SFU Office of Graduate Studies and Postdoctoral Fellows

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MEMORANDUM

ATTENTION	Senate	DATE	16 September 2014
FROM	Wade Parkhouse, Dean of Graduate Studies	No.	GS2014.29
RE:	Faculty of Applied Science		

For information:

Acting under delegated authority at its meeting of September 8, 2014, SGSC approved the following new course effective Summer 2015:

Faculty of Applied Science

Mechatronic Systems Engineering

New course: MSE 884-3 Advanced Dynamics

SFU FACULTY OF APPLIED SCIENCES

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MEMORANDUM

ATTENTION Dr. Wade Parkhouse
Dean, Graduate Studies

DATE August 31, 2014

FROM Dr. Uwe Glässer
Faculty of Applied Sciences Graduate Studies Committee

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RE: New Graduate Course Proposal in Mechatronic Systems Engineering (MSE 884)

The Faculty of Applied Sciences Graduate Studies Committee has unanimously approved by electronic vote on August 26, 2014 the new graduate course MSE 884 "Advanced Dynamics" proposed by the School of Mechatronic Systems Engineering.

The proposed course is a fundamental graduate level course in dynamics that will be taken by many graduate students in MSE (and possibly also in ENSC). The course was offered in 2013 as a Special Topics course. The required books are already available from the library.

An overlap check with the other SFU Faculties found that there are no concerns.

Would you please place this proposal on the agenda for the next SGSC meeting?

cc: *Dr. Martin Ester, Director, School of Computing Science*
Dr. Farid Golnaraghi, Director, School of Mechatronic Systems Engineering
Dr. Kamal Gupta, Director, School of Engineering Science

enclosures

SFU SIMON FRASER UNIVERSITY
DEAN OF GRADUATE STUDIES

RECEIVED
JUL 22 2014
DEAN OF GRADUATE STUDIES OFFICE

New Graduate Course Proposal Form

PROPOSED COURSE

Subject (eg. MAPH) MSE	Number (eg. 810) 884	Units (eg. 4) 3

Course Title (max 80 characters)
Advanced Dynamics

Short Title (appears on transcripts, max 25 characters)
Advanced Dynamics

Course Description for SFU Calendar ☑ see attached document ☐ Learning outcomes identified

Mechanical systems, generalized coordinates and configuration space, holonomic and nonholonomic constraints, virtual work, d'Alembert's principle and generalized forces, energy and momentum, Lagrange's equations, natural modes, principle coordinates and orthogonality, dissipation, impulsive motion, gyroscopic systems, velocity dependent potentials, Hamilton's principle and Hamilton's equations, phase space, introduction to special relativity.

Available Course Components: ☑ Lecture ☐ Seminar ☐ Laboratory ☐ Practicum ☐ Online ☐ _____

Grading Basis ☑ Letter grades ☐ Satisfactory/Unsatisfactory ☐ In Progress/Complete | This is a capstone course ☐ Yes ☑ No

Prerequisites (if any) ☑ see attached document (if more space is required)

MSE 280 (or ENSC 380) and MSE 380 (or ENSC 381) or equivalent courses

☐ This proposed course is combined with an undergrad course: Course number and units: _____

Additional course requirements for graduate students ☐ See attached document (if this space is insufficient)

Campus at which course will be offered (check all that apply) ☐ Burnaby ☐ Vancouver ☑ Surrey ☐ GNW ☐ _____

Estimated enrolment	Date of initial offering	Course delivery (eg. 3 hrs/week for 13 weeks)
10	Fall 2015	3 hrs/week for 13 weeks

☐ Yes ☑ No Practicum work done in this class will involve children or vulnerable adults
(If the "Yes" box is checked, all students will require criminal record checks)

Justification ☐ See attached document (if more space is required)

Graduate research in MSE often involves the analysis, modelling, simulation and control of complex mechanical systems. Typical methods of analysis (e.g. Newtonian) covered at the undergraduate level can be insufficient for this purpose in contrast with methods (e.g. Lagrangian) covered in this course

RESOURCES

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.

Faculty member(s) who will normally teach this course ☑ information about their competency to teach the course is appended
Dr Kevin Oldknow

Number of additional faculty members required in order to offer this course
N/A

Additional space required in order to offer this course ☐ see attached document
N/A

Additional specialized equipment required in order to offer this course ☐ see attached document
N/A

Additional Library resources required (append details) ☐ Annually $_____ ☐ One-time $_____
N/A

PROPOSED COURSE *from first page*

Program (eg. MAPH) MSE	Number (eg. 810) 884	Units (eg. 4) 3
Course title (max 80 characters) Advanced Dynamics		

APPROVAL SIGNATURES

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 (attached to this form).

The new course proposal must also be sent to the Library for a report on library resources.

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

Other Faculties
The signature(s) below indicate 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 of Dean or Designate	Date

Departmental Approval (non-departmentalized faculties need not sign)

Department Graduate Program Committee	Signature	Date
H. Moallem		July 17, 2014
Department Chair Farid Golnaraghi	Signature	Date 7/18/14

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
Uwe Glässer	See below	Aug 31 2014

Senate Graduate Studies Committee Approval
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.

Senate Graduate Studies Committee	Signature	Date
UWE GLÄSSER WADE PARKHOUSE		Aug. 31/2014 Sept 18/14

CONTACT

Upon approval of the course, the Office of the Dean of Graduate Studies 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.

Department / School / Program	Contact name	Contact email
MSE	Dr. Farid Golnaraghi	mfgolnar@sfu.ca

Graduate Course Information Form

Simon Fraser University
Mechatronic Systems Engineering

Date: 9 May 2014

Course number: MSE 884

Course title: Advanced Dynamics

Instructor: Dr Kevin Oldknow

Frequency of course offering: Annual

Course description:

Mechanical systems, generalized coordinates and configuration space, holonomic and nonholonomic constraints, virtual work, d'Alembert's principle and generalized forces, energy and momentum, Lagrange's equations, natural modes, principle coordinates and orthogonality, dissipation, impulsive motion, gyroscopic systems, velocity dependent potentials, Hamilton's principle and Hamilton's equations, phase space, introduction to special relativity.

Syllabus:

1. Introductory Concepts (2 weeks)
   - The Mechanical System
   - Generalized Coordinates
   - Constrains
   - Virtual Work
   - Energy and Momentum

2. Lagrange's Equations (3 weeks)
   - Derivation of Lagrange's Equations
   - Example Applications
   - Integrals of Motion
   - Small Oscillations
   - Applications in Mechatronic Systems

3. Special Applications of Lagrange's Equations (3 weeks)
   - Rayleigh's Dissipation Function
   - Impulsive Motion
   - Gyroscopic Systems
   - Velocity-Dependent Potentials

4. Hamilton's Equations (3 weeks)
   - Hamilton's Principle
   - Hamilton's Equations
   - Other Variational Principles
   - Phase Space

5. Special Relativity (2 weeks)
   - Introduction to Special Relativity
   - Relativistic Kinematics
   - Relativisitic Dynamics
   - Acellerated Systems

Textbook:

Classical Dynamics, Donald T. Greenwood, Dover Publications, 1997, ISBN: 0486696901

Recommended readings:

tbd

Prerequisites:

MSE 280 / ENSC 380: Linear Systems (or equivalent), MSE 380 / ENSC 381: Dynamic Systems Modelling and Simulation (or equivalent)

Grading:

Problem Sets	-
Project (Part 1)	20%
Project (Part 2)	20%
Mid-Term Exam	20%
Final Exam	40%
Component	Percentage

A project (in Two parts) will be incorporated in the course, requiring the analysis, modelling and simulation of nonlinear dynamic systems using the principles and techniques developed in the course, as well as comparison with results from physical systems (e.g. from the literature). One mid-term exam will be held during the term, as well as a final eaxm.

Does the course have a project? Yes

If yes, please provide details:

Students will be required to complete a comprehensive project in which systems involving significant continuous, nonlinear and potentially nonholonomic aspects must be analyzed, modelled and simulated with results compared to those obtained (e.g. in the literature) from physical systems.

Teaching competency:

Dr Oldknow is an expert in the area of dynamics, controls and wheel / rail systems. His research has included work in the areas of machining (and robotic) system dynamics and control, as well as large scale industrial research projects in the areas of rail vehicle dynamics and wheel / rail contact mechanics. He has published several papers in these areas, both in conference proceedings and refereed journals such as the International Journal of Machine Tools and Manufacture, Journal of Rail and Rapid Transit, IEEE Transactions on Mechatronics, and Wear. In addition, Dr Oldknow's academic work has been augmented by more than 10 years of industrial experience including extensive experience in dynamic systems modelling, control and industrial experiments.