	23 Feb 20	12 Apr 20	31 May 20	19 Jul 20
Marks Release Date	27 Sep 19	15 Nov 19	3 Jan 20	6 Mar 20	24 Apr 20	12 Jun 20	31 Jul 20

2020-2021

Blocks	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7
Corresponding Terms	Summer 2	Fall 1	Fall 2	Winter 1	Winter 2	Winter 3	Summer 1
Courses	MBA525 MBA595	MBA521 MBA531	MBA527 MBA569	MBA507 MBA529	MBA537 MBA593	MBA555 MBA561	MBA501 MBA503
Start of Registration [1]	08 Jun 20	27 Jul 20	27 Jul 20	16 Nov 20	16 Nov 20	16 Nov 20	12 Apr 21
Registration Deadline [2]	10 Jul 20	28 Aug 20	28 Aug 20	11 Dec 20	11 Dec 20	11 Dec 20	14 May 21
Start of Classes	27 Jul 20	14 Sep 20	02 Nov 20	04 Jan 21	22 Feb 21	12 Apr 21	31 May 21
Deregistration Deadline	14 Aug 20	02 Oct 20	20 Nov 20	22 Jan 21	12 Mar 21	30 Apr 21	18 Jun 21
End of Classes	05 Sep 20	23 Oct 20	11 Dec 20	12 Feb 21	02 Apr 21	21 May 21	09 Jul 21
Exams Start	07 Sep 20	26 oct 20	14 Dec 20	15 Feb 21	05 Apr 21	24 Apr 21	12 Jul 21
Exams End	13 Sep 20	01 Nov 20	20 Dec 20	21 Feb 21	11 Apr 21	30 May 21	18 Jul 21
Marks Release Date	25 Sep 20	13 Nov 20	01 Jan 21	05 Mar 21	23 Apr 21	11 Jun 21	30 Jul 21

2021-2022

Blocks	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7
Corresponding Terms	Summer 2	Fall 1	Fall 2	Winter 1	Winter 2	Winter 3	Summer 1
Courses	MBA525 MBA595	MBA521 MBA531	MBA527 MBA569	MBA507 MBA529	MBA537 MBA593	MBA555 MBA561	MBA501 MBA503
Start of Registration [1]	07 Jun 21	26 Jul 21	26 Jul 21	15 Nov 21	15 Nov 21	15 Nov 21	11 Apr 22
Registration Deadline [2]	09 Jul 21	27 Aug 21	27 Aug 21	10 Dec 21	10 Dec 21	10 Dec 21	13 May 22
Start of Classes	26 Jul 21	13 Sep 21	01 Nov 21	03 Jan 22	22 Feb 22	11 Apr22	30 May 22
Deregistration Deadline	13 Aug 21	03 Oct 21	19 Nov 21	21 Jan 22	11 Mar 22	29 Apr 22	20 Jun 22
End of Classes	03 Sep 21	22 Oct 21	10 Dec 21	11 Feb 22	01 Apr 22	20 May 22	08 Jul 22

Blocks	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7
Exams Start	06 Sep 21	25 oct 21	13 Dec 21	14 Feb 22	04 Apr 22	23 Apr 22	11 Jul 22
Exams End	13 Sep 21	31 Oct 21	19 Dec 21	20 Feb 22	10 Apr 22	29 May 22	17 Jul 22
Marks Release Date	24 Sep 21	12 Nov 21	31 Dec 21	04 Mar 22	22 Apr 22	10 Jun 22	29 Jul 22

Notes for Additional Dates and Deadlines (MBA Only)

1 For information on the specific courses offered each Block please follow this link: MBA Course Offerings

2 Late registration fees are applied (per course) after this date.

Important Notices

1. The academic programmes described in this calendar represent Senate-approved degree programmes.
2. Circumstances beyond the control of the University, such as severe budget shortfalls, may result in restrictions in the number and range of courses 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.
3. Prospective students or new registrants are advised to consult the most current information available from the offices of the Division of Graduate Studies and/or of the Office of the Registrar in printed or electronic form before making registration decisions or course/programme choices.
4. The Faculty Council, 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.

Date modified:
2020-11-26

The Graduate Studies and Research Division

Contact

Office of the Dean
613-541-6000 ext. 3728

Email
dgs-des@rmc.ca

Research Office
613-541-6000 ext. 3728

Email
vp-research@rmc.ca

Facsimile
613-541-6064

Web page
Division of Graduate Studies

General Information

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 CAF mandate through collaboration and alliance with Defence Research & Development Canada (DRDC), the Defence Research Establishments, Engineering Classifications, and Operational Commands.

Officers of the Division

Dean of Graduate Studies

Dr. Jean-Marc Noël

Associate Dean of Graduate Studies

Dr. Mohsen Ferchichi

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;

Furthermore, they will report to Faculty Council on these matters.

Graduate Studies Faculty

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 Ph.D. 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.

> ℹ Faculty members with complete privileges will be identified by a "CP" beside their names in the list of instructors.

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.

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 with 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).

Additional information: The Research Ethics Board

Library Information

Chief Librarian:

S. Toomey, B.A., M.L.S.

Head Access Services

C. Olsen, B.A., M.L.S.

Head Technical Services and Systems

L. Béchard, B.A., M.L.S.

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 specialized 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 audiovisual 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 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 carols for studying and computers, as well as one quick look-up station.

Date modified:

2020-10-30

Admission to Graduate Studies

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.

General Admission Requirements

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 programme 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 they must obtain the minimum score for admission from one of the following tests:

- 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)".
- International English Language Testing System (IELTS) score for admission is: 8+.
- Michigan English Language Assessment Battery (MELAB) score for admission is: 85 +.

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 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 recognized 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 individual programmes.

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

Full-time students registered in a Master's degree programme with a thesis, who has completed at least one full calendar year of full-time enrollment including all course requirements with no less than 80% in each course, and who display exceptional performance and promise in their research may, with the approval of their supervisor(s) apply to be admitted to a full-time PhD programme without having to complete the requirements for the Master's degree. Such a transfer to a doctoral programme, requires the successful completion of a transfer examination.

The request must be made by the student, in writing, and delivered to their supervisor(s) for their endorsement. The Programme Chair, in consultation with the supervisor(s), will form a review committee that will access the student's transfer dossier and recommend to the Programme Chair whether a transfer exam should be granted.

Upon recommendation of the review committee, the Programme Chair will inform the Dean of Graduate Studies in writing, of the following:

- the student being considered for direct admission
- Supervisor(s) name(s)
- Research/Thesis title
- Date of the transfer examination
- Examining committee, including chair, for approval by the Dean of Graduate Studies. This committee may be the same as the review committee.

The Transfer Examination

The transfer examination is used to evaluate whether a student has the knowledge and skills to be successful as a PhD candidate. The level of knowledge expectation should be that of a PhD comprehensive examination of Academic Regulation 6.4 of the Graduate Studies calendar.

The exam will have two components, an oral examination and a thesis proposal. If the Master's student fails one of the components of the transfer examination, the student will be asked to remain and complete their current degree. A second examination will not be permitted. If successful, the transfer examination will be accepted in lieu of the comprehensive examination.

Upon successful completion of the transfer examination, the student must submit an application to the PhD programme in the field-of-study where the Master programme was started along with proof of successful completion of the exam (provided by the Programme Chair). A letter of offer from the Programme, drafted in consultation with the Supervisor(s) delineating the complete programme of study must be submitted to the Dean of Graduate Studies for signature. The student will be granted credit for CP600."

Acceptance

The acceptance of an applicant is recommended by the Programme Chair to the Dean of Graduate Studies.

The Programme Chair in consultation with the intended supervisor when applicable, must indicate the academic term the applicant is expected to start in and the duration of validity of the acceptance. Normally, the validity cannot exceed three consecutive academic terms.

Official letters of acceptance are sent by the Dean of Graduate Studies, and are only valid for the duration 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, a deferral request may be made to their Programme Chair who will communicate their decision to the applicant, the Office of the Registrar and the office of Graduate Studies.

Non-Standard Admissions

An applicant who fails to meet the minimum admission requirements but who possesses a minimum of five years of post-university experience may establish eligibility for non-standard admission as a Regular Student if, since graduation, they have done significant intellectual work or made significant professional contributions that can be considered equivalent to higher academic standing. This

could include publications, research, professional advancement, development of new skills, or similar elements. Requests for non-standard admission must be supported by strong evidence that the nature and contents of the applicant’s qualifications or experience have been adequate preparation for advanced study.

Date modified:

2020-10-30

Graduate Studies Programmes Offered

General Information

- The programmes of graduate studies at the Royal Military College of Canada (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 Royal Military College of Canada 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 predicated on limiting the number of programmes and maintaining the standards to be among the best.

Master's Programmes

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

Master of Arts (M.A.)

War Studies

Master of Business Administration (M.B.A.)

Master of Defence Studies (M.D.S.)

Master of Public Administration (M.P.A.)

Master of Science (M.Sc.)

Chemistry and Chemical Engineering
Computer Science
Mathematics
Physics

Master of Engineering (M.Eng.)

Aeronautical Engineering
Chemistry and Chemical Engineering
Civil Engineering
Electrical and Computer Engineering
Mechanical Engineering

Master of Applied Science (M.A.Sc.)

Aeronautical Engineering
Chemistry and Chemical Engineering
Electrical and Computer Engineering
Mechanical Engineering

Doctoral Programmes

RMC 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)

Chemistry and Chemical Engineering
Computer Science
Mathematics
Physics

Doctor of Philosophy (Engineering)

Chemistry and Chemical Engineering
Civil Engineering
Electrical and Computer Engineering
Mechanical Engineering

Date modified:

2017-06-27

General Programme Requirements for Graduate Studies

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.

Master's Degrees

Requirements for a Master's 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 for a Master's Programme

A minimum of four 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.

> ℹ 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 term courses or the equivalent at the graduate level plus a thesis,
2. eight term courses or the equivalent at the graduate level plus a project, or
3. ten 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 for a 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 that five years. Requests for extension of the thesis will be considered on a case by case basis.

Doctoral Degrees

Residence Requirements for a 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 Doctoral degree is work equivalent to four academic terms or two academic years of full-time graduate study in a Doctoral programme at RMC.

In the case of candidates who are full-time members of the RMC faculty while undertaking a Doctoral 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 Doctoral 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 Doctoral programme, must fulfil two academic years of full-time study, but dated from the initial registration in the Master's programme.

Programme of Studies for a 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.

> ℹ 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 for a 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 for a 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.

Graduate Studies - Responsibilities

The Dean of Graduate Studies 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 their Programme Chair, and thence to the Dean of Graduate Studies.

Every graduate student whose programme includes a thesis is required to review with their supervisor(s) the guidelines outlined in the document entitled student-supervisor relations. These guidelines are intended to provide both the student and the supervisor(s) a framework for their student-supervisor(s) relationship. The document is to be signed by the student and the supervisor(s) and a copy filed with the Division of Graduate Studies and Research (DGSR). In addition, the student and the supervisor(s) are required to complete a progress report as scheduled in the student-supervisor relations document. The progress report provides an opportunity to both the student and supervisor(s) to evaluate the student's current academic standing and to set objectives to achieve the expected research progress. A copy of the report is to be filed with the DGSR.

Full-time military graduate students may be required by the Programme Chair to perform laboratory assistance or tutorial duties (excluding marking) for up to three hours a week.

A civilian and a military Graduate Studies Representative will be appointed annually.

The Senior civilian Graduate Studies Representative will be chosen by the civilian graduate students in consultation with the Dean of Graduate Studies, the Senior Military Graduate Studies Representative by the Commanding Officer for Post Graduates (CO PG and Mil Fac) in consultation with the Dean of Graduate Studies.

The Senior Military Graduate Studies Representative shall be responsible to the CO PG & Mil Fac for the general control and deportment of the military graduate students, and shall also provide liaison between the military graduate students and the CO PG & Mil Fac and the Dean of Graduate Studies.

> ℹ The two seniors are voting members of the Graduate Studies Committee.

Date modified:
2018-07-31

Faculty of Social Sciences and Humanities Graduate Studies Programmes

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

Date modified:

2019-05-16

Master of Business Administration

Programme Information

Course Descriptions

Contact

Programme Chair
Ms. Margaret B.K. Shepherd

Email
mba-maa@rmc.ca

Programme Web Page
Master of Business Administration

Programme Offered

The degree Master of Business Administration (MBA) provides a general graduate education in management to students who 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%) average; and
- 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 this 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 - by comparison to a candidate with an Honours Baccalaureate degree. Normally such students will be admitted under Provisional Status.

Programme Requirements

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

To complete the MBA, students must successfully complete the equivalent of 14 one-credit courses and a Management Research Study. The following courses are required:

Mandatory Courses

- MBA501: Advanced Topics in Management I
- MBA503: Advanced Topics in Management II
- MBA507: Data Analysis in Decision-Making
- MBA521: Economics
- MBA525: Financial Accounting
- MBA527: Management Accounting
- MBA529: Marketing
- MBA531: Management Information Systems
- MBA537: Financial Management
- MBA555: Operations Management
- MBA561: Strategic Management
- MBA569: Strategic Human Resources Management
- MBA593: Project Management
- MBA595: Organizational Theory

Plus

- MBA505: Management Research Study

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

Normal Course Load

Courses are offered in compressed format, with seven six-week blocks each year, each followed by a one-week exam period. The average workload per course is 18-24 hours per week. For full-time students, the normal course load is two courses per block. 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 programme sponsors of deviations from the normal course load.

Registration and Withdrawal

Registration will be conducted in accordance with the normal RMC trimester cycle. Students will register for Block 1 in the summer; Blocks 2 and 3 in the fall; Blocks 4 and 5 in the winter; and Block 6 and 7 in the following summer.

Students who wish withdraw from a course should consult Academic Regulation 5.5.

Course Descriptions

MBA501 Advanced Topics in Management I

This course examines advanced topics from a number of management areas. The course will provide the student who has completed the more basic MBA courses with exposure to more complex issues in areas such as accounting, marketing, production, quantitative methods, human resources management, and strategic management. In addition, the course examines areas of management the student has not previously been exposed to such as international business and logistics. Coverage of topics will be on a selective basis. Students will be permitted to be enrolled at the discretion of the Programme Chair.

Credit(s):

1

MBA503 Advanced Topics in Management II

This course examines advanced topics from a number of management areas. The course will provide the student who has completed the more basic MBA courses with exposure to more complex issues in areas such as accounting, marketing, production, quantitative methods, human resources management, and strategic management. In addition, the course examines areas of management the student has not previously been exposed to such as international business and logistics. Coverage of topics will be on a selective basis. Students will be permitted to be enrolled at the discretion of the Programme Chair.

Credit(s):

1

MBA505 Management Research Study

The project will be mandatory and will count 1 credit. The project is the primary area where the students can focus their learning based on their own desires or those of a sponsoring agency. For the choice of topic, the student will propose a subject to be approved by the MBA Chair. The topic should be chosen according to the department's CoP themes (i.e., analytic, financial, behavioural, strategic or economic). Upon the approval of the MBA Chair, the project can also take the form of a reading course.

Students must arrange a management research study topic with a supervisor during Block 1. Under the direction of the supervisor, the student must write a study proposal. Once the proposal has been accepted by the supervisor, it must be submitted to the MBA Chair for approval. Only when the Chair has given his or her approval will the student be permitted to register in MBA505.

The supervisor is free to design any evaluation scheme he or she sees fit subject to certain requirements. During the second to last registration block, the student must prepare a written study report summarizing the research. The study report will be examined by the supervisor. After examination, the student is expected to incorporate any substantive concerns raised into a final study report. Once these concerns have been dealt with to the satisfaction of the supervisor, the supervisor will assign a final grade. It is the responsibility of the supervisor to submit a copy of the final study report to the MBA Chair.

Credit(s):

1

MBA507 Data Analysis in Decision-Making

This course focuses on data-driven models used in strategic and operational-level decision-making. Fundamental methods in probability and statistics are reviewed including confidence intervals, hypothesis testing, and tests of independence. More advanced methods in regression, correlation, goodness-of-fit and forecasting techniques are also included. Special attention is given to the presentation and interpretation of statistical analyses. Inferences made based on sample statistics and the limits of statistical tools used in practice are also explored. Statistical methods are taught in the context of decision-making within human resources, marketing, operations management, finance, and other management applications.

Exclusion(s):
MBA523

Credit(s):
1

MBA509 Cyber Security Policy and Management

This course provides a launching point from which to develop or enhance an understanding of cybersecurity issues in both enterprise management and national security policy contexts. The content furnishes a useful heuristic approach to the various domains, comprising a comprehensive introduction to the spectrum of issues entangled in the practices of cybersecurity. Those with little technical background will find an introduction at a manageable level of complexity and gain a better appreciation for where and why technical depth is required. Those with technical backgrounds may find the material a useful overview of areas they are familiar with and an introduction to broader issues of international, national and legal policies and practices.

Credit(s):
1

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.

Exclusion(s):
MPA531

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 emphasizes the interpretation and use of accounting data downplaying the bookkeeping aspects.

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 organizational 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.

Prerequisite(s):

MBA525

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 organizations, 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 organizational functions on strategy in the market place will be given particular attention.

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.

Credit(s):

1

MBA537 Financial Management

This course will provide the basic knowledge required in analyzing 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.

Prerequisite(s):

MBA507 and MBA525

Credit(s):

1

MBA555 Operations Management

The focus of this course is on the important concepts of managing organizations 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 organizational 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.

Credit(s):

1

MBA561 Strategic Management

This course examines the formulation and implementation of long-term strategy for the organization 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; organizational 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 organized around cases and readings that structure and extend the student's understanding of complex organizational decisions, problems and situations.

Prerequisite(s):

MBA521, MBA527, MBA529, MBA555, MBA569, MBA593, MBA595

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 organizational 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

Prerequisite(s):

MBA595

Credit(s):

1

MBA593 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.

Prerequisite(s):

MBA527 and MBA555

Exclusion:

MPA559

Credit(s):

1

MBA595 Organizational Theory

Modern organizations 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 organizations for the challenges of tomorrow. Using the most recent developments from both organization theory and organizational behaviour, this course will examine topics such as leadership and management, group dynamics, and corporate culture. Linkages will be explored between these new organizations 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.

Exclusion:

MPA569

Credit(s):

1

Date modified:

2020-07-02

Master of Public Administration

Programme Information

Course Descriptions

MPA581 Decision and Policy Analysis

MPA583 Issues in the Health of Military Personnel, Veterans and their Families

MPA585 Cost-Benefit Analysis

MPA589 Strategic Geopolitical Analysis

MPA591 Cyber Statecraft and National Security

PR500 Project

TH500 Thesis

Contact

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Programme web page
Master of public administration programme

General Information

Programmes Offered

The Master of Public Administration (MPA) 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 MPA will be admitted under the General Admission Requirements of RMC. Details regarding admission to the Royal Military College as a graduate student can be found in the Admissions section of this Calendar. In addition to those requirements, applicants are required to submit one example of their scholarly written work. Both a paper and an electronic version in Word are required; the electronic version will be subjected to an originality test.

Course Withdrawal Procedures

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

Programme Details

Programme Time Frames

It normally takes five academic terms to complete the Programme (i.e. two 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 years, in accordance with RMC regulations.

Programme Patterns

The Programme is offered in three patterns:

1. Course Pattern
2. Research Pattern
3. Project Pattern

All students are initially registered in the Course Pattern. Students who are close to completing the core requirements of the Programme may pursue either the Research or Project Pattern following a discussion and approval of their research/project topic with the Chair of the MPA Programme.

Course Pattern

The student must successfully complete five core courses plus seven elective courses. Experience has shown that those students who focus first on core courses complete the programme sooner.

Research Pattern

The student must successfully complete five core courses plus one elective course and a thesis.

Project Pattern

The student must successfully complete five core courses plus five elective courses and a project.

Programme Requirements

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

Core Courses for the MPA

- MPA521: Canadian Government and Public Policy
- MPA531: Economics
- MPA557: Strategic Management for Defence
- MPA569: Organizational Theory
- MPA581: Decision and Policy Analysis

Elective Courses for the MPA

- MPA505: Professional Internship
- MPA507: Advanced Professional Internship
- MPA523: Defence Decision Making
- MPA527: Professional Ethics and Defence Management
- MPA535: The Cyber Challenge
- MPA539: Economics of Defence
- MPA541: Performance Audit in the National Security Sector
- MPA543: Strategic Foresight and Horizon Scanning

- MPA549: Economics of National Security
- MPA555: Management Information Systems for Defence Management
- MPA559: Project Management
- MPA565: Conflict Analysis and Management
- MPA571: Defence Technology: Strategies and Policies
- MPA573: Leading and Working in a Diverse Environment
- MPA577 Interagency Coordination
- MPA579: Government Procurement
- MPA583: Issues in the Health of Military Personnel, Veterans and their Families
- MPA585: Cost-Benefit Analysis
- MPA589: Strategic Geopolitical Analysis
- WS531: American Foreign Policy 1776 to the Present
- WS533: Studies in American Defence Policy
- WS539: Signals Intelligence
- WS589: Issues of National and International Security in International Relations: Theories and Practice Since 1945
- WS591: Issues of International and National Security in International Relations: Changing Definitions
- WS595: Armed Forces in Society

Course Descriptions

MPA505 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 of relevant experience after achieving a first degree.

Credit(s):

1

MPA507 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 of relevant experience after achieving a first degree.

Credit(s):

1

MPA521 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.

Credit(s):

1

MPA523 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. Various historical and contemporary case studies will be used as the basis of analysis and discussion.

Credit(s):

1

MPA527 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.

Credit(s):

1

MPA531 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.

Exclusion(s):

MBA521

Credit(s):

1

MPA535 The Cyber Challenge

This course will explore the digitized world (the good, the bad and the ugly) in the Canadian context with a view to assessing the breath and scope of the cyber reality within Canada and the policy challenges it poses, with emphasis on the Federal Government. Topics covered include cyberterrorism and cyberespionage, cybercrime, cyberwar, counterterrorism and the privacy/security conundrum. It will also discuss what Canada is/should/could be doing about the cyber threat and/or Internet Governance in the current legislative and constitutional context.

Credit(s):

1

MPA539 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.

Credit(s):

1

MPA541 Performance Audit in the National Security Sector

This course is an introduction to performance auditing in the Canadian national security sector. It will provide an overview of the legislative and organizational structure of audit and other oversight agencies in the security sector including the Office the Auditor General, the Commissioner for Complaints Against the RCMP, the Security and Intelligence Review Committee and the CSE

Commissioner. The role of Parliament and its committees will be reviewed as will that of internal audit and program evaluation. The course will focus on the work of performance audit in assessing the economy and efficiency of operations, the management of program effectiveness and environmental stewardship. Techniques developing multi-year entity audit plans and techniques for planning individual audits will be reviewed. Emphasis will be placed on the examination phase of the audit, including the selection of audit criteria, the selection of evidence and the use of professional judgment in forming audit opinions. Issues related to clearing audit reports with auditees will be covered. The course will also address the processes and considerations of reporting audit findings to stakeholders with different levels of knowledge and interests including management, Parliament and the public.

Credit(s):

1

MPA543 Strategic Foresight and Horizon Scanning

This course focuses on methods for public policy analysts to gather intelligence on possible futures and apply the emerging insights useful to build shared visions, guide and enable present-day decisions. Students will be introduced to strategic foresight methods to gather and develop critical knowledge, guide proactive policy, and shape strategic plans and partnerships. The course teaches students how to frame futures projects, conduct horizon scanning, analyze the impact of trends and identify drivers, confront critical uncertainties, methodically develop foresight scenarios. The course provides tools to assess the policy implications of emerging issues. Key foresight methods covered in this course include trend impact analysis, horizon scanning, and the Delphi method. Students also learn to distinguish between normative and exploratory as well as qualitative and quantitative foresight.

Credit(s):

1

MPA545 The Intersection of Social Capital and Health

This online, seminar-based course is an introduction to social capital as a determinant of health. Of the many determinants of health, recent work has identified social capital as an important contributor to health. For example, patients with strong social support systems have family and friends that assist them in accessing and taking full advantage of health care. Patients who adhere to a treatment plan and have social support often do well, but patients who lack social support are not so fortunate. The key to improving health care quality may lie in enhancing social capital and not hiring more providers, or building more hospitals. Topics covered in this course include an introduction to social capital as a operationalized concept, methods for measuring social capital in qualitative and quantitative research studies, and themes pertaining to the various ways social capital intersects with health at individual, community, and regional/national levels. At the conclusion of the course, students should be equipped to recognize the potential contribution of social capital to health outcomes and to understand how health policy might be shaped to take advantage of this contribution.

Credit(s):

1

MPA547 The Public Policy Implications of Cloud Computing

Access to high performance computing power is frequently expensive and otherwise inaccessible to anyone outside well-funded research labs or major government agencies. Thanks to the established interconnectivity of various electronic devices (such as smart phones, laptops, and tablets) and the increasing interconnectivity of devices in general (the so-called “internet of things”), access to high-performance data processing is improving as well. In short, no longer is high-performance processing limited to labs and government agencies. Instead, the concept of “cloud computing” has emerged. This course examines the public policy implications of improved access to high-performance computing power. What role does government have or should have in regulating this new, powerful, and pervasive capability? At the conclusion of the course, students will understand the unique aspects of cloud computing that separate it from traditional forms of digital computing and what this means for policy makers and the public.

Credit(s):

1

MPA549 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 preemption, domestic and international legislation.

Credit(s):

1

MPA551 The Public Policy Implications of Wearable Technology

In many ways, wearable technology is nothing new. At the most fundamental levels, any clothing or gear that an individual or group wears is a form of technology. However, what makes wearable technology like smart watches or augmented reality displays new is their ubiquity in terms of what data they collect and how potentially they alter the physiology, perception, and cognition of users as much as they enhance individual and group capabilities. Like with most emerging technology, governments are no longer in leadership positions on this front and questions of social utility, regulation, and ethics are falling behind the rapid development, prototyping, and even fielding of these technologies with mixed surveillance and intervention capabilities spanning: cybersecure communications and networking, human-teaming with artificial intelligence and autonomous systems, simulation and training, and navigation and logistics. This on-line course examines the public policy gap on this topic and proposes a series of questions that policymakers should consider regarding this powerful technology. At the conclusion of the course, students should be equipped to recognize the potential contribution as well of risks of wearable technology and the policy implications of the fielding of such technology.

Credit(s):

1

MPA555 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.

Credit(s):

1

MPA557 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.

Credit(s):

1

MPA559 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.

Credit(s):

1

MPA565 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.

Credit(s):

1

MPA569 Organizational 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.

Credit(s):

1

MPA571 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.

Credit(s):

1

MPA573 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. The course explores many of the questions and challenges facing today's leaders.

Credit(s):

1

MPA577 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.

Credit(s):

1

MPA579 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.

Credit(s):

1

MPA581 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.

Credit(s):

1

MPA583 Issues in the Health of Military Personnel, Veterans and their Families

Students are exposed to health issues associated with military experience which also includes both veterans and military families. As a weekly webinar, the course will include presentations from Canadian specialists who will contextualize military mental and physical health needs and introduce theoretical and methodological approaches to conducting applied health research among this population.

Credit(s):

1

MPA585 Cost-Benefit Analysis

This course is an introduction to cost-benefit analysis techniques used in project and program evaluation in the public sector. The emphasis will be on the use of economic analysis to identify and measure the direct and indirect benefits and costs of projects and programs. Topics covered in the first part include the welfare-economic foundations of cost-benefit analysis, investment decision rules, the choice of a social discount rate, risk and uncertainty, shadow pricing of inputs with and without distortions, and the opportunity cost of public funds. The second part of the course covers applications such as infrastructure investments, education and healthcare programs, regulation, taxation and public sector pricing, environmental policies and management, non-renewable resources management, and industrial policies.

Credit(s):

1

MPA589 Strategic Geopolitical Analysis

This course examines the conduct of strategic analysis and the provision of advice to policy makers. Commencing with an examination of how the main theoretical paradigms can be used to understand actors and actions at each level of analysis, the course will provide students with a detailed understanding of the various methodologies to explain possible objectives of actors who are the subject of the analysis. This will include applying matrices to understand how decisions result from defined and implied interests, research methodologies to support both information collection and evaluation, the various techniques employed to conduct option and risk analyses and finally the role of the analyst in the decision cycle. The course will be a mix of individual research and evaluation as well as group work to examine various case studies in order to prepare the student to participate as a member of an analytical team or as a solo researcher.

Credit(s):

MPA591 Cyber Statecraft and National Security

The course introduces students to social science dimensions of offensive and defensive computer network operations, exploitation, attacks, and cyberwarfare. Its premise is cyber as a new domain of warfare that poses an existential threat to national security, prosperity and democracy. What difference does it make to think about democracy from the perspective of cyber - and about cyber from the perspective of democracy in general, and the Canadian democratic regime, its norms, values and underlying constitutional and governance principles in particular? The course's learning proposition is that cyber is not merely a technical but, fundamentally, a behavioural, policy, administrative, legal, economic, political, cultural, social and strategic challenge.

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

Date modified:

2019-11-27

Master of Defence Studies

Programme Information

Course Descriptions

DS545 Component Capabilities

DS548 Advanced Joint Warfighting

DS549 Advanced Topics in Campaign Design

DS551 Modern Joint Air Campaigns

DS554 Advanced Topics in Institutional Policy Development

DS555 Leadership

DS556 Command

DS557 Institutional Policy Analysis

DS567 Global Power and Institutions

DS568 Advanced Topics in International Security Studies

DS569 International Security and Canadian Foreign Policy

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

Contact

Department Head
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Programme Chair
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Chair: chennoufi@cfc.dnd.ca

General Information

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

The Master of Defence Studies (MDS) is a professional degree granted by the Royal Military College of Canada (RMC) and is only offered to Canadian and foreign senior military officers selected to attend the residential Joint Command and Staff Programme (JCSP) at the Canadian Forces College (CFC) in Toronto, Ontario, Canada. The MDS is also offered to students who have graduated from the JCSP in the last three years.

If you do not meet these selection criteria, your application to the MDS will not be considered. Please ensure that you meet these selection criteria before you submit your application.

Should you have any questions pertaining to your eligibility to apply to the MDS, please contact the Canadian Forces College Registrar's office by emailing registrar@cfc.dnd.ca

Options

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 Master of Public Administration (MPA) 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 Master of Public Administration (MPA) is potentially offered to students of the National Security Programme (NSP). The programme leads to a Master of Public Administration awarded by RMC and approved by the Ontario Council of Graduate Studies.

Master 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

Individuals 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 MPA 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 a four-year Honours Bachelor's degree in Arts, Science or Engineering, or an equivalent from a recognized university with at least a "B-" average (70% or better) average.

The JCSP and NSP programmes are only available to military officers competitively selected for attendance or to civilians selected by their employer for attendance.

Information for non-JCSP students seeking details regarding admission to RMC 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

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

Master of Defence Studies

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

- Course Pattern (**ten** graduate credits)
- Directed Research Project Pattern (**eight** graduate credits plus **a two credit** directed research project)

All students are required to complete **seven** common graduate credits:

- DS520: Planning at the Operational Level (2 credits)
- DS545: Component Capabilities
- DS555: Leadership
- DS556: Command
- DS569: International Security and Canadian Foreign Policy (2 credits)

In addition to the **seven** common graduate credits, **those in the Course Pattern** are also required to complete **three** graduate credits, comprised of **two** one-credit courses selected from one of the following groups:

- DS548: Advanced Joint Warfighting and DS549: Advanced Topics in Campaign Design; or
- DS557: Institutional Policy Analysis and DS554: Advanced Topics in Institutional Policy Development; or
- DS567: Global Power and Institutions and DS568: Advanced Topics in International Security Studies.

And one of:

- DS534: Operational & Strategic Command Analysis
- DS535: Global Politics, Culture, and Conflict
- DS536: Case Studies in Canadian International Policy
- DS537: Captors and Captives
- DS538: Genocide, Conflict, and Justice
- DS539: Intelligence Studies: Historical, Theoretical, and Contemporary Dimensions
- DS543: War and Society
- Various War Studies and other Programme courses taken with permission of the Chair MDS.

In addition to the **seven** common graduate credits, **those in the Directed Research Pattern** are required to complete:

One of:

- DS534: Operational & Strategic Command Analysis
- DS535: Global Politics, Culture, and Conflict
- DS536: Case Studies in Canadian International Policy
- DS537: Captors and Captives
- DS538: Genocide, Conflict, and Justice
- DS539: Intelligence Studies: Historical, Theoretical, and Contemporary Dimensions
- DS543: War and Society
- DS548: Advanced Joint Warfighting
- DS557: Institutional Policy Analysis
- DS567: Global Power and Institutions
- Various War Studies (WS) and other Programme courses taken with permission of the Chair MDS

And:

- PR500: Directed Research Project

Non-Degree Courses

JCSP students who are not admitted to the MDS at the start of JCSP will take **two** non-credit courses to satisfy the professional military education requirements of JCSP. These courses are not eligible for any full or partial graduate course credit nor do these courses appear on RMC transcripts. Those who apply for MDS admission subsequent to commencing JCSP studies will be required to complete a minimum of **two** additional graduate credits.

JCSP and NSP Programme Descriptions

Joint Command and Staff Programme (JCSP)

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 among their peers, in accordance with exacting professional criteria. The curriculum emphasizes command and leadership, ethics, military operations across the spectrum of conflict, operational art, understanding of national security, defence management, and professional officership skills developed through individual and collective learning on common and elective courses as listed under the programme requirements.

National Security Programme (NSP)

The National Security Programme (NSP) is a ten-month residential programme, which offers courses designed to prepare senior officers at the Colonel and Captain(N) rank level or civilian equivalent for demanding command and leadership positions in a global environment. Students are competitively selected in accordance with professional standards and potential for advancement. The curriculum emphasizes strategic leadership, strategic management and war fighting in joint and combined operations at the operational and strategic levels. The nature of the modern military profession makes international standards for the conduct of 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 core courses listed above, there are a number of electives that may be taken in conjunction with the NSP core courses. This may include NSP elective defence studies courses, core MPA courses to meet degree requirements and elective MPA courses. the optional courses that could be offered are as follows:

- 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

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.

Seminar:

3 periods a week (one term)

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 require prior approval by a university Research Ethics Board. Supervisors may request evidence of competence in analytical techniques before permitting the field research to proceed.

Corequisite:

DS501: Analysis of Contemporary Conflict is recommended as a companion course.

Seminar:

3 periods a week (one term)

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.

Seminar:

3 periods a week (one term)

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 require 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.

Seminar:

3 periods a week (one term)

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.

Seminar:

3 periods a week (one term)

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 require 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.

Corequisite:

DS509 Analysis of Doctrinal Questions is recommended as a companion course.

Seminar:

3 periods a week (one term)

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 counterterrorism; environmental security. Students are welcome to suggest areas of personal interest. Course work includes a research paper of graduate seminar quality and/or presentations.

Seminar:

3 periods a week (one term)

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 toward 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.

Seminar:

3 periods a week (one term)

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.

Seminar:

3 periods a week (one term)

Credit(s):

1

DS520 Planning at the Operational Level

This course will introduce and develop the knowledge and skills essential for understanding the operational level of conflict and for planning at the operational level using the Operational Planning Process (OPP) in the context of Canadian Armed Forces doctrine. The first module of this course will examine operational functions as they apply to modern operations, providing students with strong foundational knowledge of the operational level. It introduces students to current doctrine and provides insight into how commanders and staff exercise these key functions. The second module introduces students to the OPP. Using increasingly challenging tutorials, students will work in groups to analyze problems and develop operational designs through the application of the OPP. This module includes a significant amount of group and syndicate tutorial work. The third and fourth modules build upon the first two, advancing student knowledge, understanding and skills for planning joint operations across the spectrum of conflict at the operational level in both the domestic and expeditionary environments. These modules include Case Studies of recent CAF operations and require the students to demonstrate their understanding of the overall course content through two planning exercises. Assessment is carried out with tutorials, presentations, syndicate participation, discussions, exercise participation and a confirmatory exam.

Exclusion(s):

DS540, DS544

Seminar:

3 periods a week (two terms)

Credit(s):

2

DS522 Economics of National Security and Defence

This course examines the economic theories and applications of national security and defence issues in order to enable individuals to understand the economic processes that underlie various security and defence resource allocation decisions. The first part of the course examines the processes that underlie vario us security issues, their structural, motivational and informational aspects in order to permit an assessment of how nations allocate resources towards and within national security agencies. This will include looking at variety of security related issues such as homeland security, cyber and information security, and artificial intelligence. The second part of the course examines the processes that underlie defence issues in order to permit an assessment of how nations allocate resources to defence and the impact of those decisions on a nation's economy. The course is structured to examine both the s upply and demand components of security and defence issues

Seminar:

3 periods a week (two terms)

Credit(s):

1

DS526 Peace and Stability Operations: An Evolving Practice

This course explores the field operations deployed to conflict areas to mitigate or end violence and to help rebuild war-torn societies. Peace or peacekeeping operations have evolved considerably with new and expanded mandates and more robust mechanisms for international military, police and civilians. The course will compare the concepts and experiences of UN, NATO, and regional organizations. Successes and failures will be reviewed, and case studies will help get the "sense on the ground."

Seminar:

3 periods a week (one term)

Credit(s):

1

DS527 Leading and Working in a Diverse Environment

This course will examine leading and working in 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. The course explores many of the questions and challenges facing today's leaders.

Seminar:

3 periods a week (one term)

Credit(s):

1

DS529 Political Philosophy: Insurrectional Ideologies

To analyze and understand some of the ideologies developed in the twentieth and twenty-first centuries rejecting the values of liberal democracy and promoting the violent overthrow of political systems built on this base through the analysis of their leading thinkers and theorists. The analyzed texts refer to insurrectional ideologies calling for the revolutionary replacement of liberal democracy. Through the discussion of these doctrinal texts the goal is also to develop an awareness of the complex relationship between individuals, groups, society, political ideas and armed violence.

Seminar:

3 periods a week (one term)

Credit(s):

1

DS534 Operational & Strategic Command Analysis

This course provides a solid foundation in analyzing various challenges to military decision-making at the operational and strategic levels. The organizational, institutional, and societal dimensions of military decision-making are the main focus and are introduced through various historical and contemporary case studies. The case studies examine issues such as the impact of conventional mindsets in irregular warfare conflicts, the role of ideology and cognitive predispositions in military decision-making, institutional limits to military transformation, and resolving incompatibilities between political and military objectives.

Seminar:

3 periods a week (one term)

Credit(s):

1

DS535 Global Politics, Culture, and Conflict

The role of culture in international relations is a theme that is worthy of being studied and taught due to its sensitive quality and the confusion associated with it. In fact, since the end of the Cold War, successive attempts were made to account for these relations from an academic perspective. From the controversial thesis of the clash of civilizations to the more nuanced constructivist contributions, the first module of this course will provide us with the opportunity to review the overall majority of these theoretical attempts. The second module seeks to look at a series of geocultural sets which are a priori separate, such as the West, the Arab-Moslem world, China, etc.,

in order to test the cultural hypothesis according to which cultural identity determines the behaviour of states. The ultimate goal of this course consists of developing a critical approach that lends itself to demonstrating the complexity of the main issue pertaining to the subject matter, as well as outlining the limitations of cultural determinism.

Seminar:

3 periods a week (one term)

Credit(s):

1

DS536 Case Studies in Canadian International Policy

This course is designed to introduce participants to the study of Canada's international policy. It uses history as a lens to assess contemporary issues and struggles. The early sessions of the course use historical case studies to facilitate the discussion and analysis of issues brought up in the weekly readings as well as to explore linkages between previous Canadian experiences with contemporary international policy themes. Toward the end of the course, participants research, design, and present their own contemporary cases. To understand the context of the international policy decisions taken in Canada, this course considers both the domestic situation and politics abroad, with specific reference to the policies of Canada's most significant allies.

Seminar:

3 periods a week (one term)

Credit(s):

1

DS537 Captors and Captives

This elective compares British, Canadian and Japanese captivity experiences, with emphasis on military, leadership, cultural, and legal dimensions. Historical illustrations highlight timeless dilemmas useful to understanding past and contemporary operations. Conduct will be through film, first-hand memoirs, prominent fictional works, case studies, and seminars.

Seminar:

3 periods a week (one term)

Credit(s):

1

DS538 Genocide, Conflict, and Justice

This elective course provides students with interdisciplinary intellectual frameworks for understanding and analyzing the numerous, complex, and often emotional issues related to genocide, including legal, political, historical, psychological, and sociological debates surrounding the definition, causes, and processes of genocide specifically and mass atrocity more generally. An examination of several major cases of genocide will provide the foundation for a comprehensive analysis that emphasizes both international and national dynamics, and especially 1) the historical intersections of changing international relations, great power politics, development, modernity, and the interstate/ intrastate armed conflict; and 2) the relationship between ethnic inequality and violence, and the impact of nationalist population policies. Along with case studies, more general themes will be analyzed, namely the shifting roles of perpetrators, bystanders, witnesses and victims, emerging responses of the international community with respect to genocide prevention such as the Responsibility to Protect (R2P), existing domestic, international, and international criminal law, and the use of courts, tribunals, and alternative forms of justice in punishment and reconciliation, as well as lingering questions of historical/collective memory and genocide denial.

Seminar:

3 periods a week (one term)

Credit(s):

1

DS539 Intelligence Studies: Historical, Theoretical, and Contemporary Dimensions

This course will address intelligence from the perspectives of history, theory, and current debates. It will assess the differing types of intelligence, and the differing ways in which intelligence is utilized, including the organizational entities responsible for intelligence. Although the general international context will be examined, particular emphasis will be placed upon the Canadian experience with intelligence in both military and civilian applications. It will conclude by examining current issues in intelligence in the contemporary security environment.

Seminar:

3 periods a week (one term)

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, 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 practice 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

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 CAF 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

DS548 Advanced Joint Warfighting

This course develops the advanced concepts, knowledge, and skills essential for the planning and conduct of joint and combined operations at the operational level in the context of the application of campaign planning for domestic and expeditionary operations. It builds upon the theory and background of each component and joint military planning concepts to introduce a wider variety of approaches to operational planning.

Prerequisites:

DS540, DS544, DS545

Seminar:

3 periods a week (one term)

Credit(s):

1

DS549 Advanced Topics in Campaign Design

This course introduces a range of more specialized topics related to the broad domain of campaign design and the conduct of joint and combined operations at the operational level for domestic and expeditionary operations. These topics (such as but not limited to: irregular warfare, targeting, and the cyber domain) will provide further depth to an appreciation of joint and combined operations. Assessment will be through seminar participation and a major independent research paper addressing a topic of the student's choice.

Prerequisites:

DS540, DS544, DS545

Seminar:

3 periods a week (one term)

Credit(s):

1

DS551 Modern Joint Air Campaigns

This course is designed to give students a detailed examination of modern joint campaigns, operations, and missions with a significant air power contribution. Particular types of joint air campaigns will be studied, ranging from kinetic air superiority and strategic bombardment to more non-kinetic ones such as airlift support to disaster relief efforts and Search-and-Rescue operations. Emphasis will be on Canadian joint air campaigns, though other international examples will be examined in order to cover a wide range of both kinetic and non-kinetic applications of air power in a joint environment.

Seminar:

3 periods a week (one term)

Credit(s):

1

DS554 Advanced Topics in Institutional Policy Development

This course provides focused consideration of specific topics in policy development with a particular view on the interactions between the military institution and its parent society. Using a case study methodology, consideration will be given to how policies may be developed which effectively address often conflicting requirements arising from: government direction, societal expectations, and military professional perspectives. Topics to be addressed will focus on the development and implementation of various institutional

policies such as the integration of women and minorities in the armed forces, the impact of new technologies on command culture and military capabilities, and the recruiting and integration challenges posed by the millennial generation. Assessment will be through seminar participation and a major independent research paper addressing a topic of the student's choice.

Prerequisites:

DS555

Seminar:

3 periods a week (one term)

Credit(s):

1

DS555 Leadership

The course uses lectures, practical exercises, case studies, and small group discussions to explore leadership theory, 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

DS556 Command

The course uses lectures, case studies, and small group discussions to explore the theory of command, the command environment, decision-making, negotiating, and legal constraints in order to enhance students' overall capacity to command. Participants apply 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

DS557 Institutional Policy Analysis

This course provides an understanding of the methods used in the development of Defence programmes and policies through examination of the multiple perspectives that must be considered by those working at the institutional level within Defence. The theories and analytical methods addressed will draw on the domains of public administration, strategic resource management, military capability development, human resource management, future analyses, and change management with an emphasis on their applicability to defence and, in particular, the Canadian Forces. These methods will be used to conduct critical analyses of current or draft defence policies or programmes.

Prerequisites:

DS555

Seminar:

3 periods a week (one term)

Credit(s):

1

DS567 Global Power and Institutions

This course builds on "DS565: Security and International Affairs" material along with consideration of the national security activities of Canada, the United States, and other key countries and international institutions in order to provide a general analytical view of the global system, its evolution, its basic characteristics, and the strategic implications for international interactions. By applying conceptual and empirical tools, the course develops a more active understanding of the major problems and challenges of the contemporary international system. Assessment is by oral presentations, seminar participation, and an applied case study examining a contemporary challenge from a Canadian perspective.

Prerequisites:

DS565, DS566

Seminar:

3 periods a week (one term)

Credit(s):

1

DS568 Advanced Topics in International Security Studies

This course applies conceptual and theoretical tools to analyze specific issues, powers, regions, and institutions that form the strategic environment within which Canada's foreign and security policy are conducted. Emphasis is given to developing an understanding of the differing views that various stakeholders may hold on a particular issue. The initial portion of this course will examine how international relations theories can be used to analyze the dynamics of specific security topics. The second component will apply a case study methodology to examine selected issues which are currently of importance in the contemporary security context. Assessment will be through seminar participation and a major independent research paper addressing a topic of the student's choice.

Prerequisites:

DS565, DS566

Seminar:

3 periods a week (one term)

Credit(s):

1

DS569 International Security and Canadian Foreign Policy

This course analyses domestic and international factors affecting the development of Canada's security policies. The first module (SCO) provides the theoretical foundations for analyzing and understanding state power, strategic studies and international relations. The second module (GLO) examines the existing international structures managing global security-related issues, along with the influence of independent non-governmental organizations and non-state actors, and concludes with an overlook of US security-related policy making. The third module (CNS) introduces a strategy formulation model and examines the Government of Canada security management structure. The fourth module (CGS) looks at the Canadian government system, its political culture and the major players in the context of the national security interests. The fifth module (CNP) covers current Canadian foreign, defence, and international development policies and gives students the opportunity to discuss them in light of the contemporary security environment. The sixth module (CFD) reviews the process by which DND develops its force structure to meet the demands of national policy and the national strategy which flows from that policy. The final module (REG) looks at the evolution of the world's global security management construct, by using a regionalist model applied to specific regions. Assessment is carried out with presentations, class participation, discussions, and the writing of a persuasive essay.

Seminar:

3 periods a week (two terms)

Credit(s):

2

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 reports 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 practice 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 practice 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, alliances 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 judgment 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 MPA will be required to meet the requirements of their respective programme. Credits: 1 or 2 depending on the degree programme

Credits:

2

Date modified:

2020-06-12

War Studies Programmes

Programme Information

Course Descriptions

WS530 Psychological Factors in Warfare and Human Conflict

WS531 American Foreign and Defence Policy: 1776 to the Present

WS533 Studies in American Defence Policy

WS534 Religion and Modern War

WS537 Intelligence Studies

WS538 Intelligence: Historical and Contemporary Dimensions

WS539 Signals Intelligence

WS540 The Development of Aerospace Power: Theory and Practice

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

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

WS543 First World War

WS544 The Theory and Practice of Strategy in the Classical World

WS545 History of Canadian-American Relations, 1783-present

WS546 Comparative Analysis of Secessionist Conflicts

WS547 Military History of Canada's First Nations, 1500-present

WS548 Russia’s Foreign and Security Policy

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

EG555 *La gloire et le bûcher: la représentation de l'héroïsme guerrier et du sacrifice sanglant dans l'Antiquité*

WS557 Advanced Directed Studies

WS558 War, Gender and Literature

WS559 Aspects of International History 1919 - 1945

WS560 War of Literature

WS561 Aspects of International History Since 1945

WS562 Competitive and Economic Intelligence

WS563 Topics in Literature and War

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 the Second World War

WS574 Asymmetric Threats

WS582 The Profession of Arms

WS584 Canadian Foreign Policy

WS586 Special Operations

WS588 The Second World War

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

WS599 A Canadian Way of Air Warfare

PR500 Directed Research Project

TH500 Thesis/Dissertation

TH600 Thesis/Dissertation

CP600 Comprehensive Examination

Contact

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Programme Web Page
War Studies Programmes

General Information

Degrees Offered

The Royal Military College of Canada (RMC) offers a Master of Arts in War Studies and a PhD in War Studies. The War Studies degrees can be completed full-time or, part-time. To facilitate completion of courses requirements, War Studies courses are also available on Internet.

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

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

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

Programme Requirements

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

Master of Arts in War Studies

The 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-graduate course credits
- Thesis Pattern - six graduate course credits plus a thesis.
- Directed Research Project (DRP) Pattern - eight graduate course credits plus a DRP (PR500)

> ℹ **Note:** WS500 is a two-credit course required for all the degree patterns.

The Master of Arts in War Studies, when pursued full-time normally requires four academic terms or two academic years to complete. No Master of Arts programme may exceed five years.

PhD in War Studies

The doctoral programme of study is comprised of the following:

- Six 600-level course credits (covering a major field of study and two minor fields of study);
- One additional 600-level methodology course (WS607);
- Three 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 years to complete. Students must register as full-time students for a period of two years to undertake course work and complete comprehensive examinations, followed by three years to research, write and defend the dissertation.

Language Requirement

The intent of the language requirement is for students to demonstrate their ability to understand (read and comprehend) material pertinent to their field of study in any second language. This level of performance can be documented in multiple ways, described below:

1. Canadian students with a public service language profile of CBB in their second official language are deemed to have met the requirement.
2. Students may present documentation of university-level course work completed (minimum grade of 70% in an undergraduate-level course or graduate-level course) in the second language, results from a recognized language exam (e.g., TOEFL) indicating proficiency (a grade equivalent to 70% or better), or other evaluations pertinent to their mastery of a second language that they feel demonstrated proficiency at the graduate level, for consideration by the Programme Chairs.
3. Students may request a language examination, which will comprise a text in the second language of the student's choice (approximately 500-700 words) that must be translated into comprehensible, idiomatic English such that the meaning of the text is preserved. Students may use a standard translation dictionary in the appropriate language, and the examination should last no more than 2 hours. Arrangements for the examination (procuring a text, arranging for invigilation, and evaluation) are the responsibility of the Programme Chairs. The examination will be graded on a pass/fail basis by a person appointed by the Programme Chairs who is fluent in the language of the source text. Requests for such an examination should be made in writing to the Programme Chairs within the first year of PhD studies in the War Studies programme. Students who are unsuccessful on this exam will be permitted to re-sit the examination (a different text will be used for each attempt) as many times as necessary, with a minimum 3 month waiting period between attempts. Normally the language requirement should be fulfilled prior to the student attempting their Comprehensive/Field examinations and prior to their commencing work on the dissertation.

Once a student has passed their language requirement, the Programme Chair will inform the Associate Registrar for Graduate Studies, and the student's transcript will be annotated.

Other Credits

The following courses in Public Administration are acceptable for credit toward a Master of Arts in War Studies:

- MPA523: Defence Decision Making
- MPA529: Canadian Defence and Foreign Policy
- MPA539: Economics of Defence
- MPA549: Economics of National Security
- MPA565: Conflict Analysis and Management
- MPA567: Managing and Resolving Violent Conflicts
- MPA575: Human Security: Theory and Practise

Admission Requirements

- Candidates are admitted under the General Admission Requirements. Entry to the PhD programme is competitive. Applicants must have completed Master's degree or equivalent. A thesis-route Master's degree is desirable but not a requirement for admission.
- General information about admission to the RMC as a graduate student can be found at Admission to Graduate Studies.
- Additional information, specific to admission into the war studies programmes, can be found at War Studies Graduate Studies Degree Programme.

Course Descriptions

> 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

This course is an in-depth study of the modern interpretations of warfare, including Clausewitz, Jomini, Hamley, Moltke, Schlieffen, and Foch. There will be coursework 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 cooperation 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 multidisciplinary 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 stabilization 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 analyzes 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 Stabilization Operations

This course considers peacekeeping and international stabilization 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 be 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 effect 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 exert 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 manifestos 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. Among 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 centuries. 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 analyzes 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 worldwide 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

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 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 US foreign relations as well as the institutions and policies processes associated with US 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 US 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

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, anti-democrats 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, 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-modern 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 a 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 (two terms)

Credit(s):

2

WS544 The Theory and Practice of Strategy in the Classical World

This course will examine the formulation and implementation of strategy in the classical world. It will comprise a series of case studies of specific periods and conflicts, including China in the Warring States period, the Peloponnesian War, the Punic Wars and the wars of the Byzantine Empire. In addition to modern scholarship, students will read classic studies written by observers and participants such as Sun Tzu, Thucydides and Livy, which still remain among the most insightful analyses of these conflicts.

Seminar:

3 hours per week (one term)

Credit(s):

2

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

WS546 Comparative Analysis of Secessionist Conflicts

This course covers the specific theme of secessionist movements in the World in a comparative perspective. The tensions between the principle of the intangibility of borders and the principle of the right of peoples to self-determination constitute a fundamental challenge of the twenty-first century and one of the main challenges of contemporary international conflicts. The course presents a review of contemporary secessionist movements with particular attention to the theories of self-determination, legal perspectives and international dimensions. The causes of the secessionist movements and the different solutions - federalism, autonomy, power-sharing - implemented by the states where these movements originate will be addressed, as well as the results of secessionist conflicts, such as the creation of de facto states or partitions and their consequences.

Seminar:

3 periods per week (one term)

Credit(s):

1

WS547 Military 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

WS548 Russia’s Foreign and Security Policy

This course examines the Russian foreign and security policy since the collapse of the Soviet Union. After a period of relative decline in the 1990s, Russia as a “rising Great Power” is much more assertive in the international diplomatic arena. The Western countries seek Russia’s cooperation in arms control, Afghanistan, and Iran. At the same time, Russia remains a challenge for Western democracy promotion and conflict resolution in the post-Soviet space, as well as securing Caspian energy. Students should be able to

place Russian foreign and security policy within historical, political, economic, and geostrategic contexts. There are three parts to the course: historical roots of Russian foreign and security policy, contemporary developments, and unique challenges Russia poses in the post-Soviet space, Europe, Asia and the Middle East.

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 airspace, international airspace, 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 interrelated 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, substitute 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, effect 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, 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 globalization, 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

EG555 *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

WS557 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.

Exclusion:

WS528

Seminar:

3 periods per week (one term)

Credit(s):

1

WS558 War, Gender and Literature

This course examines the experience of war through the lens of gender. Primary texts may include poetry, prose, drama, graphic novels, memoirs, letters, journalism, film, television, and other visual and digital media.

Note(s):

English Only

Seminar:

3 periods 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

WS560 Literature of War

This course examines the diverse ways that combatants and civilians imagine, perceive, and represent the unforgettable experience of war. Primary texts come from a range of geographical regions and historical periods, and exemplify a variety of modes, including poetry, prose, drama, graphic novels, memoirs, letters, journalism, film, television, and other visual and digital media. Possible themes to be explored include distinctions between fictional and autobiographical accounts of war; the aftermath of war, both personal and social ; and the politics and policies of war, including age, gender, race, sex, sexuality, nationality, ability/ disability, and trauma.

Note(s):

English Only

Seminar:

3 periods 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, decolonization, 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

WS563 Topics in Literature and War

Topics will vary based on the interest s and research of the professor. Contact the Chair of the War Studies programme for information on each year's offering.

Seminar:

3 periods per week (one term)

Credit(s):

1

WS564 Intelligence Methodologies and Operational Case Studies

This course examines the methodologies of intelligence operations, including issues of deception, human and technical intelligence gathering, counterintelligence, 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 cooperation) and the governmental

decision-making apparatuses will be emphasized. 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 timeline 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 utilization 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 multidisciplinary 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 effect 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 among 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 analyze 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

WS599 A Canadian Way of Air Warfare

This is a one-term course examining the development of air power philosophy, doctrine and practice in Canada in the past century. It looks both at the events of the First and Second World Wars as well as the Cold War; these are studied within the context of the broader Canadian military and security experience. The course is not limited to military events but also explores the creation of 'air mindedness' both in the Canadian military and Government of Canada as well as the general population. Major themes will include the employment of the RCAF and Canadian air forces in war and peace, civil military relations, alliance arrangements, force structure, procurement and the existence of a unique airforce culture. Various methodological approaches will be employed including the use of artifacts, primary source documents, oral histories, and comparative studies between the RCAF and the air arms of other nations and other Canadian services.

Seminar:

3 Periods per week (one term)

Credit(s):

1

PR500 Directed Research Project

Students who choose the Directed Research Pattern 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 PhD Students

Credit(s):

2

TH500 Thesis/Dissertation

A thesis may be required for the Master's programme. The research must demonstrate the student's ability to carry out a significant research project.

Credit(s):

6

TH600 Thesis/Dissertation

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.

Credit(s):

6

CP500 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.

Credit(s):

1

Date modified:

2020-01-17

RMC - CFC Joint Programmes

Contact

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

Telephone
416-482-6800

General Information

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

1 AMSP was replaced in 2008 by the 10 month NSP.

2 NSSP was replaced in 2008 by the 10 month NSP.

RMC transcripts will show CFC course registrations as DS credits, then the appropriate number of transfer credits toward the programme to which a student has been admitted. 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 Business Administration
- Master of Defence Studies
- Master of Public Administration

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 RMC 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 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 RMC-CFC Joint Programmes are subject to periodic review by the Ontario Council of Graduate Studies (OCGS).

Date modified:

2020-10-29

Faculty of Science Graduate Studies Programmes

The Royal Military College of Canada offers to commissioned officers of the Canadian Armed Forces and to civilian students who are either Canadian citizens or permanent residents, a graduate study programme leading to the following Master of Science (M.Sc.) and/or Doctoral (Ph.D.) degree programmes.

Graduate Programmes in Chemistry and Chemical Engineering

Graduate Programmes in Mathematics and Computer Science

Graduate Programmes in Physics

Date modified:
2019-07-11

Graduate Programmes in Chemistry and Chemical Engineering

Programme Information

Course Descriptions

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

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

CC573 Nuclear Waste Management

CC575 Materials in the Space Environment

CC577 Explosives and Explosions

CC579 Chemistry of Energetic Materials

CC587 Mechanism, Kinetics and Model Development

CC591 Ceramic Engineering

CC593 Advanced Nuclear Reactor Physics

CC595 Nuclear Materials

CC599 Advanced Topics in Analytical Chemistry

CC604 Seminar

PR500 Project

TH500 Thesis (Master's Level)

TH600 Thesis (Doctoral)

CP600 Comprehensive Examination (Doctoral Level)

Contact

Department Head
Dr. Danny Pagé

Professor-in-Charge of the Chemical Engineering Programme
Dr. Juan Beltrán

Graduate Studies Committee Chair
Dr. Emily Corcoran

Telephone
613-541-6000 ext. 6271

Fax
613-542-9489

Web Page
Department of Chemistry and Chemical Engineering

General Information

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 Masters 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 Admission to Graduate Studies section of this calendar

Programme Requirements

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

The Masters 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.

> ℹ 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

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 Master's 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 man made 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 Ground-Launched Munitions

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 (ionization, 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 organization 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 characterization 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

CC520 Transport Phenomena

The course gives on overview of the field of transport phenomena including heat transfer, mass transfer, and fluid mechanics at the graduate level. Emphasis is made on the fact that the basic equations that describe these three modes of transport are closely related. Scaling analysis is introduced. Depending on the class interests, specific advanced topics in chemical, environmental or nuclear engineering 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 specialized techniques will be included. Lectures - 3 periods per week (one term)

Lectures:

3 periods per week (one term)

Credit(s):

1

CC522 Applied Experimental Design and Data Analysis

The methodology for developing efficient experimental plans for reduced experimentation and maximum informational output will be presented, and the use of analysis of variance (ANOVA) and multiple linear regression models for data analysis emphasized. Multivariate analysis methodologies including cluster analysis, use of correlation matrices, principle component analysis (PCA), and partial least squares (PLS) regression will be presented with a focus on applied data analysis and industrial process optimisation. Data distributions including normality and homoscedasticity will be discussed in the context of analysis methodology assumptions and the use of transformations for data analysis covered.

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.

Prerequisite:

CC523 Nuclear Reactor Engineering

Lectures:

3 periods per week (one term)

Credit(s):

1

CC528 Advanced Inorganic Chemistry

This course will cover topics in inorganic chemistry at the graduate level. The course will begin with a general review of the fundamentals of ligand field theory and the nature of bonding in transition and main group metal complexes. Inorganic chemistry is a wide field and special topics may include in-depth studies in the areas of coordination chemistry (including magnetism and metal organic frameworks), bioinorganic systems (such as the function, mechanism, and toxicity of inorganic elements in biological systems), organometallics (both for transition and main group metals), and/or homogeneous catalysis (catalytic mechanisms and industrial applications).

Lectures:

3 periods per week (one term)

Credit(s):

1

CC531 Radiological Methods

Radiological techniques utilizing 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 emphasized. 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 stabilization, 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 prioritization 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

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, aluminium, ceramics, glass and composites) in various geometric configurations by long rod and spin stabilized 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 economic 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 Pressurized 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). Optimization 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

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 (in pool 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 in ground 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 economic, 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

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

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, and 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

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

This code is used when enrolled in a Project

TH500: Thesis (Master's Level)

This code is used when enrolled in a Master's Thesis

TH600: Thesis (Doctoral Level)

This code is used when enrolled in a Doctoral Thesis

CP600: Comprehensive Examination (Doctoral Level)

This code is used when enrolled in a Comprehensive Examination

Date modified:

2017-09-20

Graduate Programmes in Mathematics and Computer Science

Programme Information

Course Descriptions

CS505 Reinforcement Learning

CS507 Deep Learning with Artificial Neural Networks

CS551 Pattern Recognition and Image Processing

CS553 Modelling 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)

Contact

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Web Page
Department of Mathematics and Computer Science

Programmes Offered

The Department of Mathematics and Computer Science offers 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
- database
- intelligent tutoring systems
- numerical simulation
- signal and image processing
- user modelling
- mathematical physics
- mathematical modelling
- neural networks
- operations research
- optimization
- 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 Admission to Graduate Studies section of this calendar.

Programme Requirements

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

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 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 simplex 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

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, Linear programming, Combinatorial 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 utilized 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 opt im is at ion 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. Optimizing 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 generalizations 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

MA541 Semantic Web and Ontologies

The course Semantic Web and ontologies aims to familiarize students with the basic principles of the Semantic Web and to present its current state of development and research challenges. The course also explores the various technologies, tools and languages currently used. In particular, as ontologies are the backbone of the Semantic Web, the course also presents ontology engineering and ontology learning methodologies. The lectures take various forms: 1) discussing various readings, 2) formal lectures, and 3) Presentations by students. Students must also complete a Semantic Web project in a given application domain using Java and Semantic Web Technologies.

Prerequisite:

Java

Lectures:

3 periods per week (one term)

Laboratory:

5 hours per week (minimum)

Credit(s):

MA543 Discrete-time Stochastic Processes Modelling

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

MA545 Applied Stochastic Modelling

This course studies the general Markovian arrival process as well as phase-type distributions in discrete- and continuous time. These concepts give rise to different models leading to applications in internet and telecommunication systems as well as other types of congestion processes. Various techniques such as matrix-analytic, matrix-geometric, spectral analysis and the roots method will be used to solve these models.

Prerequisite:

MA537 and MA543 or equivalent

Lectures:

3 periods per week (one term)

Credit(s):

1

MA547 Advanced Modelling of Queues

This course studies single and bulk arrival multi-server queues wherein inter-arrival times follow arbitrary distributions. Both discrete- and continuous-time aspects of these queues will be studied. While looking at the computational aspects of these queues, various distributions such as heavy-tailed distributions which have applications in financial engineering will be considered. In addition, single-server finite-space queues will be investigated using the roots method. Current solution approaches will be examined in detail for all models studied.

Prerequisite:

MA537 and MA543 or equivalent

Lectures:

3 periods per week (one term)

Credit(s):

1

MA549 Representation Theory

Representation theory is the study of algebraic structures and their modules through the use of matrices and linear algebra. The purpose of this course is to give the student an introduction to representation theory in some algebraic settings. This includes topics ranging from representation theory of associative algebras to representation theory of Lie algebras. Key results in representation theory of associative algebras include Gabriel's theorem on finite type path algebras, classification of semi-simple algebras, Jordan-Holder theorem and Krull-RemakSchmidt theorem. On the Lie algebra side, important results include the relationship between Lie groups and Lie algebras, the classification results (including the classification of simple complex Lie algebras through Dynkin diagrams), and the description of the representations of some classical Lie algebras.

Lectures:
3 periods per week (one term)

Credit(s):
1

MA551 Topics in Combinatorics

This course covers advanced topics in combinatorics such as graph theory, ordered sets, designs, enumerative combinatorics, combinatorial group theory and extremal set theory.

Lectures:
3 periods per week (one term)

Credit(s):
1

MA553 Statistical Learning and Data Science

This course covers a number of supervised statistical learning models that predict/estimate an output based on one or more inputs. Topics covered include the efficient solution of linear systems, linear regression, multiple linear regression, recursive least squares, nonlinear regression models, classification methods, resampling methods, and tree-based methods. All computations will be done in R.

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

CS505 Reinforcement Learning

This course is an in-depth coverage of reinforcement learning theory, algorithmic solutions, neuropsychological basis, and discussions on states representations. Topics included the basic definition of reinforcement learning and Bellman equations, as well as algorithms from three classes of solutions to the problem: Dynamic Programming, Monte Carlo Methods, and Temporal Difference Learning

(including eligibility traces). It also covers the psychological and neurological foundations of animal reinforcement learning as well as advanced topics on learning state and action representations. Selected mathematical proofs may also be covered.

Lectures:

3 periods per week (one term)

Credit(s):

1

CS507 Deep Learning with Artificial Neural Networks

This course introduces the fundamentals of machine learning with a focus on deep learning with artificial neural networks. This includes, but is not limited to, deep feed forward networks, convolution networks, recurrent neural networks, regularization and optimization. At the end of the semester, the students will have a good idea of how modern deep learning artificial neural network algorithms are working and will be able to understand the relevant literature on the given topics. The students should also be able to use some deep learning library and to apply it to a problem of their choice.

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 syntactic 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 model design and execution 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 databases. Theory of relational databases. Query languages. Concurrency, transactions and distributed processes. Knowledge-based system rules, logic programming and object-oriented databases.

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 fundamental 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: Sexpressions, 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

CSE321

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 perceptron's, back propagation networks, self-organizing 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

This code is used to capture students registered in a project.

TH500 Thesis; Master's Level

This code is used to capture students registered in a master's-level thesis.

TH600 Thesis; Doctoral Level

This code is used to capture students registered in a doctoral-level thesis.

CP600 Comprehensive Examination; Doctoral Level

This code is used to capture students registered in a comprehensive exam.

Date modified:

2019-06-20

Graduate Programmes in Physics

Programme Information

Course Descriptions

PH589 Radar Polarimetry

PH591 Galaxies in the Universe

PH593 Astronomical Instrumentation

PH595 Gaussian Optics: Light Propagation in Optical Systems and Waveguide Structures

PH596 Grating and Waveguide Structures

PH597 Galactic Astronomy

PH599 Optical Observational Techniques and Data for Space Surveillance

PH601 Measurement and Modelling of Stellar Magnetic Fields

PR500 Project

TH500 Thesis (Master's Level)

TH600 Thesis (Doctoral Level)

CP600 Comprehensive Examination (Doctoral Level)

Contact

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Web Page
Department of Physics and Space Science

General Information

Programmes Offered

The Department of Physics and Space Science 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 a graduate student can be found in the Admission to Graduate Studies section of this calendar.

Programme Requirements

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

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. 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.

A Master's 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 CAF.

Course Descriptions

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 digitization 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 a particular model to predict transmission loss.

Lectures:

3 periods per week (one term)

Credit(s):

1

PH503 Advanced Optics

This course will start with a review of geometrical optics, including matrices methods and notation for paraxial optics, as well as a review of wave optics and light polarization, including Jones vectors and matrices. After that, the student will be introduced to electromagnetic waves propagation in anisotropic crystals, the optical index ellipsoid and the electro-optic effect in crystals. This will be followed by a study on non-linear optics, including second harmonic generation, and a description of the Fabry-Pérot interferometer. The student will also be introduced to the fundamentals of light propagation and coupling inside slab optical waveguides using diffraction gratings. Finally, detailed theory will be given on surface plasmon resonance and Fourier optics.

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 wave number 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, infrared and microwave is discussed, as are the algorithms necessary to transform sensor data into geophysical 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 (one term)

Laboratory:

2 periods per week (one term)

Credit(s):

1

PH509 Radio Astronomy

This course presents an introduction to the fundamental concepts of radio astronomy. The goals are to provide the background needed to read and understand the radio astronomy literature, to recognize when radio observations might help solve an astrophysical problem, and to design, propose, and analyze radio observations. Topics covered include radiation fundamentals, radio telescopes and radiometers, free-free and synchrotron radio radiation, and radio spectral lines.

Lectures:

3 periods per week (one term)

Credit(s):

1

PH511 Electromagnetic Theory

Reviews of electrostatics, magneto statics, and Maxwell's equations in a 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 localized 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, 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), third body 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

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 maneuvers 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 to 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. Biweekly 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 CAF.

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 practise in biweekly 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

PH595 Gaussian Optics: Light Propagation in Optical Systems and Waveguide Structures

This course is divided into two main parts. The first part of the course will introduce Gaussian beam and laser beam propagation in the air when focusing or collimating of a Gaussian beam with simple optical systems. Laser-matter interaction in glass and in biological tissues will be covered with some examples in micro-machining and health sciences. Heat transfer in glass material and in biological tissue will be presented in great details for focused and collimated Gaussian beams. The second part of this course will give an overview of laser beams interactions with grating waveguide structure. In this portion of the course, numerical techniques to compute diffraction efficiency in rectangular groove gratings will be presented in detail. Rigorous coupled wave analysis will be derived and applied to binary dielectric and metallic gratings.

Lectures:

3 periods per week (1 term)

Credit(s):

1

PH596 Grating and Waveguide Structures

This course will be dealing with laser beams interacting with grating waveguide structure. This course will be divided into two parts. In the first part of this course, students will learn about numerical techniques to compute diffraction efficiency in rectangular and sinusoidal gratings, which will be presented in details in class. Rigorous coupled wave analysis will be derived and applied to both binary dielectric and metallic gratings. In the second part of the course, the periodic grating will be applied to optical fibers such as Fiber Bragg gratings and Surface Nanoscale Axial Photonics (SNAP). In this course, students will be taught to use Matlab to calculate the diffraction efficiencies numerically and solve eigenvalue problems in grating waveguide structures.

Lectures:

3 periods per week (1 term)

Credit(s):

1

PH597 Galactic Astronomy

This course describes the material content, energetics, formation and evolution of the Galaxy and places our Galaxy in the context of galaxies, in general. Topics include the interstellar medium, stellar populations, dynamics, the Galactic centre and the Galactic halo.

Lectures:

3 periods per week (1 term)

Credit(s):

0.5

PH599 Optical Observational Techniques and Data for Space Surveillance

The course presents an overview of the optical observational techniques that are commonly used to track and characterize artificial Earth-orbiting objects, namely active spacecraft and space debris objects. The course will cover the planning of observations of artificial Earth-orbiting objects. It then introduces charged-coupled detectors (CCD) focussing on the instrument characteristics that have the most important impact on observation activities. Image processing of CCD images will then be studied. Next, the course surveys optics for astronomy namely image quality, telescope types and aberration. Artificial Earth-orbiting object tracking considerations are then reviewed in addition to photometry and spectrometry techniques applied to space surveillance.

Lectures:

3 periods per week (one 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, polarization 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

This code is used to capture students registered in a Project.

TH500 Thesis; Master's Level

This code is used to capture students registered in a Master's-level Thesis.

TH600 Thesis; Doctoral Level

This code is used to capture students registered in a Doctoral-level Thesis.

CP600 Comprehensive Examination; Doctoral Level

This code is used to capture students registered in a Comprehensive Exam.

Date modified:

2020-06-10

Faculty of Engineering Graduate Studies Programmes

The Royal Military College of Canada offers to commissioned officers of the Canadian Armed Forces and to civilian students who are either Canadian citizens or permanent residents, a graduate study programme leading to the following Master of Applied Science (M.A.Sc.), Master of Engineering (M.Eng.) and/or Doctoral (Ph.D.) degree programmes.

Graduate Programmes in Civil Engineering

Graduate Programmes in Electrical Engineering and Computer Engineering

Graduate Programmes in Mechanical Engineering and Aeronautical Engineering

Date modified:
2017-09-20

Graduate Programmes in Civil Engineering

Programme Information

General Information

Programme Requirements

Course Descriptions

CE501 Advanced Geotechnical Engineering

CE505 Strengthening and Repair of Concrete Structures

CE507 Advanced Reinforced Concrete Design

CE509 The Design of Multistory Buildings

CE513 Laboratory Testing of Geomaterials

CE519 Numerical Methods in Environmental Engineering

CE521 Instrumentation & Monitoring: Planning, Execution, Measurement and Data Analysis in Geotechnical and Environmental Engineering

CE525 Bridge Engineering

CE527 Advanced Numerical Methods used in Civil Engineering

CE529 GeoEngineering Seminar

CE531 Principles of Soil Mechanics

CE533 Frozen Ground Engineering

CE535 Advanced Foundation Engineering

CE539 Geosynthetics in Geotechnical Engineering

CE541 Advanced Topics in Civil Engineering

CE571 Water and Waste Water Treatment Processes

CE583 Environmental Impact Assessment

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)

Contact

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Web Page
Department of Civil Engineering

General Information

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 Masters 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 Admission to Graduate Studies section of this calendar

Programme Requirements

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

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

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

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

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

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

CE521 Instrumentation & Monitoring: Planning, Execution, Measurement and Data Analysis in Geotechnical and Environmental Engineering

This course will introduce students to the theory and practice of geotechnical and environmental monitoring. The primary objective of this course is to provide students with a systematic approach to planning monitoring programs for geotechnical (to include geoenvironmental) engineering projects that contain elements of prediction, planning, design of instrumentation/monitoring programs, instrument types, performance of commonly used sensors, data acquisition, error analysis, data interpretation and information management. The course will provide the fundamental concepts of instrumentation and monitoring that could be applied in civil, environmental and geological engineering. Students will be exposed to monitoring concepts associated with Quality Assurance, Compliance, Construction Control, Design Back analysis, prediction of hazards and alerts. At the end of the course, students will develop the ability to plan and design instrumentation and monitoring programs and determine how to use the best suited instrumentation scheme to capture better and real performance. Common sensor and geomatic instrumentation will be introduced and used by the students in the field. The student's achievement of the learning objectives will be assessed through a series of in class problem-solving exercises, design exercises, class discussion, and case studies.

Lectures:

2.5 periods per week; Laboratory - 0.5 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)

Credit(s):

1

CE529 GeoEngineering Seminar

Illustrate all areas of GeoEngineering research and practice; emphasis on breadth and interdisciplinary aspects; preparation, delivery and audience participation in oral presentations; the course links students from departments participating in the Collaborative Graduate Program in GeoEngineering; opportunities are provided to develop and refine presentation skills, to give and receive constructive criticism, and to pose and respond to questions. Instructors: GeoEngineering faculty, Invited lecturers.

Lectures:

1 period per week (two terms)

Credit(s):

0

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

CE533 Frozen Ground Engineering

In this course students will be introduced to permafrost and frozen ground engineering by an in-depth examination of physical, thermal and mechanical behaviour of frozen and thawing soils. Throughout the course, students will examine topics including: surface features in permafrost, ground ice landforms, thermal regimes in permafrost areas, thermal and mechanical properties of frozen soils, heat flow equations, site investigation in permafrost areas, and hazards related to permafrost degradation. In addition, there will be a focus on using numerical modelling to understand thermal soil-structure interactions of pipelines, roads and airfields in permafrost regions. Students will be assessed through a series of in class problem-solving exercise, case studies, seminars, and a design project.

Lectures:

3 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

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

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

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

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 homogeneous media.

Lectures:

3 periods per week (one term)

Credit(s):

1

CE595 Design and Analysis for Blast Effect on Structures

The aim of this course is to introduce the structural engineer to the phenomena of blast waves and how they interact with structures. The course will cover the fundamentals of explosives and the properties and characterization of their blast waves and scaling laws. The interaction of the blast wave with the target structure will be examined in detail. Structural response to the blast wave will be studied from a single element as well as holistic structure perspective. SDOF dynamic methodologies for element analysis will be used

to examine element response. Analysis and design of critical elements (beams and columns) for a blast environment will be studied. The concept of progressive collapse will be examined including current methodologies for designing to preclude it. Students will be introduced to a variety of texts, papers and numerical tools that define the state of the art in this rapidly evolving area of study. Threat-risk based vulnerability assessment techniques will be introduced as a means to examining existing infrastructure for suitability in a blast environment. Students in the course will complete a series of assignments and presentations as well as a major paper during the course.

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.

Lectures:

3 periods per week (one term)

Credit(s):

1

PR500: Project

This code is used for students registered in a Project.

TH500: Thesis (Master's Level)

This code is used for students registered in a Master's Level thesis.

TH600: Thesis (Doctoral Level)

This code is used for students registered in a Doctoral Level thesis

CP600: Comprehensive Examination (Doctoral Level)

This code is used for students registered in a Comprehensive Examination.

Date modified:

2017-09-20

Graduate Programmes in Electrical Engineering and Computer Engineering

Programme Information

Course Descriptions

EE543 Radar Basics and Applications

EE545 Microcomputers: Architecture and Applications

EE547 Digital Forensics

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

EE569 Malware Analysis

EE571 Advanced Topics in Power Engineering

EE573 Object-oriented Analysis and Design

EE577 Neural Networks Applications to Power Systems

EE578 Introduction to Computer Systems and Network Security

EE580 Applied Cyber Operations

EE581 Electronic Warfare Systems Engineering

EE583 Software Requirements Engineering

EE585 Real-Time Software Design and Implementation

EE587 Topics in Software Engineering

EE591 Software Engineering

EE593 Advanced Network Traffic Analysis

EE595 Cyber Threat and Attack Techniques

EE597 Operational Technology Cybersecurity

EE599 Computer System Verification and Validation

PR500 Project

TH500 Thesis (Master's Level)

TH600 Thesis (Doctoral Level)

CP600 Comprehensive Examination (Doctoral Level)

Contact

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Web Page
Department of Electrical and Computer Engineering

General Information

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, The department also offers a Graduate or Professional Certificate in Cyber Security.

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

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 Admission to Graduate Studies section of this calendar.

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

Programme Requirements

Masters and Doctoral Degree Requirements

- The Master of Engineering is comprised of at least eight 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.

> ℹ **Note:** 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.

Graduate Certificate in Cyber Security

> ℹ **Note:** This certificate is intended to allow individuals to gain a foundational understanding of the defence Cyber Security field.

The topics cover basic and specialized areas of Cyber Security across multiple disciplines. In addition, the certificate can be applied to the MEng, MASc, MBA, and MPA degrees, at the discretion of those programmess.

The equivalent of 5 one-credit courses is required for completion of the certificate.

Eligible Courses

- EE547: Digital Forensics
- EE569: Malware Analysis and Reverse Engineering
- EE578: Introduction to Computer Systems and Network Security
- EE580: Applied Cyber Operations
- EE593: Advanced Network Traffic Analysis
- EE595: Cyber Threat and Attack Techniques
- EE597: Operational Technology Cybersecurity
- MBA503: Advanced Topics in Management II (Cyber Security option)
- MPA535: The Cyber Challenge
- MPA591: Cyber Statecraft and National Security

Professional Certificate in Cyber Security Foundations

> ℹ **Note:** This certificate is intended to allow individuals to gain a basic understanding of the defence Cyber Security field in a professional context through the completion of relevant short courses.

The topics cover basic and specialized areas of Cyber Security across multiple disciplines. **These short courses are not associated with any other academic programme and are not evaluated for equivalent academic credit to regular graduate courses or undergraduate courses.** While language assistance is provided for francophone students, this program is only offered in English.

The completion of five (5) courses from the eligible courses list is required for completion of the certificate.

Eligible Courses:

1. SCINS - Short Course in Networks and Security
2. IDEAS - Intrusion Detection and Extrusion Analysis Skills
3. MASC - Malware Analysis Short Course
4. ETC - Exploitation Techniques Course
5. DigForIT - Digital Forensics Investigation Techniques
6. SPOTS - Security of Platform / Operational Technology Systems (SPOTS) course

Professional Certificate Course Descriptions

Short Course in Networks and Security (SCINS)

- **Course length:** ten (10) days over two (2) weeks
- **Course format:** The course consists of a mixture of classroom lectures (50%) and hands-on lab exercises and challenges (50%). The course culminates in a 2-day Red-on-Blue Cyber Defence Exercise.
- **Objective:** The primary objective of the Short Course in Networks and Security (SCINS) is to provide the students with an introduction to computer networks and to the security issues surrounding computer networks. The philosophy throughout the course is to provide a high ratio of hands-on practice to class-based learning. The course is designed to provide the foundation material necessary before attending more specialized training in computer security.

Intrusion Detection & Extrusion Analysis Skills (IDEAS)

- **Course length:** eight (8) days over two (2) weeks
- **Course format:** The course consists of a mixture of classroom lectures (40%) and challenging hands-on lab work (60%). The course culminates in a 1-day network traffic investigation exercise.
- **Prerequisites:** SCINS or equivalent background.
- **Objective:** The objective of the Intrusion Detection & Extrusion Analysis Skills (IDEAS) is to provide students with theoretical and practical intrusion detection analysis techniques as well as network traffic analysis skills.

Malware Analysis Short Course (MASC)

- **Course length:** fifteen (15) days (three (3) days per week over five (5) weeks)
- **Course format:** Each week consists of two (2) days of classroom instruction and supervised hands-on practical analysis followed by one (1) day of independent investigation (homework completed outside the classroom).
- **Prerequisites:** SCINS or successful completion of a pre-study distance learning package provided by the Canadian Forces School of Communications and Electronics (CFSCE). Students with an academic background in community college level Computer Programming or Computer Technology, or university level Computer Science or Computer Engineering may request to be exempt from the pre-study package. Exemption is at the discretion of the course loading authority in consultation with the instructor.
- **Objective:** The Malware Analysis Short Course (MASC) provides a basic foundation in the concepts and application of static and dynamic analysis for the purpose of reverse engineering malicious software.

Exploitation Techniques Course (ETC)

- **Course length:** fifteen (15) days (three (3) days per week over five (5) weeks)
- **Course format:** Each week consists of two (2) days of classroom instruction and supervised hands-on "ethical hacking" followed by one (1) day of independent capture-the-flag challenges (homework).
- **Prerequisites:** MASC or equivalent background.
- **Objective:** The Exploitation Techniques Course (ETC) provides a basic foundation in the concepts and application of ethical hacking and penetration testing techniques for the purpose of better understanding the context of cyber operations.

Short Course in Digital Forensics Investigation Techniques (DigForIT)

- **Course length:** five (5) days over one (1) week
- **Course format:** The course consists of a mixture of classroom lectures and challenging hands-on lab work.
- **Prerequisites:** SCINS or equivalent background.
- **Objective:** The objective of the Short Course in Digital Forensics Investigation Techniques (DigForIT) is to provide students with a basic foundation in digital forensics theory and techniques. This course is designed for students who currently have a basic

understanding of computer security and who wish to learn the fundamentals of digital forensics with practical applications.

Security of Platform and Operational Technology Systems (SPOTS)

- **Course length:** ten (10) days over two (2) weeks
- **Course format:** The course consists of 40% lecture and 60% labs and exercises and culminates in a two-day exercise that encompasses technical, management and operational factors.
- **Prerequisites:** SCINS or equivalent background
- **Objective:** The Security of Platform and Operational Technology Systems (SPOTS) course provides a comprehensive introduction to cybersecurity issues unique to platform and operational technology (OT) systems. The course is engineering focused and includes advanced technical concepts within computer security. This course prepares graduates to guide and/or provide advice to Weapons System Managers and (WSMs) and/or Project Management Offices (PMOs) on platform/OT cybersecurity matters such as:
  - security threat and vulnerability assessments;
  - security architecture and protection measures; and
  - support to defensive cyber operations.

Course Descriptions

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 through academic papers and proposals, and verbally through presentations and seminars. Standards for academic discourse and publication will be emphasized 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 is covered. Then, two classes of WMR are studied: car-like robots and mobile wheeled pendulums. For each class, modelling, 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, finite element method, finite-difference method, method of lines, field-matching and mode matching 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 modelling 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 modelling 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 optimization, microstrip antennas, microwave generation, time and frequency domain measurements using modern network analyzers, 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 modelling 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 Adaptive Control Systems

A review of linear control systems will be presented. The Lyapunov stability is covered. Identification techniques will be discussed. Introduction to Adaptive Control of Linear Systems will be presented. 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. Adaptive control for nonlinear systems will be discussed: Self-tuning and Model reference approaches are covered. Applications are mostly related to electric motors, power electronics, and power systems.

Prerequisites:

A strong foundation in linear control theory is a recommended course prerequisite.

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. Travelling 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.

Prerequisites:

Basic electronic theory is a recommended course prerequisite.

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

EE547 Digital Forensics

Digital forensics is a branch of forensic science which focuses on the recovery and analysis of information found in digital systems. It has a wide range of applications including intelligence gathering, private, corporate and criminal investigations, incident response involving digital systems and many others. In this course, students will develop a thorough understanding of digital forensics theory and techniques and will apply these to investigate incidents involving malicious user activity and malware on common operating systems. Topics will include image acquisition techniques, analysis of volatile and non-volatile memory, file systems structure, OS artifacts, e-mail systems, web browser activity, USB storage device activity, timeline of activity, data stream carving, deleted file carving, process analysis, network connection analysis and anti-forensic techniques.

Lectures:

3 periods per week (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 queueing 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

EE569 Malware Analysis

The course covers dissection of malware for the purposes of understanding, detection and mitigation. It includes static analysis topics to include hashing, packing and obfuscation techniques, portable executable file format, the execution environment, x86 architecture, code constructs in assembly, the Windows API and registry. It also examines dynamic analysis topics to include sandboxing, run-time debugging, memory maps, threads and stacks, exception handling, drivers and kernel debugging. The course covers an introduction to document-based malware, memory forensic techniques and others. The course includes practical work such as laboratories and a project.

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 optimization; 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 modelling languages, and will provide experience with implementation using a standard object-oriented programming language.

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

EE578 Introduction to Computer Systems and Network Security

The course is meant as an introduction to the security issues associated with the security of computer systems and networks. The topics covered will include computer security concepts, terminology, seminal research, operating systems, and issues of network administration related to computer security, including the deployment and configuration of servers such as directory services. The course will discuss comprehensive aspects of security such as network attack, network zoning, segmentation and protection, intrusion techniques and the detection of such attacks and intrusions. Students undertake a series of lectures, assignments and laboratory exercises throughout the course.

Lectures:

3 periods per week (one term)

Credit(s):

1

EE580 Applied Cyber Operations

Cyber Operations are much more than the use of computers and networking technology; they require coordinated action to achieve a desired effect in cyberspace. This course will explore the application of cyber operations through the preparation for and participation in a major cyber exercise where students will design networks in support of a simulated military operation, build the network and operate it. Students will be required to operate in the face of a sophisticated and determined adversary with goals in direct opposition to the students, thereby generating simulated cyberspace conflict. In preparation for the simulated engagement, students will be required to build and deploy services such as directory, name resolution, electronic mail, web, file, etc. During the simulated engagement, students will be required to monitor these services, perform other network maintenance tasks, carry out intrusion detection and other simulated defensive cyber operations tasks, as well as participate in simulated offensive cyber operations. All students registered in the course will form part of a single team which will work cooperatively with teams of students from other academic programs against teams of adversaries composed of members from the military, government, and partner organizations.

Prerequisite(s):

EE578 or similar experience in computer systems and network security

Lectures / Cyber Exercise:

Equivalent to a course of 3 periods per week (one term)

Credit(s):

1

EE581 Electronic Warfare Systems Engineering

Electronic warfare refers to techniques that are used to detect and defeat hostile electromagnetic sensors while ensuring that friendly sensors remain effective. Although electronic warfare applies to the entire electromagnetic spectrum, this course focuses on radar and communication signals that are transmitted at radio and microwave frequencies. The course is divided into three modules. In the first, the fundamentals of wave propagation, radar, and telecommunication will be reviewed, culminating in a study of modern low probability of detection methods. The second module deals with hostile signal detection, analysis, direction of arrival, and emitter geolocation. In the final module, jamming techniques and self-protection measures are considered.

Lectures:

3 periods per week (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 Analyzing 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

EE593 Advanced Network Traffic Analysis

There are many benefits to the networking of computer systems, but networks are inherently vulnerable. All networked computing devices are subject to malicious traffic; military networks can be especially attractive targets for espionage services, organized crime and hacking groups. In this course, students will develop a thorough understanding of traffic analysis theory and techniques, and apply

these to topical computer security problems such as intrusion detection, extrusion analysis and traffic classification. Specific techniques explored may include intrusion detection systems, signature-based detection and analysis, anomaly-based detection and analysis and traffic classification. Students completing this course will be able to analyze network traffic for the purpose of protecting networks against malicious activity. The course will include practical laboratory work, review and critique of traffic analysis literature and a major course project.

Lectures:

3 periods per week (one term)

Credit(s):

1

EE595 Cyber Threat and Attack Techniques

Those operating in the cyber domain that is tasked with the defence of networks and computer systems must have a sound understanding of the threats that they face and of the techniques used by their adversaries; this course discusses the fundamentals of Cyber threats and attack techniques, with a heavy focus on practical applications. Topics will include current cyber threat categories and general capabilities; attack techniques including password cracking, buffer and heap overflows, IP and DNS spoofing, viruses and worms, backdoors and remote access tools, key loggers, tunnelling and covert channels, SQL injection and cross--site scripting; advanced evasion techniques such as polymorphic code and rootkits. The course also introduces malware construction including assembly level program flow control and return oriented programming.

Lectures:

3 periods per week (one term)

Credit(s):

1

EE597 Operational Technology Cybersecurity

In this course, students will develop a thorough understanding of the components within operational technology (OT) and its similarities and differences with information technology (IT). The course will include offensive and defensive cyber security aspects of Operational Technologies at the application, network and physical layers. Components of the course will build on the foundations from civilian OT systems and protocols and focus on military platform security. The course includes practical work such as laboratories and a project. There is a security clearance requirement for this course.

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

This code is used for students enrolled in a project.

TH500: Thesis (Master's Level)

This code is used for students enrolled in a Master's Level thesis.

TH600: Thesis (Doctoral Level)

This code is used for students enrolled in a doctoral Level thesis.

CP600: Comprehensive Examination (Doctoral Level)

This code is used for students enrolled in a comprehensive Examination.

Date modified:

2020-07-02

Graduate Programmes in Mechanical Engineering and Aeronautical Engineering

Programme Information

General Information

Programme Requirements

Course Descriptions

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

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

ME555 Combustion Processes

ME563 Nonlinear Systems and Control

ME565 Experimental Approach to Turbulence in Fluid flows and Heat Transfer

ME585 Seminar

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

AE505 Advanced Design and Optimization of Engineering Systems

AE507 Gas Turbine Analysis

AE515 Advanced Plasma Spacecraft Propulsion

AE517 Fluid Dynamics - Compressible Flow

AE531 Composite Materials for Aerospace Applications

AE533 Design and Analysis for Aircraft Structural Repair

AE535 Computational Fluid Dynamics of Incompressible and Compressible Flows

AE561 Aerodynamics of Turbomachines

AE567 Aircraft Performance

AE581 Design and Stressing of Aircraft Components

AE583 Design and Stressing for Aircraft Repair

AE585 Seminar

AE591 Advanced Topics in Aeronautical Engineering

AE599 Turbulence Theory

PR500: Project

TH500: Thesis; When done at the Master's Level

TH600: Thesis; When done at the Doctoral Level

CP600: Comprehensive Examination; Doctoral Level

Contact

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Web Page
Department of Mechanical and Aerospace Engineering

General Information

Programmes Offered

The department of Mechanical and Aerospace 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 Masters of Engineering (MEng), Masters 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 Admission to Graduate Studies section of this calendar

Programme Requirements

> ⚠ **Important:** All students must complete the zero-credit course AI500: Academic Integrity or an equivalent course by the end of their first term of study.

The Masters of Engineering degree is comprised of eight term courses at the graduate level plus a project. The Masters 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. 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

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

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.

Prerequisite:

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

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

ME563 Nonlinear Systems and Control

This course discusses classical and modern methods related to nonlinear system and control analysis and design; such as: Nonlinear modelization and Phenomena, Phase Portraits, Equilibria, Comparison Principle, Theory of Lyapunov Stability with applications, Input-Output stability, Small Gain theorem, Passivity, Feedback Linearization, Lyapunov-based Nonlinear Control, and Backstepping. Examples involving electromechanical and pneumatic dynamics and robotic systems will be studied numerically and experimentally using the MATLAB/SIMULINK software.

Lectures:

3 periods per week (one term)

Credit(s):

1

ME565 Experimental Approach to Turbulence in Fluid flows and Heat Transfer

Turbulence in fluid flows is approached experimentally with the use of measurement techniques and methods to characterize its parameters and impact in fluid flows. Fundamental aspects of turbulence in viscous flows and heat transfer are studied and determined experimentally. Homogeneous and shear turbulent flows are studied and described using experimental data and turbulence theory. Coherent structures are introduced and characterized using experimental data obtained in turbulent flows. Students are trained to the use of experimental techniques such Hot and Cold Wire Anemometry; they learn and use data acquisition and signal processing methods. A laboratory project allows them to use the knowledge acquired to conduct an experiment in a turbulent flow and present the results with a comparison to the theory of turbulence. Uncertainty analysis is also conducted and used to discuss the results.

Lectures:

3 periods per week (one period in class, 2 periods in the Lab) (one term)

Credit(s):

1

ME585 Seminar

This course is a requirement to enhance the multidisciplinary opportunities and develop communication skills for candidates in a Masters or a Doctoral programme in Mechanical Engineering or Aeronautical Engineering. The students are required to attend the seminars given in the Department of Mechanical and Aerospace Engineering by invited faculty, researchers, in addition to graduate students. Each graduate student will be required to give one presentation during the course.

Note(s):

A compulsory course that is offered annually.

Lectures:

3 periods per week (one term)

Credit(s):

0

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 analyzing 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.

Lectures:

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).

Lectures:

3 periods a week (one term)

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

AE505 Advanced Design and Optimization of Engineering Systems

Paradigms for designing open-ended, complex and novel aerospace engineering problems demanding innovation, creativity, and entrepreneurship are 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. Optimal solution to the design paradigms is explored using different numerical solutions strategies. Representative engineering problems are assigned and a design project supplements the course material.

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 optimization. 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

AE533 Design and Analysis for Aircraft Structural Repair

An advanced course in the design and analysis of metallic aircraft structural repairs. Topics covered include design requirements, identification of structural loads, load path definition, fastener selection, design and analysis of joints, material properties and selection, airworthiness requirements, and durability (fatigue and environmental exposure) assessment. The analysis will include considerations of static strength, fatigue stresses, corrosion resistance, damage tolerance, and instability-critical designs. Lecture material is supplemented with analytical design-oriented assignments, numerical exercises and a project.

Lectures:

3 periods per week (one term)

Credit(s):

1

AE535 Computational Fluid Dynamics of Incompressible and Compressible Flows

The aim of this course is to build an understanding of realizable computational solutions for parabolic, elliptic and hyperbolic systems of equations as they pertain to fluid dynamics. A basic understanding of factors affecting computations such as discretization techniques, initial conditions, boundary conditions, and convergence acceleration methods will be discussed. Incompressible algorithms used in commercial codes are first discussed, and then more specialized compressible algorithms will be tackled in increasing degrees of difficulty. Finally, grid generation techniques appropriate for compressible flows are introduced. The course requires a working understanding of a programming language (C++ or MatLab preferred).

Lectures:

3 periods per week (one term)

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 analyzed.

Lectures:
3 periods per week (one term)

Credit(s):
1

AE581 Design and Stressing of Aircraft Components

Aerospace vehicle structural design extends traditional mechanical engineering design to the specialized light-weight and fail safe considerations of air vehicles. As such, traditional design techniques, philosophies and practices will be reviewed. This includes material considerations, stress analysis, conventions and methods. The course includes several component design and stressing projects, including formal reports and presentations.

Lectures:
3 periods per week (one term)

Credit(s):
1

AE583 Design and Stressing for Aircraft Repair

This course extends from the design and stressing of components to assemblies and component repair strategies. The course includes several component design and stressing projects, including formal reports and presentations.

Lectures:
3 periods per week (one term)

Credit(s):
1

AE585 Seminar

This course is a requirement to enhance the multidisciplinary opportunities and develop communication skills for candidates in a Masters or a Doctoral programme in Mechanical Engineering or Aeronautical Engineering. The students are required to attend the seminars given in the Department of Mechanical and Aerospace Engineering by invited faculty, researchers, in addition to graduate students. Each graduate student will be required to give one presentation during the course.

Note(s):
A compulsory course that is offered annually.

Lectures:
3 periods per week (one term)

Credit(s):
0

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

This code is used to capture students registered in a Project.

TH500 Thesis; Master's Level

This code is used to capture students registered in a Master's-level Thesis.

TH600 Thesis; Doctoral Level

This code is used to capture students registered in a Doctoral-level Thesis.

CP600 Comprehensive Examination; Doctoral Level

This code is used to capture students registered in a Comprehensive Exam.

Date modified:

2017-10-31

Academic Regulations for Graduate Studies

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 who is actively working toward their degree on a part-time or full-time basis.

5.1.2 Visiting Student

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.

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 audited courses or which are not to be credited toward their degree programme.

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, or Provisional 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 to the Faculty Council.

5.2.2

Cancelled (October 2012).

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 programme without having competed an Honours or equivalent degree or when the undergraduate academic background is otherwise inadequate. The required additional courses will normally 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 into a graduate programme as a Regular 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.

> **Note:** 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 into a graduate programme as a Regular or Provisional student. The full-time status is not entirely determined by the number of courses taken in a given term.

> **Note:** 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.

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.

Part-time students who have been granted a LOA, upon their return, will have their active status extended only by the number of academic terms of the LOA taken, subject to academic regulation 5.2.4.

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. A deferral request may be made to their Programme Chair for consideration. The deferral may be approved only to academic terms within the validity period stated in the letter of offer.

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. Deadlines are listed in the important dates and the forms are available through your RMC "My Services" account.

5.4 Course Coding

Courses offered by the graduate departments will either be:

- one-term courses (worth 1 credit) or,
- two-term courses (worth 2 credits) or,
- compressed courses (worth 1 credit) or,
- half-term courses (worth 0.5 credit).

Normally a one-term course consists of three contact hours per week for one term (12 weeks), a two-term course consists of three contact hours per week for two terms (24 weeks), a compressed course typically consists of six contact hours per week for a half-term (6 weeks), and a half-term course consists of three contact hours per week for a half-term (6 weeks).

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. Any 500 series course in War Studies, when taken at the PhD level, will require additional work and will be assigned a corresponding 600 series code.

Example:

- EE509 (Electrical Engineering, Master's level)
- MBA539 (MBA, Master's level)
- WS602 (War Studies, PhD level)

5.5 Course Withdrawal

> ⚠ **Reminder:** The responsibility for initiating course changes or withdrawal rests solely with the student.

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 "My Services" or an Academic Change Form to the Office of the Registrar. Neither notifying the instructor nor discontinuing class attendance will suffice. Administrative fees may apply to any course change.

Dates for course withdrawal are specified in relation to the academic term start date. These dates are found online in important dates and deadlines.

For one-term and two-term courses:

- Students who withdraw from a course before the start of the 5th week of the term will be deregistered from the course.
- Part-time students who withdraw from a course after the start of the 5th week of the term will forfeit their tuition fees.
- Course withdrawals between the start of the 5th and the end of the 7th week of the term will be reflected as "WD" or "Withdrawn" on the transcript, whereas after this period a mark will be assigned.
- A student will not be permitted to withdraw from a course after the end of the 7th week of the term.

For half-term and compressed courses:

- Students who withdraw from a course before the start of the 4th week of the term will be deregistered from the course.
- Part-time students who withdraw from a course before the start of the 4th week of the term will be refunded their course tuition fees.
- A student will not be permitted to withdraw after the start of the 4th week of classes.
- For compressed courses whose duration is less than 6 weeks, see the Office of the Registrar.
- Note that, unlike one-term and two-term courses, there is no time period in which a WD would appear on the transcript.

In exceptional circumstances, and prior to entering of a final grade in CISA, the Dean may authorize a student to withdraw from a course at any time without academic penalty reflected on the transcript. However once the course final mark is entered in CISA, only Faculty Council or Senate may authorize a withdrawal from the course as this involves expunging a grade.

> ⚠ **Reminder:** Changes to your academic programme (adding or dropping courses) must be completed by the registration change deadline by submitting an "Academic Change Form" to the Office of the Registrar. These forms are available through the RMC "My Services". Notifying the instructor or discontinuing class attendance will **not** suffice.

5.6 Programme Withdrawal

A student who wishes to withdraw from their programme must submit a request in writing to their Programme Chair. The registrar’s office will inform the student that his/her file has been closed at RMC. Voluntary programme withdrawals after the 4th week of term normally result in forfeiture of tuition fees.

On recommendation of the Graduate Studies Committee, the Dean of Graduate Studies may withdraw from their programme any student whose progress is deemed unsatisfactory, including by reason of course failure as described in 5.14.2.

On recommendation of the Programme Chair, the Dean of Graduate Studies may withdraw from their programme a student who incurs a second failure of a required course in a graduate programme, as described in 5.14.

On recommendation of the Programme Chair, the Dean of Graduate Studies may withdraw from their programme any full-time student who fails to register in two consecutive terms, not including the summer term.

On recommendation of the Programme Chair, the Dean of Graduate Studies may withdraw from their programme any part-time student who, unless in exceptional circumstances, fails to register in a minimum of one course and complete all its requirements in three consecutive academic terms, excluding periods of Leave of Absence.

> ℹ **Note:** Voluntary programme withdrawals after the 4th week of term normally result in forfeiture of tuition fees.

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.

Professors may agree to accept work after this date. The professor will report to the Programme Chair the agreed upon extension that cannot exceed one academic term. Under exceptional circumstances, the Programme Chair may extend this one-term maximum by one additional academic term.

Until a final course mark is submitted, the professor will submit a mark of "IN" with a numeric mark based on work completed preceding the first extension. A course record may be incomplete for a maximum period of two terms. After this time, a mark will be assigned based on the course work completed.

On recommendation of the Programme Chair, the Dean of Graduate Studies may extend this This two-term maximum 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 as described in academic regulation 5.5.

5.8 Required Courses versus Extra Courses

A “Required Course” is defined as a course required for the degree sought whether graduate or undergraduate. An “Extra Course” is a course that is not required for the degree sought.

Courses to be deemed “Extra” must be explicitly identified at the time of registration by the student and confirmed by the Programme Chair. Courses not so identified are deemed to be “Required”.

Courses that have been successfully completed may be changed from “Required” to “Extra” or from “Extra” to “Required” by the Dean of Graduate Studies on recommendation of the Programme Chair.

Courses in progress and courses that have been failed may not be changed from “Required” to “Extra” or from “Extra” to “Required”.

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.

> ℹ **Note:** Visiting students may not audit courses.

5.10 Transcript Notations

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

Transcript Notation	Meaning

Transcript Notation	Meaning
AC	Accepted (refers to a 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 course is considered failed if a lesser mark is obtained.

> **Note:** * (the Asterix) signifies failure in a RMC graduate level "required course".

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

5.12 Course Results

5.12.1 RMC

Results for individual courses taken at the 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 grade provided by the host university. Where the host university provides a letter grade, the letter grade shall be the grade recorded.

5.12.3 Thesis and Project Results

No grade will be assigned to a thesis forming part of a graduate degree. An accepted thesis will be recorded on the transcript as "AC" for "Accepted".

At the discretion of the Programme Chair, the results of project courses forming part of graduate degrees may be reported per regulation 5.12.1, or may be treated the same as theses.

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 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. 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.

5.14 Course Failures

When a student incurs a failure in a required course in a graduate programme, and that failure is the first failure of a required course ("first failure"), one of the actions described in 5.14.2 through 5.14.5 must be taken. The decision of which action is to be taken rests with the Dean of Graduate Studies and shall be made in accordance with the process described in 5.14.1.

A student who incurs a second failure of a required course in a graduate programme will be withdrawn from their programme under regulation 5.6. A second failure is the failure of a required course either following or coincident with a first failure, or the failure of a supplemental examination in a required course.

5.14.1 Process following first failure

Within 30 days of official release of a failing mark representing a first failure, the student shall advise their Programme Chair in writing which action they wish to pursue. On receipt of the student's request, or on expiration of the 30-day period without a request being received, the Programme Chair will recommend an action to the Graduate Studies Committee as a formal motion. The Dean of Graduate Studies will determine the action to be taken based on the results of the Committee's deliberation.

5.14.2 Withdrawal from programme

On first failure the student may voluntarily withdraw from their programme under regulation 5.6.

On first failure, subject to the process defined in 5.14.1, the Dean of Graduate Studies may withdraw the student from their programme under regulation 5.6.

5.14.3 Supplemental evaluation

On first failure, subject to the process defined in 5.14.1, the Dean of Graduate Studies may permit a student in a thesis pattern, project pattern, or course-pattern programme to complete a supplemental evaluation in the failed course.

A supplemental evaluation may take any form appropriate to the discipline. The form of evaluation will be determined by the course instructor in consultation with the Programme Chair. A supplemental evaluation may take place at any point in the period beginning on the date of the official notification of permission to take a supplemental evaluation and ending four months after that date. The date of the supplemental evaluation shall be determined jointly by the student and the Programme Chair. The evaluation should be held as early as possible whilst permitting the student reasonable time to prepare. A student receiving a passing grade (as defined by the academic regulations) or higher on a supplemental evaluation will be granted a pass standing for the course for which the supplemental evaluation was conducted. Both the original course mark and a PASS or FAIL notation for any supplemental evaluations will be shown on the student's transcript.”

5.14.4 Repeated course

On first failure, subject to the process defined in 5.14.1, the Dean of Graduate Studies may permit a student in a project pattern or a course-pattern programme to repeat the failed course. The failed course will remain on the student’s transcript and the second attempt will be recorded separately.

5.14.5 Substituted course

On first failure, subject to the process defined in 5.14.1, and where the course failed is not considered core to the programme in which the student is enrolled, the Dean of Graduate Studies may permit a student in a project pattern or a course-pattern programme to substitute another course acceptable in the programme of study. The failed course will remain on the student’s transcript.

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 equivalent to RMC courses, provided that the courses have not been credited towards another degree or diploma, marks of B- (70%) or higher have been earned, and an overall satisfactory academic record has been maintained. The maximum number of transfer credits taken at academic institutions other than RMC cannot exceed fifty percent (50%) of the required course load as specified in the letter of offer, exclud ing the thesis.

Applicants must normally make their request at the time of application to the graduate programme/degree. The academic unit/programme will confirm the suitability of the courses to the applicant's sought programme/degree and that the courses have not been used for credit towards another degree or diploma and forward their recommendation to the Dean of Graduate Studies for inclusion in the letter of offer. The marks summary and transcript will annotate these credits as “TC” or “Transfer Credit” when they are granted during the admission process.

Transfer credits for courses completed at other academic institutions while enrolled at RMC, may also be granted subject to Academic Regulation 5.1.2. The alphabetical grade obtained at the university attended will be reported in the marks summary and transcript.

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 Integrity

5.17.1

Integrity –When you do the right thing even though no one is watching. Integrity is essential to the academic enterprise, and its foundations in the open, independent, and free exchange of ideas. The core values of integrity, both academic and otherwise include: honesty, fairness, respect, responsibility, and trust. Academic Integrity demands that all members of the RMC act in accordance with these values in the conduct of their academic work, and that they shall follow the regulations concerning the legitimate and accepted conduct, practices and procedures of academic research and writing. Academic Integrity violations are defined as Cheating, Plagiarism or other violations of academic ethics. (It is important to note that, while the list below is comprehensive, it should not be considered exhaustive.)

Cheating includes:

a. An act or attempt to give, receive, share, or utilize unauthorized information or unauthorized assistance at any time for assignments, tests or examinations. Students are permitted to mentor or assist other students with assignments and laboratory reports, but, students will not permit other students to copy their work, nor will students copy other students' work, and they must acknowledge when they have received assistance from others;
b. Failure to follow rules on assignments, presentations, exercises, tests, or examinations as detailed by the respective professor or test/exam invigilator;
c. Unauthorized co-operation or collaboration;
d. Tampering with official documents, including electronic records;
e. Falsifying research, experimental data, or citations;
f. The inclusion of sources that were not used in the writing of the paper or report; and
g. The impersonation of a candidate at presentations, exercises, tests or an examination. This includes logging onto any electronic course management tool or program (e.g. Moodle, Black Board, etc.) using someone else's login and password.

Plagiarism includes:

a. Using the work of others and attempting to present it as an original thought, prose or work. This includes failure to appropriately acknowledge a source, misrepresentation of cited work, and misuse of quotation marks or attribution;
b. Failure to acknowledge adequately collaboration or outside assistance and;
c. Copying.

Other violations of academic ethics include:

a. Not following ethical norms or guidelines in research;
b. Failure to acknowledge that work or any part thereof has been submitted for credit elsewhere;
c. Misleading or false statements regarding work completed; and
d. Knowingly aiding or abetting anyone in committing any form of an Academic Integrity violation.

5.17.2

All cases of suspected Academic Integrity violations must be reported to the Programme Chair responsible for the course in which the alleged Academic Integrity violation took place. The Programme Chair must coordinate with the appropriate Department Head and must inform the Dean of Graduate Studies and the appropriate Faculty Dean of the suspected Academic Integrity violation. All allegations of an Academic Integrity violation will be investigated. Investigations of alleged incidents of Academic Integrity violations shall be under the control of the Dean of Graduate Studies, who will coordinate with the Faculty Dean to delegate a faculty member to carry out the investigation. The results of all such investigations are reviewed at a regular meeting of the Academic Integrity Council. If the Academic Integrity Council determines that an Academic Integrity violation has taken place, the Academic Integrity Council may award one or more Academic Sanctions listed in Regulation 5.17.3. All cases involving expulsion will generate an automatic appeal to Senate. The Senate has the authority to require a student to withdraw. Faculty Council will be informed on a regular basis of any Academic Sanctions that are awarded. The findings with respect to Academic Integrity violations will be published in a public forum without names or other identifiers, such as student numbers on a periodic basis.

5.17.3

Academic Sanctions imposed upon students found guilty of an Academic Integrity violation will consist of one or more of:

a. Recorded Caution;

b. Reduction in mark for the work involved;
c. Reduction in mark of the course for which the work involved was submitted;
d. Suspension for a fixed period of time; and
e. Expulsion.

When determining the appropriate Academic Sanction mitigating or aggravating circumstances may be considered. In addition to the sanctions described above, a student found guilty of an Academic Integrity violation may be required to re-submit any work that was deemed to constitute an Academic Integrity violation. If work is required to be resubmitted, the student will be informed in writing by the appropriate Department Head or Programme Chair within seven (7) calendar days of the decision being made of the nature of the required submitted work, the maximum mark it will be eligible to receive and the date by which it must be submitted. Work that is resubmitted may be awarded a reduced mark or zero. If a student fails to re-submit the required work to a satisfactory standard by the required date, a mark of zero will be awarded for the course. Academic sanctions imposed may also include exclusion from or suspension, cancellation, or forfeiture of any scholarships, bursaries, or awards with any academic component.

5.17.4

When it is determined that a member of the Canadian Armed Forces has committed an academic integrity violation(s), the Academic Integrity Council, through the Registrar, will notify the respective Commanding Officer (CO) of the findings and the sanction(s) imposed by the Academic Integrity Council. In any instance of an Academic Integrity violation by a Canadian Armed Forces member further administrative or disciplinary action may be taken, as deemed appropriate by the member's Commanding Officer.

5.17.5

Students who are found guilty of repeated or aggravated academic misconduct and, as a consequence, are expelled from the RMC will not be considered for admission or readmission to any degree programme or course offered by or through the RMC. After a period of not less than five years from the date of expulsion, the Senate may, upon receipt of a written request, review an expelled student's case and consider an application for
admission or readmission.

5.17.6

All-Academic Sanctions will become part of a student's permanent academic record. For serious cases of Academic Integrity violations, and upon specific direction by the Academic Integrity Council, a student's Official Transcript may be annotated so as to indicate that an Academic Integrity violation took place and that an Academic Sanction was awarded.

5.17.7

The RMC and its faculty members reserve the right to employ originality checking and plagiarism detection instruments or services to protect, preserve, and promote the academic integrity of the credits and degrees it grants. Students enrolled in a RMC course may, as part of the requirements to receive credit for that course, be required to submit their work to such originality checking and plagiarism detection instruments or services.

5.17.8

Students must be provided with the investigation report and any other documents or evidence that may be used in determining their culpability. In addition they have a right to provide a written response to the investigation and any other evidence that may be used by the Academic Integrity Council in determining culpability. Students have the right to appeal any decision of an Academic Integrity violation or any sanction awarded as a result of a finding of an Academic Integrity violation. If the student is not satisfied with the decision of the Academic Integrity Council, an appeal may be made to the Deans' Council. The final authority to hear any appeals arising from decisions made by the Academic Integrity Council will be Deans' Council, except for sanctions that involve expulsion; all cases involving expulsion will generate an automatic appeal to Senate. The student must submit the appeal in writing within twenty-one (21) calendar days of receiving the decision of the Academic Integrity Council. The student must submit the appeal in writing to the Deans' Council through the Registrar, and should attach to the appeal copies of all relevant documents including a statement describing the basis of the appeal. Appeals will only be heard by Deans' Council if they are based on new information or an abuse of process. Merely disagreeing with the decision of the Academic Integrity Council will not be considered a legitimate basis for an Appeal. Deans' Council may decline to hear an appeal if it finds that there is no legitimate basis for the appeal. Appeals to Deans' Council or Senate will normally be heard at the next scheduled meeting of Deans' Council or the Senate. Normally, appeals to Deans' Council or

Senate will be on a paper basis only. At the request of the student, Deans' Council or Senate may agree to hear the appeal in viva voce but this is at the discretion of Deans' Council or Senate. The Registrar will notify the student in writing of Deans' Council's or the Senate's decision concerning the appeal within seven (7) calendar days of the decision being made. In cases not involving expulsion, the decision of Deans' Council is final and may not be appealed further. In cases involving a sanction of expulsion, the decision by Senate is final and may not be appealed further.

5.17.9

Academic Policy Directive No 1 – "Academic Integrity" amplifies this academic regulation, describes the process to be followed in greater detail, and provides sample documentation.

Academic Integrity Course Description

> **Note:** The following course or an equivalent course on academic integrity is mandatory for all students enrolled in a graduate studies programme.

AI500 Academic Integrity

This course is intended to enhance graduate student awareness of the principles of academic integrity and to provide them with the necessary knowledge to recognize potential academic integrity violations and avoid them in their own work. This course requires graduate students to complete online modules "Academic and Research Integrity" and "Understanding and Avoiding Plagiarism". Successful completion of the Moodle modules will constitute a pass in the course.

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/Programme Chair and/or Dean of the division/faculty 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 or Programme Chair as applicable, who will decide how the reread will be conducted. The result of the final exam reread will be used in the student's final course grade. To ensure that such matters are addressed with due diligence, a request for reread must normally be submitted not later than 30 days after the student has been made aware of the result. Requests for rereads 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.

If the student is not satisfied with the outcome of the re-read, a formal petition to the Faculty Council may be made. The petition 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.

If the student is not satisfied with the decision of Faculty Council an appeal may be made to the Senate. The student must submit the Appeal in writing within 30 days of receiving the decision of Faculty Council. The student must submit the Appeal in writing to the Senate through the Registrar, and should attach to the appeal copies of all relevant documents including a statement describing the basis of the appeal. Appeals will only be heard by Senate if they are based on new information or an abuse of process. The Registrar will notify the student in writing of the Senate's decision concerning the Appeal within seven (7) calendar days of the decision being made. The decision of Senate is final and may not be appealed further.

5.19 Language of Instruction, Course Work and Examination, and Supervision

Given the need to provide a suitable pedagogical environment and level of demand, the primary language of graduate course instruction at the College is English. However, where sufficient demand exists, programmes may offer courses and supervision in French. Further where a course is taught in one official language, a student may ask to have their assignment completed in the other official language, if possible. This policy is in accordance with the findings of the Commissioner of Official Languages.

A student whose graduate programme is either a thesis pattern or project pattern programme, and who prefers to be supervised in French, must inform the Programme Chair to confirm the availability of a faculty member who has both the expertise in the field of interest and the ability to act as the student’s supervisor in French.

A student who registers in a graduate course (language courses excepted) and who intends to submit the course work, including exams, in an official language other than the official language of instruction, must inform the instructor within seven days of the course registration or by the first day of the course. If the instructor is unable to evaluate the course work in that official language, the instructor must immediately inform the Programme Chair responsible for the course of the student's request. The Programme Chair will assess the availability of resources for supporting the instructor in the evaluation of the course work. Permission to submit course work in an official language other than the official language of instruction will be withheld only if the programme does not have qualified experts capable of properly evaluating the course work in that language.

Date modified:

2020-11-12

Thesis and Dissertation Regulations | Graduate Studies

6.1 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.

A thesis may be required for the Master's programme. The research must demonstrate the student's ability to carry out a significant research project.

6.1.1 Thesis Format

All graduate theses must conform to the current Thesis Preparation Guidelines

6.2 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 fewer than two terms.

6.3 Thesis Supervision

6.3.1 Master's Level Thesis

The student's research programme shall be under the direction of a thesis supervisor or co-supervisors. The supervisor or at least one of the co-supervisors shall be a full-time member of the student's major department and of the Graduate Faculty.

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.

6.3.2 Doctoral Level Thesis/ Dissertation

The student's research programme shall be under the direction of a thesis supervisor or co-supervisors. An Advisory Committee shall also be appointed, consisting of the supervisor or one of the co-supervisors as Chair and normally two other members, which will periodically review the progress of the research.

The thesis supervisor or at least one of the co-supervisors, 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(s) 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. The remainder of the committee will be appointed either at the same time or as soon after as possible.

6.4 Doctoral 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 completed within 24 months of registration in the programme. An extension may be granted upon written request to the Graduate Studies Committee. The examination must be held at least one calendar year before the submission of the thesis. Under exceptional circumstances, and upon written request from the Head of the student's major department or programme, the Dean may waive the one-year minimum requirement.

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(s) 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. A thesis research proposal may form part of this examination.

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. A 12-month extension of the 24-month limit is implicit in this authorization.

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

6.5 Doctoral Thesis/Dissertation Proposal

Where a thesis research proposal does not form part of the student's comprehensive examination, the 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 thesis will be examined by an Examining Committee, recommended by the supervisor and the Head of the Academic Department or Programme Chair, and approved by the Dean of Graduate Studies. This committee will consist of the following members:

For a Doctoral Examination

- A Chair, non-voting, appointed by the Dean, charged with the conduct of the Examination;
- The Candidate's supervisor;
- Co-supervisors when applicable;
- A representative from the Graduate Faculty in the Candidate's Department or Programme;
- An examiner, internal to the College, but not from the Candidate's Department or Programme, who should have some general knowledge of the area of research of the thesis;
- An examiner, external to the College, who is an acknowledged expert in the subject matter of the thesis, either an academic qualified to supervise graduate student research, or industrial or military professionals with normally a doctoral degree in the general field of study of the thesis. A written assessment from the external examiner will be required.

For a Master's Examination at a minimum

- A chair, non-voting, appointed by the Dean, charged with the conduct of the Examination;
- The Candidate's supervisor;
- Co-supervisors when applicable;
- A representative from the Graduate Faculty in the Candidate's Department or Programme and/or an examiner, internal to the College, but not from the Candidate’s Department or Programme, who should have some general knowledge of the area of research of the thesis;
- An examiner who is an acknowledged expert in the subject matter of the thesis. This examiner may be a member of the Graduate Faculty, internal or external to the candidate's department or programme, who has not collaborated with the candidate on the material presented on the thesis. Alternatively, an examiner external to the College and who meets the requirements for the Doctoral external examiner may be selected.

> **Note:** At least one voting member of the examining committee, not including the supervisor or co-supervisors, must be a representative from the Graduate Faculty in the Candidate’s Department or Programme.

The supervisor will ensure that a copy of the thesis is delivered to each member of the thesis Examination Committee no later than two weeks prior to the oral examination of a Master's thesis, and three weeks prior to the oral examination of a PhD thesis. Specific departments or programmes may require longer lead-times. The thesis will be provided to committee members in electronic format (PDF or equivalent). A paper copy of the thesis shall be provided to any committee member upon request.

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.

The public will normally be welcome to attend the oral presentation. Security considerations for the research may require the final examination to be open only to the Examining Committee. The Chair, acting on the will of the student, shall inform whether or not the public is welcome to attend the oral examination. Only the Examining Committee is permitted to ask questions during the oral examination. Prior to the oral examination the public may ask a nominal number of questions of the student at the Chair's discretion.

Following the oral examination, the Examining Committee will decide if the candidate has successfully defended the thesis.

6.7 Acceptance of the Thesis

Acceptance of the thesis is based on the successful completion of the oral examination, and approval of the thesis document.

The Examining Committee will decide if the thesis document is acceptable, requires revision, or is rejected. A thesis is acceptable if no revisions or additional work relating to the thesis are required of the student. Should the thesis require revision, the Examining Committee shall determine if the revised thesis requires approval of the entire committee, a portion of the committee, or just the supervisor(s). A thesis requiring revision shall remain unaccepted until all revisions are completed and approved and the Supervisor has informed the Chair of the Examining committee of the approval. A rejected thesis may be revised and submitted once for re-examination, but not sooner than three (3) months from the time of its rejection.

A thesis whose revisions have not been submitted to the Supervisor within twelve (12) months of its oral examination will be deemed to be "abandoned". An "abandoned" thesis may be revised and re-submitted, but will require the formation of a new Examining Committee, and another oral examination.

6.8 Submission of Thesis Results

The thesis acceptance will be reported in writing 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, the candidate must submit a final copy, in PDF form, through RMC's eSpace electronic submission process. Where an electronic copy cannot be submitted (e.g., for classified theses or theses containing commercially sensitive information), permission must be sought from the Dean of Graduate Studies to submit a paper copy for secure archiving.

With the thesis, the candidate must submit one copy of the signed Library and Archives Canada *Theses Non-exclusive Licence* available from the Library's Binding of Theses for Graduate Students at RMC web page.

6.9.2 Bound Copies of the Thesis

The major department of the candidate will provide the Library with the two complete copies, ready for binding, conforming to the instructions regarding paper copies in the current Thesis Preparation Guidelines. These must be accompanied by a completed copy of the Thesis Binding Checklist available from the Library's Binding of Theses for Graduate Students at RMC web page. Once bound, these copies will be returned to the department for distribution to the candidate and primary supervisor. If the candidate or supervisor(s) requires additional bound copies, they must make arrangements with the library and assume all costs relating to duplicating and binding of those copies.

6.9.3 Non-exclusive Licence to Publish

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

6.9.4 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 copyrighted work by other authors, as well as publication of proprietary material or data, must not appear in the thesis without proper reference and permission from the authors or companies involved.

6.9.5 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.

6.10 Convocation

A graduate student wishing to be considered as a candidate for receiving a Master's degree or a Doctoral degree at a particular Convocation will, no later than eight (8) full weeks before the date on which the Convocation is scheduled to be held:

- Inform the Head of the major department in writing.
- Complete an "Application to Graduate" form and submit it to the Office of the Registrar.

All requirements for the degree must be met by a date published by the Office of the Registrar, normally approximately four (4) weeks before the Convocation.

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.

All CAF members 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.

Date modified:
2019-11-27

Administration and Tuition Fees

Fees and Income Tax

⚠ **Important:** 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

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.

ℹ **Note:** Administrative fees, Tuition fees, and Policies related to them can be viewed at: RMC Academic Fees

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.

Date modified:
2017-10-17

Areas of Military Specialization

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.

Table of Occupational Speciality Specification (OSS) Codes

> **Note:** The following list only constitutes a "mapping" of OSS to faculties/departments or degree titles, not the capability to deliver each OSS programme.

Master of Arts in War Studies
AESX, AIHZ

Master of Business Administration
AESV

Master of Science in

Physics
AEPD, AFAC, AIEI

Ocean Science
AEOR, AIEI

Mathematics

AENM, AERK, AEZV, AIQD

Materials Science
AENF

Computer Science
AEPM, AEPR, AEYN, AIQD

Master of Engineering and Master of Applied Science in

Ammunition Engineering
AEXO

Civil Engineering
AHPI, ADUM, ADVK, AEOW, AISM

Chemical and Materials Engineering
ADUM, ADVK, AENF, AEPB

Computer Engineering
ADOH, ADOM, ADON, ADQI, ADSB, ADTQ, ADTU, ADUJ, AEOM, AEPR, AEQF, AEYN

Electrical Engineering
ADOH, ADOM, ADON, ADQI, ADSB, ADTQ, ADTU, ADUJ, AELN, AENI, AENJ, AEOM, AEQF, AEYN, AIIP

Mechanical Engineering
ADOE, ADUJ, AEKI, AEOV

Nuclear Engineering
AEOX

Software Engineering
ADSB, ADTQ, AEOM, AEPM, AEPR, AKQX, AEYN

Doctor of Philosophy

War Studies
AIIL, AIIO

Physics
AIIH

Occupational Speciality Specification (OSS) Code Names

ADOF
Aircraft Propulsion System

ADOH
Systems Engineer Avionics Instrumentation

ADOM
(MLE) Aerospace Systems Engineering

ADON
Aircraft Communications Systems Engineering

ADQI
Signal Processing Systems

ADSB
Telecommunications Management

ADTQ
Combat Systems Engineering

ADTU
(MEL) Master of Engineering (Electrical)

ADUJ
Marine Systems Control and Instrumentation Engineering

ADUM
Environmental Engineering

ADVK
Research and Development Explosives

AEKI
Land Mobility Systems

AELN
Space Systems Operations

AENF
NonDestructive Testing

AENI
Radar System Design

AENJ
Radar Systems Research and Circuit Design

AENM
Operations Research/Systems Analysis

AEOM
Electrical Engineering Real Time Digital System

AEOR
Underwater Acoustics

AEOV
Mechanical Engineering

AEOW
Civil Engineering

AEOX
Nuclear Engineering

AEPB
Chemical Engineering

AEPD
ElectroOptics Engineering and Maintenance

AEPM
ADP Management Information Systems

AEPR

Computer Systems Design

AEQF
Elec Eng Comms

AERK
System Engineering (Logistics Option)

AESV
Masters of Business Administration

AESX
Military and Strategic Studies

AEXO
Advanced Ammunition Engineering

AEYN
Computer Software Management

AEZV
Mathématique

AFAC
Physics

AHPI
Soil Mechanics

AIEI
Ocean Acoustics

AIHZ
Master of Arts in War Studies (Intelligence)

AIIP
Airborne Electronic Warfare Systems

AIQD
Modelling and Simulation

AISM
Force Protection Engineering

AKQX
Computer Network Security

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