CHEM 4610/5610 – General Description

This course will survey important aspects of analytical, organic, and physical chemistry as they pertain to structures and processes in living systems. Lectures will be delivered in an **online synchronous** format. The prerequisite for this course is a passing grade of C or better in Chem 2220. If you have any additional questions or concerns, please email me at nercal@mst.edu.

COURSE DELIVERY:
Chem 4610/5610 will be an **online synchronous** course, meaning that all lectures will be delivered remotely via live video stream. You will be able to ask questions and interact with me during the stream. Recordings of each lecture will be posted on Canvas for review.

ATTENDANCE AND GRADING POLICY:
Class attendance is strongly recommended. The course grade will be determined by three 75-minute exams (30% each) and two homework assignments (5% each), for a total of 100%. Quizzes are not currently in the schedule, but if given, will be delivered online. However, **exams will be administered in-person** during the **normal lecture period (11 a.m. to 12:15 p.m.)** in **Room 104 Castleman Hall**. Examinations will primarily consist of multiple choice and short answer questions. The last exam will not be comprehensive.
The final grades for the course will be determined as follows:

Grade	Percent
A	≥ 88%
B	70-88%
C	55-70%
D	35-55%
F	< 35%

Note:

- Late homework assignments will **NOT** be accepted.
- There will be no extra credit or extra assignments to improve your grade.
- **There is absolutely no tolerance for plagiarism.**
- If you will miss an exam, you must contact me **in advance** and schedule an alternative time to take it.
- If you will miss a homework deadline, you are expected to submit it **in advance**.

SYLLABUS
The course will cover the following chapters in *Biochemistry*. The schedule is tentative and may be subject to change as the semester progresses. There will be 26 lectures. As a result, each exam will cover 8 or 9 lectures.

Course Material and Exam Schedule:

PART I: INTRODUCTION TO BIOCHEMISTRY	***Prelude* and *Biochemistry: An Evolving Science (Ch 1)*** Biochemical unity, definition and significance of biochemistry (1 lecture) ***Acid-base Reactions (Ch 1)*** pH, pKa, the Henderson-Hasselbalch equation, disorders associated with acidosis and alkalosis (2 lectures)
PART II: PROTEIN COMPOSITION AND STRUCTURE	***Protein Composition and Structure (Ch 2)*** Structures of 20 amino acids, peptide bonds, protein architecture (primary, secondary, tertiary and quaternary), 3D structures of proteins and their functional importance (2 lectures) ***Exploring Proteins and Proteomes (Ch 3)*** Gel electrophoresis, ultracentrifugation, determination of amino acid sequence in proteins, importance of X-ray crystallography in determination of 3D structure of proteins and more (3 lectures) **Exam I: September 24, Thursday**
PART III: THE CENTRAL DOGMA OF MOLECULAR BIOLOGY	***DNA, RNA, and Flow of Genetic Information (Ch 4)*** Molecular structures of DNA and RNA, DNA replication, single-stranded nucleic acids, RNA tumor viruses and retroviruses, transcription, translation, types of RNA, major features of genetic code, introns, exons, and regulation of gene expression (3 lectures) ***Exploring Genes and Genomes (Ch 5)*** Theory and techniques in biotechnology, role of restriction enzymes, Maxam-Gilbert method, Sanger dideoxy method, plasmids, chromosome walking, PCR in medical diagnostics, cDNA, transgenic animals, and recombinant DNA technology (3 lectures)
PART IV: PROTEIN FUNCTION (ENZYMES)	***Enzymes: Basic Concepts and Kinetics (Ch 8)*** Introduction to enzymes, free energy, thermodynamics, enzyme-substrate complex formation, common features of active sites, Michaelis-Menten kinetics, inhibition of

	enzymes, suicide inhibition of bacterial cell wall synthesis by penicillin (3 lectures) ***Catalytic Strategies (Ch 9)*** A few basic catalytic strategies used by enzymes with emphasis on chymotrypsin (1 lecture) **Exam II: November 3, Tuesday** ***Regulatory Strategies (Ch 10)*** Negative feedback inhibition in biochemical pathways, regulation of ATCase in pyrimidine synthesis, phosphorylation of enzymes, cAMP activation of protein kinase A, acidic cleavage of pepsinogen, cascade of zymogen activation in blood clotting, hemophilia, and fibrinolysis (3 lectures) ***Hemoglobin: Portrait of a Protein in Action (Ch 7)*** Oxygen binding to heme group in hemoglobin and myoglobin, CO poisoning, allosteric interactions, Bohr effect, effect of BPG on oxygen affinity of hemoglobin, sickle cell anemia, fetal DNA analysis for sickle cell gene, thalassemias (3 lectures).
PART V: SELECTED TOPICS IN BIOCHEMISTRY	***Carbohydrates (Ch 11)*** Evolutionary relationships and modern analytical techniques (1 lecture) ***Lipids and Cell Membranes (Ch 12)*** Fatty acids, types of membrane lipids, and membrane processes (2 lectures) If time permits… ***Signal Transduction Pathways (Ch 14)*** Heterotrimeric G protein-coupled receptor pathways and insulin signaling pathway (1 lecture) **Exam III: December 10, Thursday**