



湖北工業大學
HUBEI UNIVERSITY OF TECHNOLOGY

Course Title	Metabolic Biochemistry
Course Code	BIOC 3504
Semester	Summer 2026
Course Length	8 Weeks, 60 Contact Hours
Credits	4
Instructor	TBA
Office	TBA
Email	TBA
Prerequisite	CHEM 2021 Organic Chemistry I
Antirequisite	BIOC 3502 Metabolic Biochemistry (4 Weeks)

Course Description:

This course provides a comprehensive exploration of the chemical logic underlying cellular metabolism. It examines how living organisms extract energy from their environment and synthesize the building blocks of life through highly regulated enzymatic pathways. Key topics include the principles of bioenergetics, the mechanisms of enzyme action, and the detailed catabolic and anabolic pathways of carbohydrates, lipids, and amino acids. Emphasis is placed on the integration of these pathways and their systemic regulation in response to physiological and nutritional cues.

Course Goals:

Students who successfully complete this course will demonstrate competency in the following general education core goals:

- **Critical Thinking Skills** – Students will engage in analytical thinking, demonstrating the ability to critically evaluate, synthesize, and apply knowledge to complex problems, and construct well-reasoned solutions and arguments.
- **Independent Research and Inquiry** – Students will conduct independent research, utilizing academic resources to explore relevant topics, formulating research questions, analyzing data, and presenting findings in a coherent, scholarly manner.
- **Problem-Solving and Application** – Students will apply theoretical concepts and methodologies learned in the course to real-world problems, demonstrating the ability to develop practical solutions informed by academic inquiry.
- **Global and Cultural Awareness** – Students will gain awareness of the global and cultural contexts relevant to the course, appreciating diverse perspectives and considering the implications of their studies in a broader, international context.

Student Learning Outcomes:

Upon completion of this course, students will be able to:

- Explain the principles of enzyme catalysis, metabolic regulation, and bioenergetics;
- Detail the major pathways for carbohydrate, lipid, and amino acid breakdown and synthesis;
- Analyze how metabolic pathways interconnect and respond to nutritional and physiological states;
- Apply thermodynamic concepts and regulatory mechanisms to predict outcomes in normal and disease conditions;
- Evaluate the nutritional and clinical significance of key metabolic processes.

Textbooks/Supplies/Materials/Equipment/ Technology or Technical Requirements:

Lehninger Principles of Biochemistry by David L. Nelson and Michael M. Cox (8th Edition, W.H. Freeman & Company).

Course Requirements:**Unit Problem Sets (20%)**

Four structured problem sets designed to reinforce quantitative skills in bioenergetics, enzyme kinetics, and metabolic stoichiometry.

Midterm Examination (25%)

A written examination evaluating the student's mastery of energy transduction principles and carbohydrate metabolism.

Case Study Report (20%)

A 1200-word analysis of a metabolic disorder (e.g., Diabetes or Glycogen Storage Disease), focusing on the underlying biochemical lesions. The report must explain how this disruption ripples through interconnected pathways (e.g., how a defect in fatty acid oxidation affects glucose sparing), and propose biochemical interventions based on current literature.

Final Examination (35%)

A comprehensive written exam covering the entire course with emphasis on pathway integration, hormonal regulation, and clinical applications.

Assessments: Activity	Percent Contribution
Unit Problem Sets	20%
Midterm Examination	25%
Case Study Report	20%
Final Examination	35%

Grading:

Final grades will be based on the sum of all possible course points as noted above.

Grade	Percentage of available points
A	94-100

A-	90-93
B+	87-89
B	84-86
B-	80-83
C+	77-79
C	74-76
C-	70-73
D	64-69
D-	60-63
F	0-59

Course Schedule:

The schedule of activities is subject to change at the reasonable discretion of the instructor. Minor changes will be announced in class, major ones provided in writing.

BIOC 3504 Schedule		
Lecture	Topics	Chapters
L1	Perspectives on Intermediary Metabolism & Bioenergetics	Ch 1 & 13
L2	High-Energy Compounds and ATP-Dependent Group Transfer	Ch 13
L3	Biological Oxidation-Reduction Reactions	Ch 13
L4	Principles of Enzyme Action and Catalytic Strategies	Ch 6
L5	Regulatory Enzymes: Allosteric and Covalent Control	Ch 6
L6	Glucose Catabolism: The Glycolytic Pathway	Ch 14
L7	Anaerobic Fates of Pyruvate and Fermentation	Ch 14
L8	Gluconeogenesis: Synthesis from Non-carbohydrate Sources	Ch 14
L9	The Pentose Phosphate Pathway: Oxidative & Non-oxidative	Ch 14
L10	Glycogen Breakdown and Synthesis in Animal Tissues	Ch 15
L11	Regulation of Carbohydrate Metabolism & Signaling	Ch 15 & 12
---	Midterm Exam (Covers L1-11)	
L12	The Pyruvate Dehydrogenase Complex & Acetyl-CoA	Ch 16
L13	The Citric Acid Cycle: Reactions and Energetics	Ch 16
L14	Cycle Intermediates as Biosynthetic Precursors	Ch 16
L15	Mitochondrial Electron Transport and the ETC	Ch 19
L16	ATP Synthesis and Chemiosmotic Coupling	Ch 19
L17	Digestion and Transport of Dietary Lipids	Ch 10 & 17
L18	Fatty Acid Catabolism: Beta-Oxidation	Ch 17
L19	Ketone Body Formation and Utilization	Ch 17
L20	Biosynthesis of Fatty Acids and Triacylglycerols	Ch 21
L21	Synthesis of Membrane Lipids and Cholesterol	Ch 21
L22	Protein Degradation and the Urea Cycle	Ch 18
L23	Catabolism of Amino Acid Carbon Skeletons	Ch 18
L24	Biosynthesis of Amino Acids and Nucleotides	Ch 22
L25	Systemic Integration and Hormonal Regulation	Ch 23
---	Case Study Report Due	
---	Final Exam (Comprehensive)	

Accommodation Statement:

Academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he/she is not legally permitted to inquire.

Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow.

Academic Integrity Statement

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in coursework may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or outside the University; and nondisclosure or misrepresentation in filling out applications or other University records.

Other Items:

Attendance and Expectations

All students are required to attend every class, except in cases of illness, serious family concerns, or other major problems. We expect that students will arrive on time, be prepared to listen and participate as appropriate, and stay for the duration of a meeting rather than drift in or out casually. In short, we anticipate that students will show professors and fellow students maximum consideration by minimizing the disturbances that cause interruptions in the learning process. This means that punctuality is a must, that cellular phones be turned off, and that courtesy is the guiding principle in all exchanges among students and faculty. You will be responsible for the materials and ideas presented in the lecture.

Assignment Due Dates

All written assignments must be turned in at the time specified. Late assignments will not be accepted unless prior information has been obtained from the instructor. If you believe you have extenuating circumstances, please contact the instructor as soon as possible.

Make-Up Work

The instructor will not provide students with class information or make-up assignments/quizzes/exams missed due to an unexcused absence. Absences will be excused and assignments/quizzes/exams may be made up only with written documentation of an authorized absence. Every effort should be made to avoid scheduling appointments during class. An excused student is responsible for requesting any missed information from the instructor and setting up any necessary appointments outside of class.

Access, Special Needs, and Disabilities

Please notify the instructor at the start of the semester if you have any documented disabilities, a medical issue, or any special circumstances that require attention, and the school will be happy to assist.