McGill

AC-04-43
New Course Proposal Form
(09/2003)

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: Science

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

5. Effective Term of Implementation (Ex. Sept. 2004 = 200409)
Term: 200601

6. Course Title (Limit 30 Characters) - required for all courses:
Everyday Phys: A Baker's Dozen

7. Course Number(s)
Indicate course number & the number of terms spanned: (tick all that apply)

Subject/course number: PHYS 202

Course(s) Span:
☒ 1 term
☐ 2 consecutive terms (D1, D2)
☐ 2 non-consecutive terms (N1, N2)
☐ 3 terms (J1, J2, J3)

8. 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.
Everyday Physics: A Baker's Dozen

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

10. Schedule Type(s):
(Enter all that apply – see form, STVSCHD in Banner 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

11. Projected Enrolment:
100

12. 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**

13. 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**

14. Consultation Reports Attached
☐ **Yes** ☒ **N/A**

15. Additional Course Charges (must be approved by the Fee Policy Committee)
Description of Fee
(e.g. screening fee) **Amount**

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

17. Other Information (specify):

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

The day-to-day physics behind the materials and phenomena around us. Demonstrations of the intriguing properties of materials and the simple physical theories explaining them.

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

The course will be divided into thirteen weeks with a different topic for each week through the semester.

20. Rationale

This is a new general interest course to be given by the Physics Department. The material in this course is sufficiently different from materials in our physic's programs that we will allow physics students to take this course as one of their electives.

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**

21. Approvals:

Routing Sequence	**Departmental Meeting**	**Departmental Chair**	**Other Faculty**	**Curric/Academic Committee**	**Faculty**	**SCTP**
Name	M. Sutton	M. Grant				
Signature						
Date	Oct. 8/04					
Departmental Contact Person (name/phone/email)	Mark Sutton / 6523 / mark@physics.mcgill.ca					

Proposed New 200-level Course

Everyday Physics: A Baker's Dozen – PHYS 202

*Course Objective:

(3 credit hours, one semester course.)

A course to examine the day-to-day physics behind the materials and phenomena around us. Demonstrations of the intriguing properties of materials and the simple physical theories explaining them. The course will be divided into thirteen weeks with a different topic for each week through the semester.

*Prerequisite: none.

The anticipated audience is non-physics undergraduate students in all faculties. Particularly targeted towards Arts faculty undergraduates.

*Mark Scheme

The marking expected will be 20% assignments, 35% midterm and 45% final.

*Texts

No required text, as the course covers many different topics that are not found in a single text.

Recommended texts are the following:

- Richard A. L. Jones,
  Soft Condensed Matter, Oxford University Press: Oxford, 2000.

- J. E. Gordon, *The New Science of Strong Materials* or, *Why you don't fall through the floor*, Princeton University Press, 1988. + others.

Supplementary materials in the form of scientific articles and films will be provided regularly, and will be placed on a WebCT site for the course.

*Syllabus

Topics are listed with the intention that each topic will be elaborated for one week. Possible topics for each week are:

1. How does baker's yeast work? Why is ice cream a solid (it's not just frozen cream)? Why is mayonnaise stiff but can be spread? Why does beer foam have such a short and tragic life?

Food *materials*, and why they have the mechanical properties they do.

2. *Color in materials: Why do peacock feathers appear iridescent? Why is the sky blue and why are sunsets red? Why does the hope diamond appear blue?*

All can be described by interactions of light with matter in the form of, respectively, interference, Rayleigh scattering by density fluctuations, and absorption of light by impurities.

3. *Why doesn't everything in a biological cell clump up together and sink to the bottom of the cell?*

How Nature avoids this *clumping catastrophe* by arranging for the big macromolecules to have the same sign of net charge and hence repel each other, and how the charged macromolecules get neutralized enough so that things can approach each other for cells to work at all.

4. *Why ketchup, paints and inks in ballpoint pens do not flow indefinitely*.

Materials whose properties are determined by their particulate suspension can have a yield stress. Thixotropic fluids can liquefy when touched.

5. *Materials that are mostly surface: other surface forces in colloids, and foams*.

6. *Why do stars twinkle? Why is the sky dark at night (Oberon's paradox)?*

These are related to density, and density fluctuations, in the galaxy, and the finiteness of the universe.

7*. How stiff are biological cells? Why do cells have any stiffness since they are mostly made of water?*

Viscoelasticity in polymers, biopolymers including DNA. Mechanical properties of cytoskeletal proteins that form networks which can support a load.

8. *How Jimi Hendrix's fuzz box worked*.

Semi-conductor physics, and why the world of rock 'n' roll would be a pretty boring place without it. Guitarists use various transistor-based circuits between their instrument and amplifier that distort the music that's played through them.

9. *Why does lightning occur, why does it rain?*

Electricity and density in Earth's atmosphere.

10. *What is it that distinguishes the hundreds of different states of matter?*

Crystallization and broken symmetry. Elastic properties of materials, why things fracture or are ductile.

11. *Why we can skate on ice, why glaciers move*.

Ice physics and some simple thermal physics.

12. *How do plants move the water they need and sugars they produce around? What is their energy budget?*

Osmotic pressure, and efficiency in plants. What animals do with energy, from their smallest engines. (How much wood could a woodchuck really chuck, if a woodchuck could chuck wood?)

13. *How to estimate things, the physicists secret weapon*.

Estimating the size of an effect or the physical limits to some thing or process is a useful skill. Estimates would include, how big can an animal be, how tall are mountains and how much energy could solar cells provide. One far out example is the Fermi paradox resulting from estimating the probability of extraterrestrial life / planetary habitation in the universe.

McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see http://www.mcgill.ca/integrity for more information.