New Course Proposal Form

(07/2004)

1. Will this new course affect a current program? Yes ☐ No ☒
   If "yes", has a Program Revision Form been submitted concurrently? Yes ☐ No ☒

2. Teaching Department: Physics

3. Administering Faculty/Unit: GPSO

4. Campus (Downtown, Macdonald, Off Campus, Distance Ed, Other – specify): Downtown

5. Effective Term of Implementation (Ex. Sept. 2004 = 200409)
   Term: 200709

6. Responsible Instructor: M. Sutton, J. Vinals

7. Course Title (Limit 30 Characters) - required for all courses:
   Classical Condensed Matter

8. Course Number(s)
   Indicate course number & the number of terms spanned: (tick all that apply)
   Subject/course number: PHYS 657
   Course(s) Span:
   ☒ 1 term
   ☐ 2 consecutive terms (D1, D2)
   ☐ 2 non-consecutive terms (N1, N2)
   ☐ 3 consecutive terms (J1, J2, J3)

9. Course Title to Appear in the Calendar (optional)
   (Limit 59 characters):
   Note: This can ONLY be an expansion of word(s) abbreviated in the 30 character course title above.
   Classical Condensed Matter

10. Credit Weight
    (or CEU's for non-credit CE courses): 3

11. Rationale for new course

This proposed course is one of several changes to expand graduate core-level curriculum in condensed matter in the department of physics, as described in ``Graduate Curriculum for Masters and Ph.D. Degree Students in the Department of Physics, Specializing in Condensed Matter Physics." Following the expansion of the department in this field, and the hiring of several new Faculty, the proposed curriculum will provide coursework at the MSc and PhD level equal to that available at top-tier international programs.

12. Course Description
    (as it will appear in the Calendar [maximum 50 words]):
    (N.B. Faculty of Medicine must append complete course outline)

Coarse grained dynamic models in condensed matter. Spontaneously broken symmetry and slow dynamics. Nonlinear phenomenology (Ginzburg-Landau), perturbation theory, mode coupling, and dynamic renormalization group. Strong nonlinearity: solitons, unstable interfaces, topological defects. Nonlinear dynamics: secular perturbation theory, stability, center manifold reduction, amplitude and phase equations. Stochatic differential equations and stochastic bifurcation.

13. Supplementary information to appear in the Calendar in addition to the course description.
    Such as: equivalent course(s), contact hours, enrolment limitations, language of instruction etc.
    Please enter the information as it should appear in the calendar notes.

14. Schedule Types(s):
(Enter all that apply – see course guidelines for a complete list.)
(i.e. Lecture, Labs, Tutorial)

	Hours per Week		Hours per Week		Hours per Week
Lecture	3				

Total Hours per Week: 3

Total Number of Weeks: 13

15. Projected Enrolment:

20

16. Required text and/or preliminary reading list sent to library?

X Yes ☐ No

17. Prerequisite(s) (Courses or Tests)
Specify course number(s) or name(s) of test(s):

none

If the student does not have a prerequisite should web registration be blocked?
☐ Yes ☒ No

If "Yes" complete A and B:

A. Indicate minimum grade or test score(s) the student must attain in prerequisite course(s) or test(s):

B. Can the prerequisite course(s) or test(s) be taken in the same term as this course?
☐ Yes ☐ No

18. Corequisite(s) Course Number(s):
Specify course number(s) and title(s):

none

If the student does not register for the corequisite in the same term should web registration be blocked?
☐ Yes ☒ No

19. Restriction(s):

20. Consultation Reports Attached
☐ Yes ☒ N/A

21. Additional Course Charges (must be approved by the Fee Policy Committee)

Description of Fee (e.g. screening fee)	Amount
None.	

22. Requires Teaching, Physical, or Financial Resources Not Currently Available (attach explanation)
☐ Yes ☒ No

INFORMATION FOR ADMISSIONS, RECRUITMENT & REGISTRAR'S OFFICE

To be completed by the Faculty	*To be completed by ARR*	*For Continuing Education Use*
Slot Course: ☐ Yes ☐ No	CIP Code	CE Admin. Unit :
Thesis Component: ☐ Yes ☐ No		CE Non-Grant Courses:
		Flat Rate: CdnFlat Rate: ☐ Yes ☐ N/A

23. Approvals:

Routing Sequence	Departmental Meeting	Departmental Chair	Other Faculty	Curric/Academic Committee	Faculty	SCTP
Name	Charles Gale	Charles Gale				
Signature						
Date						

Departmental Contact Person (name/phone/email)	Peter Grutter, 398-2567, grutter@physics.mcgill.ca

Syllabus PHYS 657

1. Introduction to dynamics. Coarse grained variables, effective Hamiltonians, and coarse grained equations of motion. Conserved and broken symmetry variables, reversible and dissipative dynamics. Long range correlations and slow modes, Goldstone theorem. Application: Hydrodynamic Goldstone modes.

2. Nonlinear dynamical models (TDGL). Linearized theory and critical slowing down. Mode coupling. Perturbation theory for TDGL equations, and dynamic renormalization group. Other phenomenological models: conservation laws, symmetry requirements and transport equations. Application: Liquid crystals, generalized elasticity and dissipation. Polymer dynamics and viscoelasticity.

3 Nonlinear excitations: solitons, interfacial and topological defect motion. Application: unstable interface motion, crystal growth, dislocation and grain boundary motion in mesophases.

4. Bifurcation theory. Classical perturbation theory, adiabatic invariance, and secular perturbation theory. Stability, center manifold reduction, multiple scale reduction, amplitude and phase equations. Application: Nonlinear Schrodinger equation, dispersive waves, lasers.

5. Transition to chaos. Poincare maps, stability of limit cycles and bifurcations, intermittency and quasi-periodicity. Lyapunov exponents. Spatio temporal chaos. Application: Calcium dynamics in ventricular myocytes.

6. Stochastic models. Projection operator methods, and generalized fluctuation-dissipation relations. Langevin and Fokker-Planck equations. Integration of stochastic differential equations, and stochastic bifurcations. Applications: stochastic nematodynamics, and genetic regulatory networks.