COURSE TITLE:

Nuclear Chemistry and Radiochemistry

CALENDAR ENTRY:

CHEM 417. (3) *Nuclear Chemistry and Radiochemistry* — Basic treatment of the nucleus, with analogy to concepts in chemistry. Nuclear stabilities and associated radioactive decay processes. Nuclear structure. Applications of radioisotopes in chemistry. The interaction of radiation with matter. *Prerequisites*: CHEM 201 or with permission CHEM 205. CHEM 312 is recommended. [0–0–0; 3–0–0]

TIME AND PLACE: Lectures: Chemistry C126 - Tues & Thurs 11:00 AM -12:20 PM. Tutorials: none

WEB SITE: http://www.chem.ubc.ca/courseware/courseware.shtml - see Chem417 link

INSTRUCTOR: W. Andrew MacFarlane
OFFICE: AMPEL 317: 822-6866
LABORATORY: TRIUMF: 222-1047, ext 6713
OFFICE HOURS: by appointment

MARKING:

ITEM	MARKS
Assignments	20
Midterm Exam	30
Final Exam	50
TOTAL	100

TEXTBOOK: none

REFERENCES: G. Choppin, J.O. Liljenzin and J. Rydberg, "Radiochemistry and Nuclear Chemistry" (Butterworth,1996).

G. Friedlander, J.W. Kennedy, E.S. Macias and J.M. Miller, "Nuclear and Radiochemistry" (Wiley, 1981).

CHEM 417 (Spring 2006) General Outline

I **The Atomic Nucleus**

- The Nuclear Model of the Atom
- Properties of Nuclei
- Basic Description of Radioactivity

II **Detection and Measurement of Radiation**

- Types of detectors
- Statistics of random events

III **Interaction of Radiation with Matter**

- Types of Radiation, Stopping power and LET
- Effects in Biological Systems and Radiation Safety

IV **Nuclear Masses and Binding Energies**

- Einstein's Theory of (Special) Relativity
- The Mass Excess Δ
- Mass and Stability
- The semi-empirical mass equation

V **Radioactive Decay and Nuclear Reactions**

- Activity and Decay Chains, Decay Processes
- Mathematical description of radioactive decay
- Cross-sections, nuclear reaction rates, energetics
- Radionuclide production
- examples: Radionuclide dating, Radiopharmaceuticals

VI **Models of the Nucleus**

- Brief intro. to Liquid Drop, Shell, Fermi Gas and Collective Models

VII **Optional Topics (as time permits)**

- Nucleosynthesis in the universe
- Nuclear hyperfine probes in chemistry
- Nuclear energy