S.11-78

REVISED

MEMO

Dean of
Graduate Studies

STREET ADDRESS
Maggie Benston Student Services
Centre 1100
Burnaby BC V5A 1S6
Canada

MAILING ADDRESS
8888 University Drive
Burnaby BC V5A 1S6
Canada

TO: Senate

TEL

FROM Wade Parkhouse, Dean, Graduate Studies

RE Faculty of Science **[GS2011.05]**

CC Derek Bingham

DATE April 15, 2011

For information
Acting under delegated authority at its meeting of 11 April 2011, the SGSC approved the following curriculum revisions:

Effective Date is January 2012

5.3 Faculty of Science **[GS2011.05]**

a. Department of Mathematics

1) New course: MATH 741-3 Commutative Algebra and Algebraic Geometry

2) Applied and Computational Mathematics:

i) Change of title:
APMA 900-4 Asymptotic Analysis of Differential Equations
APMA 901-4 Partial Differential Equations
APMA 912-4 Advanced Partial Differential Equations
APMA 930-4 Computational Fluid Dynamics
APMA 939-4 Selected Topics in Mathematical Image Processing

ii) Change of course description:
APMA 900-4 Asymptotic Analysis of Differential Equations
APMA 901-4 Partial Differential Equations
APMA 912-4 Advanced Partial Differential Equations
APMA 920-4 Numerical Linear Algebra
APMA 922-4 Numerical Solution of Partial Differential Equations
APMA 923-4 Numerical Methods in Continuous Optimization
APMA 930-4 Computational Fluid Dynamics
APMA 939-4 Selected Topics in Mathematical Image Processing

Senators wishing to consult a more detailed report of curriculum revisions may do so on the Web at http://www.sfu.ca/senate/Senate_agenda.html following the posting of the agenda. If you are unable to access the information, please call 778.782.3168 or email shelley_gair@sfu.ca.

APMA 939-4 Selected Topics in Mathematical Image Processing
APMA 990-4 Selected Topics in Applied Mathematics

iii) Eliminate course prerequisites:
APMA 900-4 Asymptotic Analysis of Differential Equations
APMA 901-4 Partial Differential Equations
APMA 902-4 Applied Complex Analysis
APMA 905-4 Applied Functional Analysis
APMA 910-4 Ordinary Differential Equations
APMA 912-4 Advanced Partial Differential Equations
APMA 920-4 Numerical Linear Algebra
APMA 921-4 Numerical Solution of Ordinary Differential Equations
APMA 922-4 Numerical Solution of Partial Differential Equations
APMA 923-4 Numerical Methods in Continuous Optimization
APMA 930-4 Computational Fluid Dynamics
APMA 934-4 Selected Topics in Fluid Dynamics
APMA 935-4 Analysis and Computation of Models
APMA 939-4 Selected Topics in Mathematical Image Processing

Senators wishing to consult a more detailed report of curriculum revisions may do so on the Web at http://www.sfu.ca/senate/Senate_agenda.html following the posting of the agenda. If you are unable to access the information, please call 778.782.3168 or email shelley_gair@sfu.ca.

RECEIVED
MAR 25 2011
DEAN OF GRADUATE
STUDIES OFFICE

SFU

TO: W. Parkhouse
Dean of Graduate Studies

FROM: D. Bingham, Chair
Faculty of Science Graduate Studies
Committee

RE: MATH 741-3 - New Course

DATE: March 23, 2011

Attached is the corrected version of the new course, MATH 741-3, which was tabled at a previous SGSC meeting. It has been approved by the Faculty of Science and is forwarded for approval by the Senate Graduate Studies Committee. Please include it on the next SGSC agenda.

D. Bingham

Enclosure

c. C. Cupples

SIMON FRASER UNIVERSITY

NEW GRADUATE COURSE PROPOSAL FORM

When a department proposes a new course it must first be sent to the chairs of each faculty graduate program committee where there might be an overlap in course content. The chairs will indicate that overlap concerns have been dealt with by signing the appropriate space or via a separate memo or e-mail (attach). The new course proposal must also be sent to the Library for a report.

Once overlap concerns have been dealt with, signatures indicate approval by the department, home faculty and Senate Graduate Studies Committee.

Department or School: Mathematics

Proposed course number and title: Math 741-3 Commutative Algebra and Algebraic Geometry

Other Faculties:

Other Faculties approval indicates that the Dean(s) or designate of other Faculties affected by the proposed new course support(s) the approval of the new course.

Name of Faculty _____ Signature _____ Date _____

Name of Faculty _____ Signature _____ Date _____

Name of Faculty _____ Signature _____ Date _____

Name of Faculty _____ Signature _____ Date _____

Name of Faculty _____ Signature _____ Date _____

Departmental approval *(non-departmentalized faculties need not sign)*

Department Graduate Program Committee

Signature _____ Date March 7, 2011

Department Chair

Signature _____ Date MAR 17, 2011

Faculty approval

Faculty approval indicates that all the necessary course content and overlap concerns have been resolved, and that the Faculty/Department commits to providing the required Library funds and any other necessary resources

Faculty Graduate Program Committee

Signature _____ Date March 23/11

SGSC approval

Signature _____ Date MAY 0 2 2011

SGSC approval indicates that the Library report has been seen, and all resource issues dealt with. Once approved, new course proposals are sent to Senate for information.

RECEIVED
MAR 2 1 2011
DEAN OF SCIENCE OFFICE

NEW GRADUATE COURSE PROPOSAL FORM

Subject: Math *(max. 4 chars)* **Catalog Number:** 741

Course Title: Commutative Algebra and Algebraic Geometry *(max. 80 char.)*

Short Title *(appears on transcripts etc.)* Comm. Algebra & Algebraic Geom *(max. 25 char.)*

Course Description for Calendar: ***(append a course outline as a separate document)***

A study of ideals and varieties. Topics include affine varieties, ideals, the Hilbert basis theorem, resultants and elimination, Hilbert's Nullstellensatz, irreducible varieties and prime ideals, decomposition of varieties, polynomial mappings, quotient rings, projective space and projective varieties. Additional topics depending on the instructor: Groebner bases and automatic theorem proving in geometry, Bezout's theorem, dimension, and elliptic curves.

Units: 3

Available Course Components: *(select all that apply)*

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Prerequisites: *(if any)*

Appropriate knowledge of algebraic structures

Campus at which course will be offered: Burnaby

Estimated Enrolment: 5 The term course will first be offered: Spring 2012

Frequency of course offering: Every other year

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Justification:

We have been offering the content of this course under Math 739: Algebraic systems in 2008 and 2010 with Math 439 and now that we have decided on content we wish to give the offering a regular title. Graduate students will be required to answer advanced homework questions and to complete a related project.

Resources:

Faculty member(s) who will normally teach this course:
(append information about their competency to teach the course)

Jason Bell, Nils Bruin, Michael Monagan

Number of additional faculty members required in order to offer this course: 0

Additional space required in order to offer this course: ***(append details)*** 0

Additional specialized equipment required in order to offer this course: ***(append details)***

0

Additional Library resources required: ***(append details)*** Annually $ 0 One-time $ 0

If additional resources are required to offer this course, the department proposing the course should be prepared to provide information on the source(s) of those additional resources.

Upon approval of the course proposal, the Dean of Graduate Studies office will consult with the department or school regarding other course attributes that may be required to enable the proper entry of the new course in the student record system.

MATH 741 – Commutative Algebra and Algebraic Geometry

Topics:
A study of ideals and varieties. Topics include affine varieties, ideals, the Hilbert basis theorem, eresultants and elimination, hilbert's Nullstellensatz, irreducible varieties and prime ideals, decomposition of varieties. Additional topics depending on the instructor: Groebner bases and automatic theorem proving in geometry, Bezout's theorem, dimension, and elliptic curves.

Outline:
An introduction to the objects of algebraic geometry: polynomials (in one or more variables over a field), varieties (solutions of systems of polynomial equations), ideals, Groebner bases, and quotient rings. This is a generalization of the heory of linear systems and linear algebra to treat systems of non-linear polynomial equations. the discovery of Groebner bases by Bushberger in 1965, followed by the development of software implementations for computing Gorebner bases has made possible a very constructive approcah to this subject. Throughout the course we will be using Maple for doing calculations.

- **Ideals and Varieties:**
  - Polynomials, ideals and varieties
  - Curves and surfaces in two and three dimensions
  - Parametrizations of affine varieties
- **Groebner Bases:**
  - The division algorithm, the Hilbery basis theorem and Groebner bases
  - Buchbergers algorithm in two and three dimensions
  - Parametrizations of affine varieties
- **Elimination Theory:**
  - Elimination theory, implicitization of curves and surfaces, unique factorization, and polynomial resultants.
- **Hilberts Nullstellensutz and ideal decomposition:**
  - Hilberts Nullstellensatz
  - Decomposition of varieties and the primary decomposition of ideals
  - Quotient rings
- **Applications:**
  - Geometric Theorem proving, circle packing problems

Grading:
Homeworks and project - 60%
Final Exam - 40%

Remark. As this course is a joint undergraduate/graduate course, homeworks for MATH741 will include additional advanced questions. Also a graduate project might be included, specific to graduate students.

Required Texts:
Ideals, Varieties and Algorithms, 3rd Edition, Author: Cox, Little and O'Shea, Publisher: Springer-Verlag, Year: 2007, ISBN: 387356509

Prequisite:

Enrollment in graduate studies

SFU Connect mathusec@sfu.ca

± Font size :

Fwd: Library Course Assessment Request: MATH 441/741

From : Leslie Rimmer <lsrimmer@sfu.ca> Thu, 09 Dec, 2010 12:57

Subject : Fwd: Library Course Assessment Request: MATH 441/741 3 attachments

To : JoAnne Hennessey <mathusec@sfu.ca>

Dear JoAnne,

I have completed the review for your new course proposal, MATH 441/741 - Comparative Algebra and Algebraic Geometry, and have determined no additional resources are required. I have added this course to the appropriate list at http://www.lib.sfu.ca/collections/course-assessments This will be proof of Library sign off for you

Please don't hesitate to contact me should you have any questions.

----- Forwarded Message -----
From: "JoAnne Hennessey" <mathusec@sfu.ca>
To: gbird@sfu.ca
Cc: "mathusec" <mathusec@sfu.ca>
Sent: Wednesday, December 1, 2010 10:59:23 AM
Subject: Library Course Assessment Request: MATH 441/741

Happy Wednesday,

Could I ask that a library Course Assessment be done for the following proposed course:

1) MATH 441/741

The Meeting for the Faculty of Science Undergraduate Studies Committee, at which these course proposals will be approved will, be held on ??? Jan, 2011.

Note, we are in the process of approving the course numbers with the Registrar = as such they are subject to change - from the course outline\other information will not.

Find the new course forms/draft outlines attached.

Please feel free to contact me should you have any questions or comments.

Have a Fabulous Day!

J.

JoAnne Hennessey
Undergraduate Secretary
Department of Mathematics
General Office: SC K10512
Tel: 778-782-3332

~~~~~~

Leslie Rimmer
Collections Librarian
Liaison Librarian for Biological Sciences

WAC Bennett Library
~~~~~~

Kelleen Toohey

SFU

TO: Associate Deans – Arts & Social Sciences, Applied Sciences, Education, Health, Environment, Business Administration, Communication, Art & Technology

FROM: D. Bingham, Chair
Faculty of Science Graduate Studies Committee

RE: New Course – MATH 741-3

DATE: January 31, 2011

Please check the enclosed new course for overlap and/or any other difficulties.

Please indicate your comments, on the cover memo, and return it to Rosemary Hotell through campus mail, or by e-mail to hotell@sfu.ca.

Thanks.

No overlap

K Toohey
EDUCATION

/

Duncan Knowler

RECEIVED
FEB 04 2011
DEAN OF SCIENCE
OFFICE

SFU

TO: Associate Deans – Arts & Social Sciences, Applied Sciences, Education, Health, Environment, Business Administration, Communication, Art & Technology

FROM: D. Bingham, Chair
Faculty of Science Graduate Studies Committee

RE: New Course – MATH 741-3

DATE: January 31, 2011

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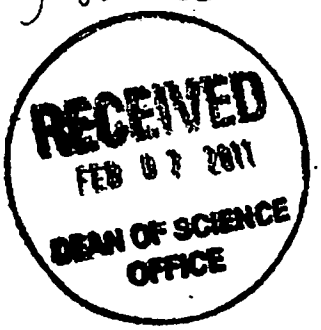
Please indicate your comments, on the cover memo, and return it to Rosemary Hotell through campus mail, or by e-mail to hotell@sfu.ca.

Thanks.

No issues.
Feb 3, 2010.

Craig Janes



SFU

TO: Associate Deans – Arts & Social Sciences, Applied Sciences, Education, Health, Environment, Business Administration, Communication, Art & Technology

FROM: D. Bingham, Chair
Faculty of Science Graduate Studies Committee

RE: New Course – MATH 741-3

DATE: January 31, 2011

Please check the enclosed new course for overlap and/or any other difficulties.

Please indicate your comments, on the cover memo, and return it to Rosemary Hotell through campus mail, or by e-mail to hotell@sfu.ca.

Thanks.

No concerns
Craig Janes -
Health Sciences

HSCI 902-3 Interdiciplinary Seminar in Health Sciences
HSCI 903-1 Interdiciplinary Research Colloquium1
HSCI 904-1 Interdiciplinary Research Colloquium2
HSCI 905-1 Interdiciplinary Research Colloquium3
Motion: Move to approve.
(C. Janes/W. Haider) **(Unanimous)** **Motion Carried**

HSCI 983-6 Comprehensive Exam and Thesis Proposal
HISC 990-6 Thesis Research
Motion: Move to approve.
(C. Janes/W. Haider) **(Unanimous)** **Motion Carried**

HSCI 998-6 Thesis Preparation and Defense
Motion: Move to approve.
(R. Cameron/J. Nesbit) **(Unanimous)** **Motion Carried**

HSCI PhD Program Proposal will go on to SCUP.

5.6 Faculty of Science **[GS2011.05]**
a. Department of Mathematics
1) New course: MATH 741-3 Commutative Algebra and Algebraic Geometry
Motion: **Tabled**
Department to be contacted; the new course documentation requires further clarification

6. Items for information- minor course changes approved
6.1 Faculty of Business Administration **[GS2011.03]**
a. Master of Business Administration
1) Title and Description change: BUS 718-4 Strategic Management/Comprehensive Examination

6.2 Faculty of Communication, Art and Technology **[GS2011.04]**
1) Title and description change: IAT 833-3 Performance, Technology and Embodiment

6.3 Faculty of Science **[GS2011.05]**
a. Department of Mathematics
1) Prerequisite and Title Change: MATH 739-3 Algebraic Syst-ST Algebra

7. Other Business
- **SFU Exchange Program/Outbound Graduate Students – Proposed Eligibility** Criteria established by the Senate Committee on International Activities (SCIA) was reviewed.
- **Academic Integrity Advisory Committee** requires an SGSC representative. The Chair asked for volunteers.
- **Search for two new Associate Deans** – the SGSC Chair updated committee members on the search.

8. Next scheduled meeting **March 14, 2011** *(material deadline -**February 28, 2011**)*

SFU Connect sheilagh@sfu.c

± Font Size :

Fwd: Scanned from MFP-05018470 03/02/2011 19:09

From : Sheilagh MacDonald <sheilagh@sfu.ca> Thu, Mar 03, 2011 04:58 PM
Subject : Fwd: Scanned from MFP-05018470 03/02/2011 19:09 1 attachment
To : Derek Bingham <dbingham@stat.sfu.ca>
Cc : Rosemary Hotell <rosemary_hotell@sfu.ca>

Dear Derek,
SGSC had the following concerns with the new course proposal:
-the course outline appears to be for 441
SGSC needs a course outline specific to 741

-the outline refers to an undergraduate pre-requisite - needs a graduate prereq

Wade would like to know - What additional work will be done in 741 given that this is a piggy-backed course.

From: "Dean of Grad Studies Office" <dgs-sfu@sfu.ca>
To: "Sheilagh MacDonald" <sheilagh@sfu.ca>
Sent: Wednesday, March 2, 2011 7:09:33 PM
Subject: Scanned from MFP-05018470 03/02/2011 19:09

Scanned from MFP-05018470.
Date: 03/02/2011 19:09
Pages:10
Resolution:200x200 DPI

--
Sheilagh MacDonald
Secretary, Dean of Graduate Studies
sheilagh@sfu.ca

phone: 778 782 4255
fax: 778 782 3080

DOC030211.pdf
251 KB

RECEIVED
MAR 17 2011
DEAN OF GRADUATE
STUDIES OFFICE

SFU

TO: W. Parkhouse
Dean of Graduate Studies

FROM: D. Bingham, Chair
Faculty of Science Graduate Studies
Committee

RE: **MATH Curriculum Changes** **DATE:** March 15, 2011

The following has been approved by the Faculty of Science and is forwarded for approval by the Senate Graduate Studies Committee. Please include it on the next SGSC agenda.

Mathematics

Changes to the Mathematics Graduate Program as described in the attached documentation.

D. Bingham

Enclosure

c. C. Cupples

DEPARTMENT OF MATHEMATICS
FACULTY OF SCIENCE

MEMO

ATTENTION:	**Derek Bingham** Chair of Faculty of Science Graduate Studies Committee
FROM:	**Razvan Fetecau** Co-chair, Graduate Admissions Committee Department of Mathematics Local 23335 van@math.sfu.ca
RE:	Graduate Curriculum Changes
DATE:	04 March, 2011

DEPARTMENT OF MATHEMATICS

RAZVAN FETECAU
Co-chair,
Graduate Admissions Committee

MAILING ADDRESS
Simon Fraser University
8888 University Drive
Burnaby BC V5A 1S6
Canada

CONTACT INFO
Telephone: 778.782.3335
Facsimile: 778.782.4947
Email: van@math.sfu.ca

Please see enclosed are documents related to graduate curriculum changes and rationales, to be considered by the Dean of Science Office.

I. A Summary of Course Title Changes:

	COURSE	Title FROM	Title TO
1	APMA 900 - 4	Advanced Mathematical Methods I	Asymptotic Analysis of Differential Equations
2	APMA 901 - 4	Advanced Mathematical Methods II	Partial Differential Equations
3	APMA 912 - 4	Partial Differential Equations	Advanced Partial Differential Equations
4	APMA 930 - 4	Fluid Dynamics	Computational Fluid Dynamics
5	APMA 939 - 4	Selected Topics in Mechanics of Solids	Selected Topics in Mathematical Image Processing

DEPARTMENT OF MATHEMATICS
FACULTY OF SCIENCE

II. In addition to those already submitted: **A Summary of Course Description Changes:**

	COURSE	Description FROM	Description TO
1	APMA 900 -4	Hilbert spaces. Calculus of variations. Sturm-Liouville problems and special functions. Green's functions in one dimension. Integral equations.	Analysis and computation of classical problems from applied mathematics such as eigenfunction expansions, integral transforms, and stability and bifurcation analyses. Methods include perturbation, boundary layer and multiple-scale analyses, averaging and homogenization, integral asymptotics and complex variable methods as applied to differential equations.
2	APMA 901-4	First order partial differential equations. Characteristics. Eigenfunction expansions and integral transforms. Discontinuities and singularities; weak solutions. Green's functions. Variational methods.	First order nonlinear partial differential equations (PDEs) and the method of characteristics. Hamilton-Jacobi equation and hyperbolic conservation laws; weak solutions. Second-order linear PDEs (Laplace, heat and wave equations); Green's functions. Sobolev spaces. Second-order elliptic PDEs; Lax-Milgram theorem.
3	APMA 912 - 4	An advanced course on partial differntial equations. Topics covered usually will include quasi-linear first order systems and hyperbolic, parabolic and elliptic second-order equations.	An advanced course on partial differential equations. Potential topics include linear and nonlinear elliptic equations, second-order parabolic and hyperbolic equations, calculus of variations, semigroup theory, Hamilton-Jacobi equations, hyperbolic conservation laws.
4	APMA 920 - 4	Direct and iterative methods for the numerical solution of linear systems, factorization techniques, linear least squares problems, eigenvalue problems. Techniques for parallel architectures.	Conditioning and stability of numerical methods for the solution of linear systems, direct factorization and iterative methods, least squares, and eigenvalue problems. Applications and mathematical software.
5	APMA 922 - 4	Analysis and application of numerical methods for solving partial differential equations. Finite difference methods, spectral methods, multigrid methods.	Analysis and application of numerical methods for solving partial differential equations. Potential topics include finite difference methods, spectral methods, finite element methods, and multilevel/multigrid methods.

DEPARTMENT OF MATHEMATICS
FACULTY OF SCIENCE

	COURSE	Description FROM	Description TO
6	APMA 923 - 4	Numerical solution of systems of nonlinear equations, and unconstrained optimization problems. Newton's method, Quasi-Newton methods, secant methods, and conjugate gradient algorithms.	Theory and algorithms of nonlinear programming with an emphasis on modern computational considerations. Topics may include: optimality conditions for unconstrained and constrained optimization, gradient methods, conjugate direction methods, Newton method, quasi-Newton methods, penalty and barrier methods, augmented Lagrangian methods and interior point methods.
7	APMA 930 -4	Basic equations and theorems of fluid mechanics. Incompressible flow. Compressible flow. Effects of viscosity.	Basic equations governing compressible and incompressible fluid mechanics. Finite difference and finite volume schemes for hyperbolic, elliptic, and parabolic partial differential equations. Practical applications in low Reynolds number flow, high-speed gas dynamics, and porous media flow. Software design and use of public-domain codes.
8	APMA 939 - 4	Study of a specialized area of the mechanics of solids such as composite materials, micromechanics, fracture, plate and shell theory, creep, computational solid mechanics, wave propagation, contact mechanics.	Study of mathematical and computational aspects of image science. Some of the main mathematical tools are partial differential equations, iterative solutions to systems of equations, filters and wavelets. Applications include deblurring, denoising, inpainting, reconstruction, registration, and segmentation. Previous course offerings focused on computational methods in medical imaging, introduction to wavelets, and mathematical image processing and analysis.
9	APMA 990 - 4	N/A	Topics vary depending on faculty availability and student interests. Recent offerings include: geophysical fluid dynamics, adaptive numerical methods for differential equations, learning theory, and stability, pattern formation and chaos.

DEPARTMENT OF MATHEMATICS
FACULTY OF SCIENCE

III. In addition, to those already submitted: **A Summary of Course Prerequisite Changes:**

	COURSE		Prerequisite FROM	Prerequisite TO
1	APMA 900	MATH 314 or equivalent. Students with credit for MATH 900 may not take APMA 900 for further credit. Recommended: MATH 419.	N/A
2	APMA 901	MATH 314 or equivalent. Students with credit for MATH 901 may not take APMA 901 for further credit. Recommended: MATH 418.	N/A
3	APMA 902	MATH 322 or equivalent. Students with credit for MATH 836 or 902 may not take APMA 902 for further credit.	N/A
4	APMA 905	MATH 900 or permission of the instructor. Students with credit for MATH 905 may not take APMA 905 for further credit.	N/A
5	APMA 910	MATH 415 or equivalent. Students with credit for MATH 842 or 910 may not take APMA 910 for further credit.	N/A
6	APMA 912	MATH 901 or permission of the instructor. Students with credit for MATH 845 or 912 may not take APMA 912 for further credit.	N/A
7	APMA 920	Students with credit for MATH 850 or 920 may not take APMA 920 for further credit.	N/A
8	APMA 921	Students with credit for MATH 851 or 921 may not take APMA 921 for further credit.	N/A
9	APMA 922	Students with credit for MATH 852 or 922 may not take APMA 922 for further credit.	N/A
10	APMA 923	Students with credit for MATH 853 or 923 may not take APMA 923 for further credit.	N/A
11	APMA 930	MATH 361 or equivalent. Students with credit for MATH 930 may not take APMA 930 for further credit. Recommended: MATH 462.	N/A
12	APMA 934	APMA 930 or permission of the instructor.	N/A
13	APMA 935	MATH 418 and MACM 316 or equivalent. Students with credit for MATH 883 or 935 may not take APMA 935 for further credit.	N/A
14	APMA 939	APMA 935 or permission of the instructor.	N/A

N/A = NONE
FOR DEC
D. Bagaev
Mar 31/11

DEPARTMENT OF MATHEMATICS
FACULTY OF SCIENCE

IV. Rationale for the proposed changes:

Course Title Changes

1. APMA 900: The titles for APMA 900 and APMA 901, "Advanced Mathematical Methods" I and II, are currently not particularly informative. The new names more accurately reflect the content of these courses.

2. APMA 901: See the rationale for the name change for APMA 900, above.

3. APMA 912: In the light of the name change for APMA 901 to "Partial Differential Equations" (PDEs), this course needs to be renamed; the new name reflects the status of this course as a second graduate-level course in PDEs.

4. APMA 930: We suggest the inclusion of the word "computational" in the title of APMA 930 to better reflect the nature of the course. We teach a modern, computationally-oriented fluid dynamics course, which includes state of the art techniques used for simulations of fluid flow. To date the course has been taught like this for at least eight years (every second year). Our offering of a computational course in fluid mechanics should be properly emphasized in the calendar, as training in computational methods is highly sought after by prospective applicants; and we feel that adding the word "computational" to the description would distinguish APMA 930 from more classical, theorem-based courses on mathematical fluid mechanics.

5. APMA 939: We propose a major change in this special topics area. The reason is that we no longer have any faculty doing research in Mechanics of Solids, nor do we expect to have anyone suitable to teach this topic in the near future. We feel that a suitable specialized area is Mathematical Image Processing, a very dynamic and fast-growing field that has wide practical applications. The course will be taught from a mathematical perspective, to complement possible related courses in Engineering or Computer Science. Several Mathematics faculty have research pertaining to imaging, including Steve Ruuth, Manfred Trummer, and Adam Oberman. In the recent past M. Trummer has taught two courses on mathematical image processing as selected topics courses (APMA 990): "Computational Methods in Medical Imaging" and "Introduction to wavelets". In addition, S. Ruuth has co-taught "Mathematical Image Processing and Analysis" in Spring 2008 and 2011. All of these courses were extremely well received by students. Having a selected topics course in Mathematical Image Processing in the calendar would add to the visibility of our graduate program and would potentially attract considerable attention from prospective applicants.

DEPARTMENT OF MATHEMATICS
FACULTY OF SCIENCE

Course Description Changes

1. APMA 900: The course's syllabus has been extensively changed in the last 10 years to include modern applied mathematics techniques. This is perhaps the most outdated description of all APMA courses and it needs a significant update. The suggested new description, which is significantly different from the old one, reflects the current content of the course.

2. APMA 901: The course has been redesigned recently to include different material. More specifically, we no longer teach eigenfunction expansions and integral transforms, but we cover Sobolev spaces, second-order elliptic partial differential equations (PDE's) and Lax-Milgram Theorem. The new material presents a functional analytic approach to PDE's and represents an essential component of a modern treatment on this topic.

3. APMA 912: The proposed description reflects the new status of this course as a second graduate-level course in PDEs (see rationale for course title change of APMA 912 in Section IV, point 3). The topics listed in the new description complement those taught in APMA 901 ("Partial Differential Equations").

4. APMA 920: Minor change from the old version. We added the phrase "Applications and mathematical software" to the description to emphasize the practical nature of the course and its usefulness in real world applications. We removed from the old description "Techniques for parallel architectures", which is a more specialized topic.

5. APMA 922: Minor change from the old version to include "finite element methods" under potential topics.

6. APMA 923: This course is essential for students working on operations research and it will be offered regularly by the department. The content has been recently revised to include a more diverse list of topics relating to the theory and algorithms of nonlinear programming. In addition, the updated description indicates that the course puts "an emphasis on modern computational considerations". This note is important for attracting interest from prospective students, as computational skills in operations research are a great asset on the job market.

7. APMA 930: The description has been extensively revised. The motivation was presented above, see rationale for course title changes, Section IV, point 4. The new description outlines the numerical methods ("finite difference and finite volume schemes") used in the course for simulating fluid flow. It indicates clearly the "practical applications" of compressible and incompressible fluid mechanics, and the computational component of the course ("software design", "use of public-domain codes").

8. APMA 939: The description has been changed entirely to address the suggested name change discussed above in rationale for course title changes, Section IV, point 5. The proposed description lists the main mathematical tools and applications of imaging that will be taught or addressed in the course. Examples of recent offerings are also provided.

9. APMA 990: The course had no previous description, as its title was expected to be self-explanatory. However this course is one of our regular offerings and we teach a wide variety of topics under this title. We now list some of the recent offerings to give prospective applicants a much better idea of how diverse and modern the topics taught under APMA 990 have been.

DEPARTMENT OF MATHEMATICS
FACULTY OF SCIENCE

Course Prerequisite Changes

1-14: We wish to remove the listings of prerequisites from ALL graduate APMA courses. There are several reasons for this proposal. First, we cannot enforce prerequisite undergraduate requirements in graduate courses using the SIMS online system. Second, the MATH graduate courses do not list any prerequisites, and we would certainly want a uniform style for course descriptions across the department. Furthermore, since most of our graduate students are not SFU graduates, listing SFU-numbered courses as prerequisites could be confusing. In general, we feel that calendar descriptions of graduate courses should primarily serve to advertise our graduate program to prospective applicants. Prerequisites will be included and properly discussed by instructors, along with other course details, in the "Detailed Course Outlines", centrally listed by the university.

Please find attached the modified *Graduate Course Minor Change Forms*. If anything is missing or unclear, please do not hesitate to contact Wendy Szeto or me.

Thank you,

Razvan Fetecau
Co-chair, Graduate Admissions Committee

SIMON FRASER UNIVERSITY
DEAN OF GRADUATE STUDIES OFFICE

SENATE GRADUATE STUDIES COMMITTEE FORM

GRADUATE COURSE MINOR CHANGE FORM

This form is to be used when there is a request for a minor change to an existing graduate course. The form is completed by the department and then approved by the Faculty graduate studies committee. It should then be forwarded to the Dean of Graduate Studies for approval by SGSC. SGSC will forward the approval to Senate for information. NOTE: Please complete pertinent sections only

Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☒ Title ☒ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 900 **Units:** 4

Course Title: Advanced Mathematical Methods I *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Hilbert spaces. Calculus of variations. Sturm-Liouville problems and special functions. Green's functions in one dimension. Integral equations.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

MATH 314 or equivalent. Students with credit for MATH 900 may not take APMA 900 for further credit. Recommended: MATH 419.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 900 **Units:** 4

Course Title: Asymptotic Analysis of Differential Equations *(max. 80 char)* (i)

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Analysis and computation of classical problems from applied mathematics such as eigenfunction expansions, integral transforms, and stability and bifurcation analyses. Methods include perturbation, boundary layer and multiple-scale analyses, averaging and homogenization, integral asymptotics and complex variable methods as applied to differential equations. (ii)

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (NONE) (iii)

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 12 2011

Upon approval of the minor course change, the Dean of Graduate Studies office will consult with the department or school regarding other course attributes that may be required to enable the proper entry of the course change in the student record system

SIMON FRASER UNIVERSITY
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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☒ Title ☒ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 901 **Units:** 4

Course Title: Advanced Mathematical Methods II *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

First order partial differential equations. Characteristics. Eigenfunction expansions and integral transforms. Discontinuities and singularities; weak solutions. Green's functions. Variational methods.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

MATH 314 or equivalent. Students with credit for MATH 901 may not take APMA 901 for further credit. Recommended: MATH 418.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 901 **Units:** 4

Course Title: Partial Differential Equations *(max. 80 char)* (i)

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

First order nonlinear partial differential equations (PDEs) and the method of characteristics. Hamilton-Jacobi equation and hyperbolic conservation laws; weak solutions. Second-order linear PDEs (Laplace, heat and wave equations); Green's functions. Sobolev spaces. Second-order elliptic PDEs; Lax-Milgram theorem. (ii)

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (NONE) (iii)

***Attach rationale for changes as a separate document.*

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 0 2 2011

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☐ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 902 **Units:** 4

Course Title: Applied Complex Analysis *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Review of complex power series and contour integration. Conformal mapping, Schwartz-Christoffel transformation. Special functions. Asymptotic expansions. Integral transform.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

MATH 322 or equivalent. Students with credit for MATH 836 or 902 may not take APMA 902 for further credit.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 902 **Units:** 4

Course Title: Applied Complex Analysis *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Review of complex power series and contour integration. Conformal mapping, Schwartz-Christoffel transformation. Special functions. Asymptotic expansions. Integral transform.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (None) (///)

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date _____

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☐ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 905 **Units:** 4

Course Title: Applied Functional Analysis *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Infinite dimensional vector spaces, convergence, generalized Fourier series. Operator Theory; the Fredholm alternative. Application to integral equations and Sturm-Liouville systems. Spectral theory.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

MATH 900 or permission of the instructor. Students with credit for MATH 905 may not take APMA 905 for further credit.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 905 **Units:** 4

Course Title: Applied Functional Analysis *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Infinite dimensional vector spaces, convergence, generalized Fourier series. Operator Theory; the Fredholm alternative. Application to integral equations and Sturm-Liouville systems. Spectral theory.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (NONE) (iii)

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 0 2 2011

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☐ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 910 **Units:** 4

Course Title: Ordinary Differential Equations *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

The solutions and properties of ordinary differential equations and systems of ordinary differential equations in the real and complex domains.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

MATH 415 or equivalent. Students with credit for MATH 842 or 910 may not take APMA 910 for further credit.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 910 **Units:** 4

Course Title: Ordinary Differential Equations *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

The solutions and properties of ordinary differential equations and systems of ordinary differential equations in the real and complex domains.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (NONE) (!!!)

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 0 2 [illegible]

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☒ Title ☐ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 912 **Units:** 4

Course Title: Partial Differential Equations *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

An advanced course on partial differential equations. Topics covered usually will include quasi-linear first order systems and hyperbolic, parabolic and elliptic second-order equations.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

MATH 901 or permission of the instructor. Students with credit for MATH 845 or 912 may not take APMA 912 for further credit.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 912 **Units:** 4

Course Title: Advanced Partial Differential Equations *(max. 60 char)* (i) –

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

An advanced course on partial differential equations. Potential topics include linear and nonlinear elliptic equations, second-order parabolic and hyperbolic equations, calculus of variations, semigroup theory, Hamilton-Jacobi equations, hyperbolic conservation laws. (ii) –

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (NONE) (iii) –

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date May 9, 2011

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☒ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 920 **Units:** 4

Course Title: Numerical Linear Algebra *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Direct and iterative methods for the numerical solution of linear systems, factorization techniques, linear least squares problems, eigenvalue problems. Techniques for parallel architectures.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

Students with credit for MATH 850 or 920 may not take APMA 920 for further credit.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 920 **Units:** 4

Course Title: Numerical Linear Algebra *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Conditioning and stability of numerical methods for the solution of linear systems, direct factorization and iterative methods, least squares, and eigenvalue problems. Applications and mathematical software. (ii) -

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (אופא) (iii) -

**Attach rationale for changes as a separate document.*

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 0 2 2011

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☐ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 921 **Units:** 4

Course Title: Numerical Solution of Ordinary Differential Equations *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Study of the practical numerical methods for solving initial and boundary value problems for ordinary differential equations.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

Students with credit for MATH 851 or 921 may not take APMA 921 for further credit.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 921 **Units:** 4

Course Title: Numerical Solution of Ordinary Differential Equations *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Study of the practical numerical methods for solving initial and boundary value problems for ordinary differential equations.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (NONE)

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date _____

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☒ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 922 **Units:** 4

Course Title: Numerical Solution of Partial Differential Equations *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Analysis and application of numerical methods for solving partial differential equations. Finite difference methods, spectral methods, multigrid methods.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

Students with credit for MATH 852 or 922 may not take APMA 922 for further credit.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 922 **Units:** 4

Course Title: Numerical Solution of Partial Differential Equations *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Analysis and application of numerical methods for solving partial differential equations. Potential topics include finite difference methods, spectral methods, finite element methods, and multilevel/multigrid methods.

(ii) –

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (NONE)

(iii) –

**Attach rationale for changes as a separate document.*

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 27 2011

Upon approval of the minor course change, the Dean of Graduate Studies office will consult with the department or school regarding other course attributes that may be required to enable the proper entry of the course change in the student record system

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☒ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 923 **Units:** 4

Course Title: Numerical Methods in Continuous Optimization *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Numerical solution of systems of nonlinear equations, and unconstrained optimization problems. Newton's method, Quasi-Newton methods, secant methods, and conjugate gradient algorithms.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

Students with credit for MATH 853 or 923 may not take APMA 923 for further credit.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 923 **Units:** 4

Course Title: Numerical Methods in Continuous Optimization *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Theory and algorithms of nonlinear programming with an emphasis on modern computational considerations. Topics may include: optimality conditions for unconstrained and constrained optimization, gradient methods, conjugate direction methods, Newton method, quasi-Newton methods, penalty and barrier methods, augmented Lagrangian methods and interior point methods. (ii) –

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (NONE) (iii) –

**Attach rationale for changes as a separate document.*

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 0 2 2011

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☒ Title ☒ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 930 **Units:** 4

Course Title: Fluid Dynamics *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Basic equations and theorems of fluid mechanics. Incompressible flow. Compressible flow. Effects of viscosity.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

Prerequisite: MATH 361 or equivalent. Students with credit for MATH 930 may not take APMA 930 for further credit. Recommended: MATH 462.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 930 **Units:** 4

Course Title: Computational Fluid Dynamics *(max. 80 char)* (i) ✓

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Basic equations governing compressible and incompressible fluid mechanics. Finite difference and finite volume schemes for hyperbolic, elliptic, and parabolic partial differential equations. Practical applications in low Reynolds number flow, high-speed gas dynamics, and porous media flow. Software design and use of public-domain codes. (ii) –

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (None) (iii) –

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 0 2 2011

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☐ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 934 **Units:** 4

Course Title: Selected Topics in Fluid Dynamics *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Study of a specialized area of fluid dynamics such as hydrodynamic stability, multiphase flow, non-Newtonian fluids, computational fluid dynamics, boundary-layer theory, magnetic fluids and plasmas, bio- and geo-fluid mechanics, gas dynamics.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

APMA 930 or permission of the instructor.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 934 **Units:** 4

Course Title: Selected Topics in Fluid Dynamics *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Study of a specialized area of fluid dynamics such as hydrodynamic stability, multiphase flow, non-Newtonian fluids, computational fluid dynamics, boundary-layer theory, magnetic fluids and plasmas, bio- and geo-fluid mechanics, gas dynamics.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (None)

(ii) –

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 02 2011

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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☐ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 935 **Units:** 4

Course Title: Analysis and Computation of Models *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Analysis of models from the natural and applied sciences via analytical, asymptotic and numerical studies of ordinary and partial differential equations.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

MATH 418 and MACM 316 or equivalent. Students with credit for MATH 883 or 935 may not take APMA 935 for further credit.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 935 **Units:** 4

Course Title: Analysis and Computation of Models *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Analysis of models from the natural and applied sciences via analytical, asymptotic and numerical studies of ordinary and partial differential equations.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (None) (nil) ✓

**Attach rationale for changes as a separate document.*

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 0 2 2011

Upon approval of the minor course change, the Dean of Graduate Studies office will consult with the department or school regarding other course attributes that may be required to enable the proper entry of the course change in the student record system

SIMON FRASER UNIVERSITY
DEAN OF GRADUATE STUDIES OFFICE

SENATE GRADUATE STUDIES COMMITTEE FORM

GRADUATE COURSE MINOR CHANGE FORM

This form is to be used when there is a request for a minor change to an existing graduate course. The form is completed by the department and then approved by the Faculty graduate studies committee. It should then be forwarded to the Dean of Graduate Studies for approval by SGSC. SGSC will forward the approval to Senate for information. NOTE: Please complete pertinent sections only

Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☒ Title ☒ Description ☒ Other Prerequisite

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 939 **Units:** 4

Course Title: Selected Topics in Mechanics of Solids *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Study of a specialized area of the mechanics of solids such as composite materials, micromechanics, fracture, plate and shell theory, creep, computational solid mechanics, wave propagation, contact mechanics.

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

APMA 935 or permission of the instructor.

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 939 **Units:** 4

Course Title: Selected Topics in Mathematical Image Processing *(max. 80 char)* (i) ✓

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Study of mathematical and computational aspects of image science. Some of the main mathematical tools are partial differential equations, iterative solutions to systems of equations, filters and wavelets. Applications include deblurring, denoising, inpainting, reconstruction, registration, and segmentation. Previous course offerings focused on computational methods in medical imaging, introduction to wavelets, and mathematical image processing and analysis. (ii) ✓

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) N/A (NONE) (iii) ✓

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date MAY 02 2011

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SIMON FRASER UNIVERSITY
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Please Check appropriate revision(s):

☐ Catalog Number ☐ Units ☐ Title ☒ Description ☐ Other

Department or School: Department of Mathematics

Current course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 990 **Units:** 4

Course Title: Selected Topics in Applied Mathematics *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: *(if any)*

Modified Course

Subject: APMA *(max: 4 chars)* **Catalog Number:** 990 **Units:** 4

Course Title: Selected Topics in Applied Mathematics *(max. 80 char)*

Short Title *(appears on transcripts etc.)* _____ *(max. 25 char)*

Course Description for Calendar:

Topics vary depending on faculty availability and student interests. Recent offerings include: geophysical fluid dynamics, adaptive numerical methods for differential equations, learning theory, and stability, pattern formation and chaos.

(ii) ←

Available Course Component:

☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum

Grading Basis: ☑ Graded ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete

Prerequisites: (if any) _____

Attach rationale for changes as a separate document.

Approvals

Faculty Graduate Studies Committee _____ Date _____

Senate Graduate Studies Committee _____ Date OCT 0 2 2011

Upon approval of the minor course change, the Dean of Graduate Studies office will consult with the department or school regarding other course attributes that may be required to enable the proper entry of the course change in the student record system

Simon Fraser University

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Applied Mathematics APMA Courses

Department of Mathematics | Faculty of Science
Simon Fraser University Calendar 2011 Summer

APMA 900-4 Advanced Mathematical Methods I

Hilbert spaces. Calculus of variations. Sturm-Liouville problems and special functions. Green's functions in one dimension. Integral equations. Prerequisite: MATH 314 or equivalent. Students with credit for MATH 900 may not take APMA 900 for further credit. Recommended: MATH 419.

APMA 901-4 Advanced Mathematical Methods II

First order partial differential equations. Characteristics. Eigenfunction expansions and integral transforms. Discontinuities and singularities; weak solutions. Green's functions. Variational methods. Prerequisite: MATH 314 or equivalent. Students with credit for MATH 901 may not take APMA 901 for further credit. Recommended: MATH 418.

APMA 902-4 Applied Complex Analysis

Review of complex power series and contour integration. Conformal mapping, Schwartz-Christoffel transformation. Special functions. Asymptotic expansions. Integral transform. Prerequisite: MATH 322 or equivalent. Students with credit for MATH 836 or 902 may not take APMA 902 for further credit.

APMA 905-4 Applied Functional Analysis

Infinite dimensional vector spaces, convergence, generalized Fourier series. Operator Theory; the Fredholm alternative. Application to integral equations and Sturm-Liouville systems. Spectral theory. Prerequisite: MATH 900 or permission of the instructor. Students with credit for MATH 905 may not take APMA 905 for further credit.

APMA 910-4 Ordinary Differential Equations

The solutions and properties of ordinary differential equations and systems of ordinary differential equations in the real and complex domains. Prerequisite: MATH 415 or equivalent. Students with credit for MATH 842 or 910 may not take APMA 910 for further credit.

APMA 912-4 Partial Differential Equations

An advanced course on partial differential equations. Topics covered usually will include quasi-linear first order systems and hyperbolic, parabolic and elliptic second-order equations. Prerequisite: MATH 901 or permission of the instructor. Students with credit for MATH 845 or 912 may not take APMA 912 for further credit.

APMA 920-4 Numerical Linear Algebra

Direct and iterative methods for the numerical solution of linear systems, factorization techniques, linear least squares problems, eigenvalue problems. Techniques for parallel architectures. Students with credit for MATH 850 or 920 may not take APMA 920 for further credit.

APMA 921-4 Numerical Solution of Ordinary Differential Equations

Study of the practical numerical methods for solving initial and boundary value problems for ordinary differential equations. Students with credit for MATH 851 or 921 may not take APMA 921 for further credit.

APMA 922-4 Numerical Solution of Partial Differential Equations

Analysis and application of numerical methods for solving partial differential equations. Finite difference methods, spectral methods, multigrid methods. Students with credit for MATH 852 or 922 may not take APMA 922 for further credit.

APMA 923-4 Numerical Methods in Continuous Optimization

Numerical solution of systems of nonlinear equations, and unconstrained optimization problems. Newton's method, Quasi-Newton methods, secant

methods, and conjugate gradient algorithms. Students with credit for MATH 853 or 923 may not take APMA 923 for further credit.

APMA 929-4 Selected Topics in Numerical Analysis

Study of a specialized area of numerical analysis such as computational fluid dynamics, approximation theory, integral equations, integral transforms, computational complex analysis, special functions, numerical quadrature and multiple integrals, constrained optimization, finite elements methods, sparse matrix techniques, or parallel algorithms in scientific computing.

APMA 930-4 Fluid Dynamics

Basic equations and theorems of fluid mechanics. Incompressible flow. Compressible flow. Effects of viscosity. Prerequisite: MATH 361 or equivalent. Students with credit for MATH 930 may not take APMA 930 for further credit. Recommended: MATH 462.

APMA 934-4 Selected Topics in Fluid Dynamics

Study of a specialized area of fluid dynamics such as hydrodynamic stability, multiphase flow, non-Newtonian fluids, computational fluid dynamics, boundary-layer theory, magnetic fluids and plasmas, bio- and geo-fluid mechanics, gas dynamics. Prerequisite: APMA 930 or permission of the instructor.

APMA 935-4 Analysis and Computation of Models

Analysis of models from the natural and applied sciences via analytical, asymptotic and numerical studies of ordinary and partial differential equations. Prerequisite: MATH 418 and MACM 316 or equivalent. Students with credit for MATH 883 or 935 may not take APMA 935 for further credit.

APMA 939-4 Selected Topics in Mechanics of Solids

Study of a specialized area of the mechanics of solids such as composite materials, micromechanics, fracture, plate and shell theory, creep, computational solid mechanics, wave propagation, contact mechanics. Prerequisite: APMA 935 or permission of the instructor.

APMA 981-4 Selected Topics in Continuum Mechanics

APMA 982-4 Selected Topics in Mathematical Physics

APMA 990-4 Selected Topics in Applied Mathematics

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