UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DISCIPLINE/DEPARTMENT: Chemistry **IMPLEMENTATION DATE**: Fall 1997

Revised: _____

SUBJECT/NUMBER OF COURSE	**DESCRIPTIVE TITLE**	**UCFV CREDITS**
CHEM 323	Physical Chemistry for the Life Sciences	4

CALENDAR DESCRIPTION: The basic concepts of physical chemistry such as thermodynamics, kinetics and electrochemistry will be introduced in such a manner as to make these concepts relevant to biology students.

RATIONALE: UCFV has recently introduced a biology major and it is therefore necessary to add chemistry courses which are of interest to biology students. The introduction of this course is also part of the process of bringing the requirements for a UCFV chemistry minor more in line with those of the SFU chemistry major.

COURSE PREREQUISITES: Chemistry 111/112 or a B or better in Chemistry 101/102, and Math 111/112. Math 211 is highly recommended.

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	**Lecture**	**42**	**hrs**	**Student Directed Learning**		**hrs**
	Laboratory	**36**	**hrs**			
	Seminar		**hrs**	**Other - specify:**		
	Field Experience		**hrs**	Extra lab time used for exams	**6**	**hrs**
				TOTAL	**84**	**HRS**

MAXIMUM ENROLMENT: 24

Is transfer credit requested? **:** **Yes** **9** **No**

AUTHORIZATION SIGNATURES:

Course Designer(s): L. Martin **Chairperson**: T. Cooper

Curriculum Committee

Department Head: A. Last **Dean**: W. Welsh

PAC: Approval in Principle _____ **PAC: Final Approval**: November 27, 1996

(Date) **(Date)**

CHEM 323
NAME & NUMBER OF COURSE

SYNONYMOUS COURSES:

(a) replaces CHEM 222
(course #)

(b) cannot take CHEM 222 for further credit
(course #)

SUPPLIES/MATERIALS:

All materials and laboratory supplies will be supplied by the Chemistry department.

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

Physical Chemistry with Applications to the Life Sciences by David Eisenberg and Donald Crothers, published by Benjamin/Cummings.

OBJECTIVES:

Students will understand the basic principles of physical chemistry with special reference to biological applications. Examples include thermodynamics with reference to the CO_2-O_2 cycle; kinetics with reference to enzyme kinetics; and ionic solutions with reference to ADP-ATP.

METHODS:

Lectures, problem-solving, and laboratory experimentation. Audio visual aids will be used as appropriate.

STUDENT EVALUATION PROCEDURE:

Assignments	10%
Labs	25%
Midterms	30%
Final	35%

It is the policy of the chemistry department that in order to pass a course a student must obtain at least a P grade in the laboratory and lecture evaluations, considered separately. The lecture evaluation includes the assignments, and midterm and final examinations.

CHEM 323
NAME & NUMBER OF COURSE

COURSE CONTENT:

Part I: Thermodynamics

- Definitions of thermodynamics, state functions, work and heat, math review.
- The 1st law, enthalpy, heat capacities, gas expansions, water as a special case.
- The 2nd law, spontaneous processes, calculations of various entropy changes, the 3rd law.
- Free energy, equilibrium, standard states, chemical potential, phase equilibria.
- Solar energy, the CO_2-O_2 cycle, coupled reactions vis a vis enzymes, group transfer potential, the energetics of sprinting and cycling.

Part II: Chemical and Biochemical Kinetics

- Activation energies and entropies, mechanisms and elementary steps, microscopic reversibility, steady state assumptions, first and second order integrated rate laws, DNA renaturation, reaction profiles, Arrhenius and Eyring theories.
- Experiemental methods, enzymes kinetics, the Michaelis-Menton model, activated complexes, transition states.

Part III: Solutions and Electrochemistry

- Macromolecules, Gibbs-Durham Equation, ideal and non-ideal solutions, fugacity, activities, colligative properties, biological significance of osmotic pressure.
- Electrostatic field and potential, ion solvation, conductivity, ionic strength, ionic activity.
- Electrochemical cells, biochemical examples ADP--ATP, ion effect of membrane equilibria, Donnan Equilibrium, osmotic pressure and the sodium pump.

LABORATORY EXPERIMENTS:

Eight to ten experiments will be chosen from the following list:

- Use of the gas liquid chromatograth to establish a phase diagram
- Determination of energy of combustion using a bomb calorimeter
- Determination of molar mass by freezing point depression
- Vapour pressure of a pure liquid and of a binary solution
- Electrochemical determination of thermodynamic quantities
- Conductance of solutions
- A homogeneously catalyzed reaction
- Chemical kinetics: The hydrolysis of ethyl acetate
- Enzyme catalyzed reaction kinetics: the hydrogenation of pyruvate
- Determination of formation constants of calcium-ATP complexes
- Electrophoresis of amino acids

- Adiabatic expansion of gases
- Non-ideality in gases

CHEM 323
NAME & NUMBER OF COURSE

LIBRARY RESOURCES:

In addition to regular physical chemistry textbooks, the following are useful:

Morris, J.G., A Biologist's Physical Chemistry, 2nd Ed., William Cloves and Sons, 1974*
A.G. Marshall, Biophysical Chemistry: Principles, Techniques and Applications, Wiley, 1978
K.E. van Holde, Physical Biochemistry, 2nd Ed., Prentice Hall, 1985
D. Freifelder, Physical Biochemistry: Applications to Biochemistry and Molecular Biology, Freeman, 1976
K.J. Laidler, Physical Chemistry with Biological Applications, Benjamin Cummings, 1978*
J.R. Barrante, Physical Chemistry for the Life Sciences, Prentice Hall, 1977*
Tinoco Jr., Sauer and J.C. Wang, Physical Chemistry: Principles and Applications to Biological Sciences, 3rd Ed., Prentice Hall, 1995

The * indicates the book is already in the UCFV library; others will have to be purchased.