First Course Sheet – BSE221A

1. Objectives: The overall purpose of the course is to understand the functioning of living organisms from the perspective of a chemist. However, the chemistry in the cell operates under special conditions of biological cells where the system is not isolated rather partially open to its surrounding through membranous and non-membranous barriers.

   I do NOT expect you to memorize the chemical reactions and/or chemical structures of different compounds. In fact, whenever necessary, and central to a question, I would supply such information in the question paper. However, I do expect you to understand the cellular logic of the reactions, the advantage of coupling certain reactions, the advantage of a particular entity acting as an inhibitor or an activator particularly in a feedback loop.

   Though BSE221A is not a course on structural biology but it will be important to understand the chemical reactions from the perspective of structure of enzymes and substrates.

   The techniques should be learned as if you will be using it in the laboratory tomorrow. I would put special emphasis on the techniques and you must strive to understand it from the vantage point of a user of the technique. You will need to refer to several web-based tutorials and engage classmates in group discussions to understand the techniques comprehensively.

   Thus it will be an advanced level course where the learning outcome will have emphasis on "why" and "how" instead of "what" and development of a comprehensive, philosophical understanding of chemistry of the biological system.

   However, a very thorough reading of the prescribed text book and attending EVERY class should ensure very good performance.

   Prerequisites: There is no obligate pre-requisite for this course. This course will assume your knowledge of LIF101, Physiology and Biotechnology courses.

2. Course Contents:

Topic	No. of Lectures
Enzymes: Concepts, kinetics, catalytic strategies and regulation: Free energy as a thermodynamic function, formation of transition states, The Michaelis-Menten model, enzyme inhibitors, coenzymes, proteases, oxygen transport, hemoglobin, allostery, isozymes	4
Metabolism basic concepts and design: Introduction, coupled reactions and inter-connectivities.	1
Glycolysis and Gluconeogenesis: Energy conversion pathways in organisms, control of glycolytic pathway, synthesis of glucose from non-carbohydrate precursors, reciprocal regulation of gluconeogenesis and glycolysis	1
The citric acid Cycle: Pathway, control, source of biosynthetic precursors, glyoxylate cycle.	1
Oxidative phosphorylation and electron transport chain: Mitochondrial membrane, electron transfer, proton pumps and physical link to citric acid cycle, regulation of cellular machinery	2
Glycogen metabolism: Interplay of enzymes, epinephrine and glucagon signaling, reciprocal regulation of glycogen breakdown and synthesis.	2
Fatty acid Metabolism: Triacylglycerols as energy stores, stages of processing, pathways of synthesis and degradation, acetyl Coenzyme A	2

Synthesis of the molecules of life : Nitrogen fixation, amino acid synthesis, feedback inhibition, pyrimidine and purine synthesis, salvage pathway, synthesis of lipids and steroids, regulation of cholesterol biosynthesis	8
Protein Folding and turnover: Stability, pathways of folding, chaperones, proteasomes, amino acid degradation, urea formation.	8
Techniques in biochemistry: Carbohydrate, lipid and nucleotide analysis, protein purification, differential centrifugation, salting out, chromatography, isoelectric focusing, gel electrophoresis, mass spectrometry, ultracentrifugation, peptide mass fingerprinting, Edman degradation, solid phase peptide synthesis, protein sequencing, ELISA, monoclonal antibodies, fluorescence microscopy	10
Metabolic diseases: Vitamin deficiencies, prion diseases, carbon monoxide poisoning, sickle-cell anemia, abnormal accumulation of membrane lipids, diabetes, cystic fibrosis, glycogen storage diseases, amino acid catabolism disorders.	3
Total lectures	**42**

3. Special Emphasis: (optional): Understanding the processes of biochemistry. More than 50% of the questions in the exams will require explanation (and NOT description) of a figure panel from textbook. Of course, I will explain these figures in my classes.

4. Lecture, Tutorial & Lab Schedule & Venue – There is no formal tutorial or lab for this course. The lectures will be held at **BSBE Seminar Hall**.
   LEC: MTF 10:00-11:00 BSBH

   I am willing and available to offer extra classes on Saturdays/Sundays to go over the topics taught in the week. I will arrange these on week by week basis if I receive requests by email from at least five registered students.

5. Office Hours: or, recommended mode of contact beyond formal contact hours – I should be available in the afternoon of everyday other than Tuesday. However, the best method would be contacting me over email to seek an appointment.

6. Evaluation Components & Policies: Exams, Quizzes, Assignments, Attendance, Participation etc. – There will be NO CREDIT for attendance. Attendance is purely voluntary however, one should note that without attending classes it may be very difficult to answer examination questions.

   There would be a minimum of 2 quizzes (one before the midsem and one after) and 2 assignments (one before the midsem and one after) apart from midsem and endsem examinations.

   Quizzes (collectively) and assignments (collectively) will have 20% weightage each while the midsem will have 25% weightage and the endsem 35%. Knowledge of portions covered before the midsem may be required to answer endsem questions.

7. Course Policies: Attendance, Honesty Practices, Withdrawal (within the limits of DOAA Guidelines) – As mentioned above attendance is purely voluntary. No stipulation would be there.
   Adoption of dishonest practice by one student, adversely affects the class. Thus, I take honesty very seriously. If I get proof of dishonest practices in assignments or quizzes or exams, strict action will be taken.

For the first offence 10% of the "Full Marks" for that particular component will be deducted irrespective of the marks obtained and/or questions attempted by the student. For example, if an assignment has 100 points and I find evidence of dishonest practice first, there will be no credit for the particular question(s), in addition I will deduct 10 points, which may mean up to 2 point deduction from the aggregate.

If there is a second instance, I will refer the case to S-SAC for appropriate action as per institute rules.

Special note for assignments – Since assignments are to be solved at home/hostels the following policy will be adopted to prevent dishonest practices:

First, any detection of plagiarism (copying each other's answers and/or copying answers from internet sources) will be treated as described above.

Second, if you have participated in solving an assignment, I would assume that you understood how the problem was solved. I may – RANDOMLY – pick answers from one/few student(s) and ask him/her/them to explain the answer(s) in the class. Failure to do so will be taken as an evidence of dishonesty and the policy described above will be followed.

8. Books & References: Properly Formatted along with listing of possible internet sources.

Textbook - Biochemistry by Berg and Stryer (8th edition) is adopted as the text book for this course. Four copies of the book is available in the reserve section of the library. More copies of the 7th edition of the book is also available in reserve section. Further, the 5th edition of the book is available ONLINE in NCBI Bookshelf - https://www.ncbi.nlm.nih.gov/books/NBK21154/