PURDUE UNIVERSITY | College of Engineering

Engineering Faculty Document
No.: 38-25
October 25, 2024

TO: The Engineering Faculty

FROM: The Faculty of the College of Engineering

RE: New graduate course – ENGR 58100

The Faculty of the College of Engineering, Interdisciplinary Engineering has approved the following new graduate course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ENGR 58100 Biotechnology and Bioprocess Masters Project Course

Fall, Spring, Summer

3 total credits;

Pre-requisites: Enrollment in the Interdisciplinary Engineering Professional M.S. Program in Biotechnology and Bioprocess (students will not be in the first semester of their program) or with permission from the instructor.

Course Description: Practical experience with 1) engineering design principles; 2) professional skills required for effect project definition, management and communication; and 3) gaining experience and technical depth in current biotechnology areas 4) using statistical analysis, and machine learning for data analysis and data-driven decision making. Two inquiry-based project modules address current advances in biotechnology, bioprocess, and biomanufacturing principles and applications. Projects are initiated by an open-ended prompt and contain computer simulation, engineering design, implementation, and data analysis. Students will work in diverse teams to complete project goals.

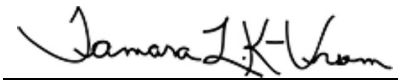
Course Learning Outcomes:

Upon completion of the course each student will have the ability to:

1. Combine mechanistic understanding in the form of theoretical equations from applied physics and engineering with ML and data analytical methods to apply data-driven decision-making to biotechnology, bioprocess and biomanufacturing problems.
2. Design an engineering process, collect and analyze relevant data, and compile comprehensive reports that clearly demonstrate mastery of the project area.
3. Work in a team to design and simulate biotechnology, bioprocess, and biomanufacturing processes, and use peer- and self-reviews to describe how each team member contributed to group efforts.

RATIONALE:

This course will be one of the two core courses for the new Interdisciplinary Biotechnology and Bioprocess Professional Masters degree



Head/Director of the Interdisciplinary Engineering

Link to Curriculog entry: [Paste link to Curriculog entry.]

ENGR 58100: Biotechnology and Bioprocess Masters Project Course

Instructor of Record: TBD
Email: xxx@purdue.edu
Office:
Office hours:

Course TA: TBD **TA Office Hours:** TBD

Class Location: TBD
Lab:

Pre-requisites: Enrollment in the Interdisciplinary Engineering Professional M.S. Program in Biotechnology and Bioprocess (students will not be in the first semester of their program) or with permission from the instructor.

Course Description:

Practical experience with 1) engineering design principles; 2) professional skills required for effect project definition, management and communication; and 3) gaining experience and technical depth in current biotechnology areas 4) using statistical analysis, and machine learning for data analysis and data-driven decision making. Two inquiry-based project modules address current advances in biotechnology, bioprocess, and biomanufacturing principles and applications. Projects are initiated by an open-ended prompt and contain computer simulation, engineering design, implementation, and data analysis. Students will work in diverse teams to complete project goals.

Course Learning Outcomes:

Upon completion of the course each student will have the ability to:

1. Combine mechanistic understanding in the form of theoretical equations from applied physics and engineering with ML and data analytical methods to apply data-driven decision-making to biotechnology, bioprocess and biomanufacturing problems.
2. Design an engineering process, collect and analyze relevant data, and compile comprehensive reports that clearly demonstrate mastery of the project area.
3. Work in a team to design and simulate biotechnology, bioprocess, and biomanufacturing processes, and use peer- and self-reviews to describe how each team member contributed to group efforts.

Academic Conduct: Students are expected to behave in a professional and ethical manner in all aspects of this course. Plagiarism or cheating will result in a zero for that particular assignment. Instances of unethical behavior will be reported to the Dean of Students Office and will result in a grade reduction of at least one letter grade. If an individual behaves unprofessionally or unethically during the semester, the instructor reserves the right to fail the student. For more information, see Purdue University Student Conduct Code at: http://www.purdue.edu/usp/acad_policies/student_code.shtml .

Class Attendance: Attendance (100 %) is required to pass the course. If a student misses a class due to an extenuating circumstances (e.g., death in family), he/she must contact the lab instructor immediately. In some instances, written documentation will be required. Make-up work will be considered and assigned on a case-by-case basis. **To receive credit for the lab, a student must be in the lab on time, no more than 15 minutes late. A student who is more than 15 minutes late and who does not have an excused reason may receive a zero on the lab.**

Office Hours: In addition to using office hours to obtain further understanding of course concepts, office hours may also be used to complete laboratory procedures. Office hours are listed on page 1 of this syllabus, extra office hours will be announced in class. Appointments to discuss course material can be made with course instructor by request.

Campus Emergency Response Procedures:

http://www.purdue.edu/fire/safety_handbook.pdf

- **Fire Alarm** – Evacuate MJIS 1061 through the south door (nearest the elevator); then, leave the building through the doors which exit to the east side of the building (back of the building near the construction of the Herrick Labs extension). Only gather personal items if it does not jeopardize your safety. Assist those who need help. Proceed to the front lawn Lilly Hall of Life Sciences (corner of State St. and S. Russell Dr.) **Report to a course instructor your name before leaving the emergency assembly area.**
- **All hazards warning** (Tornado, hazardous release, civil unrest, etc.) – When you hear the all hazards alarm immediately seek shelter (**Shelter-In-Place**) in a safe location. For a tornado, proceed to the basement of MJIS, using either the stairwell on the northwest side (by the police station) or the southeast side (across from MJIS 1087).

Campus Emergency Policy: In the event of a major campus emergency, course requirements, deadlines, and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. If an emergency should occur, check Blackboard and your Purdue email accounts to learn about modifications to the course.

Online Material: Course material and deliverable are distributed and collected through the digital learning management system **Brightspace**. It is expected and required that students watch and learn the material presented in the online lectures available through Brightspace. This material is to be learned prior to coming to lab each week it is assigned. The course schedule details when each lecture is assigned. Watching and learning this material is part of the lecture component of the course (you signed up for this as a separate section) and constitutes a percentage of your grade for the course.

All assignments must be submitted to **Brightspace** before the assignment deadline. Late work will automatically have 25% of the points deducted for every 24-hour period it is late.

Example of expected activities and deliverables in each week of each project Module*:*

Week one

- Problem statement (given)
- Screen literature base
- Initial system definition and design
- Break the process down into components and assign team member responsibilities
- Create a team charter

Week two

- Present the problem and initial design to classmates and course mentors for feedback (Deliverable: Preliminary Presentation)
- Construct and use mathematical model to set system conditions and parameters
- Conduct any necessary preliminary inquiries to obtain key estimates of model parameters

Week Three

- Present individual progress to course mentors (Deliverable: individual Demonstration Written Report)
- Use ML and Data analytical methods to analyze data from initial designs and mathematical model predictions
- Interpret results within context of the data/results analysis and your problem statement to work toward data-driven decision making

Week Four

- Data-driven problem solving iterate and improve engineering designs, mathematical model, and data analysis
    - Design implementation iteration: Continue to modify engineering designs and use mathematical model to extend findings to predict behaviors that are too complex to evaluate experimentally
    - Design analysis iteration: Refine data analysis techniques and interpret the data/results analysis to work toward data-driven decision making
- Start to integrate individual components into a working system
- Start compiling project report

Week Five

- Present individual progress to course mentors (Deliverable: individual Demonstration Discussion with teaching team members)
- Data-driven problem solving iterate and improve engineering designs, mathematical model, and data analysis
    - Design implementation iteration: Continue to modify engineering designs and use mathematical model to extend findings to predict behaviors that are too complex to evaluate experimentally
    - Design analysis iteration: Refine data analysis techniques and interpret the data/results analysis to work toward data-driven decision making
- Use mathematical model to extend findings to predict behaviors that are too complex to evaluate experimentally

Week Six

- Finalize data analysis and integrate results from each component.
- Interpret results within context of the data/results analysis and your problem statement to and document data-driven decision making
- Finalize project report

* Subject to adjustment

Formal Reports and Post Analysis: At the conclusion of each module, your team will write a formal project report. This will include an executive summary, problem statement, methods, results, discussion/analysis, and conclusion sections. The ability to integrate ideas will demonstrate that you have fully achieved the objectives of the module; this is an important part of your lab report. It is up to your team to integrate the concepts from your work in each module.

Self and Peer Reviews: At the mid-point and close of each module, your team will complete self and peer evaluations; that is, each person will assess his/her own performance on the team as well as the performance of each team member. Evaluations will be submitted online. A link to the survey will be sent to you. It is expected that you will provide substantive feedback in the peer evaluations. Your team members will not be able to view this feedback, but this information is essential to the teaching team so that any problems can be identified and addressed in a timely manner.

Evaluation results will be factored in as part of your overall course grade; negative evaluations can adversely affect your grade.

Grading Scale: The following grading scale is a guaranteed minimum; however, based upon student performance, final grades may be curved by the instructor.*

Letter Grade	Percentage	GPA score
A+	100	4.0
A	≥ 95	4.0
A-	≥ 90	3.7
B+	≥ 87	3.3
B	≥ 83	3.0
B-	≥ 80	2.7
C+	≥ 77	2.3
C	≥ 73	2.0
C-	≥ 70	1.7
D+	≥ 67	1.3
D	≥ 63	1.0
D-	≥ 60	0.7
F	60 >grade>0	0

*Note: Negative peer evaluations can adversely affect your final grade.

Grading Rubrics: Grading rubrics for Reports, Team Presentations and Individual Demonstrations are available on Blackboard. You should use these as a guide in your preparation for these learning assessments.

Grading Breakdown:

Module Preliminary Presentations	20 %
Individual Demonstrations	20 %
Lectures and Quizzes	15 %
Module Reports	30 %
Individual Participation and Rigor	15 %*

***** Assessed via self and peer evaluations and class participation

Re-grade Policy: Students have the right to contest any grade throughout the semester. Once an assignment has been graded and returned, students have **1 week** to protest a grade; after this time grade disputes will not be accepted. In the event that a student feels an assignment has been inappropriately graded, the student must submit a one page, typed document indicating the source of the problem and an explanation for the re-grade submission. The original assignment must be returned with the protest explanation. Papers submitted for a re-grade will be completely reevaluated (i.e., the entire paper will be re-graded, not only the portion under protest), which means that students risk losing additional points for mistakes missed during the first grading process. Please note that all re-grade requests will be evaluated at the end of the term and will only be considered for those students with a borderline grade (e.g., between an A and B).

Course Schedule*

Week	Activities	Required Reading
1	Course Introduction and team assignments	See Blackboard for reading material
2	Refresher material: Modeling and statistics	See Blackboard for reading material
3	Refresher material: Data analysis and application case studies in bioprocess engineering	See Blackboard for reading material
4-8	Project Module 1 See above: Example of expected activities and deliverables in each week of each project module	
9	Module 1 Final Project Report DUE	
10-15	Project Module 2 See above: Example of expected activities and deliverables in each week of each project module	
16	Module 2 Final Project Report DUE Post-course survey / Course Evaluations	

*Course schedule and assignment due dates are subject to change, as needed.