

UNIVERSITY OF MICHIGAN
College of Engineering
Curriculum Committee Meeting
Tuesday, March 7, 2023

Attending: Xiaogan Liang (Chair), Achilleas Anastasopoulos, Robert Bordley, Yavuz Bozer, Saadet Guralp, Roman Hryciw, Odest Chadwicke Jenkins, Xianzhe Jia, Amir Kamil, Cameron Loutitt, Jamie Niehof, Eric Rutherford, Rachael Schmedlen, Katie Snyder, Jan Stegemann, Roxanne Walker, Steven Yalisove, Won Sik Yang

Support Staff: Stacie Benison, Mercedes Carmona, Betsy Dodge, Matthew Faunce

Call to Order: 1:34

Adjourned: 2:10

AGENDA

1. Approval of 2.21.2023 Meeting Minutes (Page 2) - **APPROVED**
2. AMPED SUGS BME Proposal - Action Item (Page 5) - **APPROVED**
 - a. This program is for students to earn a Bachelor of Science in an approved field and a Master's degree in Advanced Medical Product Engineering and Development upon completion of five years of study. AMPED MEng degree curriculum includes statistics requirement, concentration core, technical electives, and seminar and RCR courses.
 - b. The BME SUGS programs are well established with 35-45 SUGS students per year and with the addition of the AMPED Program this will help with students interested in making an impact in the medical technology industry.
 - c. To be eligible to apply to the 27 credit AMPED SUGS Program, students must have a minimum 3.20 GPA with a holistic application review. Students will meet with their academic advisor at the end of the junior year to outline a course plan for the program.
 - d. Double counting is a maximum of 6 credits from an undergraduate degree as part of the AMPED curriculum with a grade equal to or better than a B.
 - e. Transfer credits are a maximum of 3 credits not used for an undergraduate degree, but can be used in the AMPED curriculum with a grade equal to or better than a B.
 - f. 3 Letters of Recommendations are required as this was determined by academic advisors who state this serves as a career development exercise for a student to gain the skills to reach out and form connections with faculty.
 - i. The issue of providing more work for faculty members, etc. and advising to reduce the recommendations to two instead of three was brought up. Jan said he would discuss this with advisors and changes will be adjusted if need be.
 - g. A question was raised regarding the transition into the curriculum for students who apply for the program from non-biomedical engineering backgrounds.
 - i. Jan commented on the curriculum being designed with courses in topics such as design for students to be able to gain the background principles of biomedical engineering needed for the AMPED program. There is no requirement for biology in the AMPED curriculum, but if students wish to enter the SUGS program and have little background with biology, there are courses that they can take which will provide them with background on anatomy of physiology needed for the AMPED SUGS program.
 - h. The double counting and transfer credit numbers were questioned as there weren't any other programs, to knowledge, that required the numbers given as they're the least amount of any program within CoE.
 - i. Jan used the Robotics SUGS Program as reference when determining the credit numbers required. The Robotics SUGS program is 30 credit and allows 9 credits to double count and 3 credits to transfer. Jan stated he did not want to take away from the program by increasing the credit numbers for transfer or double counting.

CARF SUMMARIES

PAGE	SUBJECT	COURSE #	ACTION	SUMMARY	EFFECTIVE TERM	MIN. GRADE REQ. FOR ENF. PREPREQ	APPROVED	NOTES & REVISIONS	TABLED
12	CHE	230	MOD	Changes to Course Title, Course Description, Course Components	FT 2024	C-	APPROVED		
15	CHE	341	MOD	Changes to Course Description, Enforced Prerequisite, Course Components	WT 2024	C-	CONDITIONAL APPROVAL	Change Course Description – First sentence to “Fluid mechanics for chemical engineering”	
18	CHE	342	MOD	Changes to Course Description, Course Components	FT 2024	C-	APPROVED		
21	CHE	466	MOD	Changes to Course Description	FT 2024	C-	APPROVED		
24	MECHENG	517	MOD	Changes to Course Description, Course & Abbreviated Title, Course Credit Type, Advisory Prerequisite	WT 2024	NO	CONDITIONAL APPROVAL	Cross Listed with MACROMOL 517. Update Advisory Prerequisite to include necessary background/curricular experience recommended for students.	
27	MECHENG	617	DEL		WT 2024	NO	APPROVED		

UNIVERSITY OF MICHIGAN
College of Engineering
Curriculum Committee Meeting
Tuesday, February 21, 2023

Attending: Xiaogan Liang (Chair), Achilleas Anastasopoulos, Robert Bordley, Diann Brei, Yavuz Bozer, Saadet Guralp, Roman Hryciw, Odest Chadwicke Jenkins, Xianzhe Jia, Amir Kamil, Leena Lalwani, Cameron Loutitt, Kathleen Panagis, Ken Powell, Eric Rutherford, Rachael Schmedlen, Katie Snyder, Roxanne Walker, Steven Yalisove, Won Sik Yang

Support Staff: Stacie Benison, Mercedes Carmona, Betsy Dodge, Matthew Faunce

Call to Order: 1:34pm

Adjourned: 2:39pm

AGENDA

1. Approval of 2.7.2023 Meeting Minutes (Page 2) - **APPROVED**
2. NERS-ISD SUGS Program Proposal – Action Item (Page 4) - **APPROVED**
 - a. ISD has had success with their newly developed curriculum as well as their SUGS pathways with various CoE departments. They are interested in adding NERS to the list of SUGS partnerships and may wish to add others in the future. Developing a SUGS pathway with ISD and NERS is proposed for all MEng programs. This will exclude Master of Science programs at this time, but this may be added in the future.
 - b. To be eligible to apply for the program, undergraduate students will need 80 or more NERS undergraduate credit hours, a 3.2 GPA, and completion of the standard MEng application and review process. To graduate from the proposed SUGS program, students must meet their requirements for both their master’s degree program and their undergraduate degree program. A maximum of 15 hours taken outside ISD may count towards the MEng. Degree, with 9 credit hours of double counting allowed with NERS. NERS and ISD departments would co-advise students in the preliminary process for the SUGS program. The courses within the proposed curriculum are reviewed regularly by the departments along with review of the curriculum with the CoE ADUE.
 - c. A comment was made that the proposed departments may wish to evaluate the need for three letters of recommendation for admission to the program.
 - i. Diann will take this back to their department to discuss any potential changes to this.
 - d. A question was raised regarding developing a standardized process for SUGS programs to be approved within all CoE majors.
 - i. There was some positive support for having more opportunities for students to customize their degree options.
 - ii. Xiaogan mentioned that this item will be brought to Kevin for discussion.
 - iii. A suggested proposed structure for this process is creating a template for what standard SUGS partnerships would look like with all CoE departments and then ask departments if they wish to opt into this process.
 1. Additional features of the structure that should be considered in future discussion may include what requirements students must meet depending on the department that they are entering, GPA requirements, double counting rules across CoE, and how admissions to programs may be handled.
 - a. A note was made that some departments only allow 6 credits of double counting as opposed to 9 credits.
3. CSE and ECE Subject Codes Proposal – Action Item (Page 38) - **APPROVED**
 - a. CSE and ECE are divisions within the EECS Department, but due to large size and number of courses, there are not enough numbers to support the continued development of new graduate-level courses. There is also student confusion on which courses count towards an ECE and CSE program.

- b. EECS is proposing the creation of separate ECE and CSE subject codes and transitioning most 500-level courses to these divisions, with some 500 level or above courses that will remain as EECS if there is overlap in applying towards both ECE and CSE graduate programs. At this time, the EECS designation will stay in place for 400 level and below courses.
 - c. About 120 CARFs will need to be submitted to transition these courses, some of which are cross listed with other departments and EECS will need to work with these departments to develop these changes.
 - d. This proposal seeks to obtain approval from the CCC to begin this work prior to the creation of the CARFs.
 - e. There were a few mentions of support of this idea from CCC members and upon a vote of the CCC, this proposal has been approved.
4. HLC Annual Audit Project Updates – Informational Item (Page 44)
- a. The CAEN Administrative Burden Group will assist the CCC with this work to develop a process to coordinate the work with curriculum experts (Mike Solomon and Christine Gerdes) as determined by Provost’s Office. The HLC Annual Audit Working Group has been developed, which includes members of the CoE Registrar’s Office staff (Betsy Dodge, Stacie Benison, and Chevette White), CCC Chair Xiaogan Liang, and will include participation from faculty/CCC members (to be determined). The purpose of this work is to ensure Title IV student financial aid eligibility and that CoE is following applicable guidelines. Winter 2023 is planned as the discovery and planning phase, in which the working group will evaluate the effectiveness of the HLC Report provided by the University Registrar’s Office and will identify the HLC annual audit process going forward. The working group will then help implement the process beginning Fall 2023. The project will officially end in December 2023, but the process that is identified will continue annually.
 - b. Benchmarking update - Many of the schools and colleges did not respond or did not have a process in place when benchmarking was completed.
 - c. A question was raised regarding what does not apply within the risk example. Further discussion will need to take place with the curriculum experts on this topic, and in developing a process to move forward with an annual review of CoE courses, this process seeks to limit the associated risks for CoE.
 - d. A question was raised about the recipients of these updates, which up to this point have primarily been Undergraduate and Graduate Chairs, to ask whether Undergraduate and Graduate Program Advisors would be looped into these conversations at the department level as well.
 - i. Xiaogan mentioned that these conversations with constituents across CoE are ongoing and that discussions about how to incorporate the appropriate individuals is something that can continue to be discussed.
 - e. A question was raised regarding the action items for CoE Curriculum Committee members. The action items for CCC Members have been outlined below:
 - i. CCC members will be asked to discuss and answer questions sent by Undergraduate and Graduate Chairs regarding allowable behaviors (what counts as a contact hour and what does not) to map contact hours.
 - 1. An example given discussed ENGR 301, a study abroad course that serves as a placeholder for students to remain active in their program while taking courses abroad. Due to the intent of courses such as these, there may be a reasonable explanation for why this course does not meet the policy, and those justifications must be approved by the CCC as allowable.
 - 2. Another example is ENGR 101, which has some of the course content delivered utilizing self-paced modules on Canvas. The CCC will need to address questions such as these to determine what counts as eligible contact hours.
 - ii. Based on discussions and answers to questions received, CCC members will then be asked to update the CoE Policy for Assignment of Contact Hours. Members will receive assistance from the HLC Annual Audit Working Group with these tasks.
 - f. An overall summary provided concluded that instructors must be able to justify how the course is setup to follow the contact hours as defined by the Provost’s Office.
 - g. A question was raised regarding whether course evaluations have been utilized in trying to show compliance in this work. It was discussed that the University Registrar’s Office pulls the report for all the schools/colleges from the contact hours listed within CoE classroom records only. This method has its limitations; CoE may have to create our own report for more accurate data.
5. Topics for the Joint CoE/LSA Curriculum Committee Meeting on April 4, 2023
- a. Reciprocity for Minor Approvals between CoE and LSA
 - b. HLC Annual Audit Process within CoE
 - c. The CoE Incomplete Grade Policy and Course Withdrawals
 - d. Sharing of student credit hours

CARF SUMMARIES

PAGE	SUBJECT	COURSE #	ACTION	SUMMARY	EFFECTIVE TERM	MIN. GRADE REQ. FOR ENF. PREPREQ	APPROVED	NOTES & REVISIONS	TABLED
58	EECS	543	DEL		WT 2024	NO	APPROVED		
61	NERS	672	NEW		WT 2024	NO	APPROVED	Cross listed with SPACE 545	

February 21, 2023

Dear College Curriculum Committee,

I am happy to submit this letter of support for the proposed request to establish a new Sequential Undergraduate/Graduate Studies (SUGS) program in the Department of Biomedical Engineering, in the area of Advanced Medical Product Engineering and Development (AMPED). Through this program, students will be able to earn their Bachelors of Science in an approved field and a Master's degree in Advanced Medical Product Engineering and Development upon completion of five years of study. The AMPED program leads to an MEng degree and is targeted at engineers who seek careers in the medical technology field.

The graduate program in Biomedical Engineering is over 50 years old and is well established and thriving. Currently the Master's program has approximately 75 Master's students. The AMPED MEng degree is the first new degree in the BME graduate program since its inception, and was created by spinning out the former Medical Product Development concentration in the Master's program into a stand-alone professional degree. The former MPD program was attractive to SUGS students, and we expect that the new AMPED SUGS program will be similarly successful. The undergraduate student population in BME also continues to grow, and therefore we expect a continued demand for the AMPED SUGS program. The BME Department is also implementing new initiatives that will help increase the diversity, inclusiveness, and success of its graduate programs.

This new AMPED SUGS program in BME will allow students to double count a maximum of 6 credits from their Bachelor's degree towards a 27 credit Master's (MEng) degree. In addition, a SUGS student may transfer a maximum of 3 credits to their graduate degree, so long as those transfer credits were not used for their undergraduate degree. This leaves 18-21 credits required to complete their Masters, which can be accomplished in one year with two semesters of graduate coursework.

The plan for Academic Year F23/W24 is for the AMPED SUGS option to be available to undergraduate students that are currently eligible for the existing BME SUGS program: Biomedical Engineering, Cellular and Molecular Biomedical Science (CMBS), Chemical Engineering, Electrical Engineering and Computer Science, Industrial and Operations Engineering, Material Science Engineering, Mechanical Engineering, Nuclear Engineering & Radiological Sciences, and Robotics. As the AMPED program becomes established, the BME Department may seek agreements from other departments across the College of Engineering to support expansion of the SUGS program, as appropriate.

In summary, I believe the AMPED SUGS program will be a valuable tool in growing the diversity, excellence, and impact of our Master's programs and I am excited to see that happen.

Sincerely,



Mary-Ann Mycek, Ph.D.

Interim Chair, Biomedical Engineering Department
Professor of Biomedical Engineering

February 22, 2023

Dear Colleagues;

On behalf of Michigan Engineering and as Associate Dean for Graduate and Professional Education, I am pleased to submit this letter of support for the proposed request to establish a new Sequential Undergraduate/Graduate Studies (SUGS) program in the Department of Biomedical Engineering. The new program is called Advanced Medical Product Engineering and Development (AMPED), and represents the conversion of the former Medical Product Development (MPD) concentration in the BME Master's program into a separate professional MEng degree that is designed specifically for those who are interested in careers in the medical technology industries.

SUGS programs offer our most promising students the opportunity to complete Master's degree requirements as part of a seamless program combined with their undergraduate study at Michigan Engineering. Participating students will earn their Bachelors of Science in an approved field and a Master's degree in Advanced Medical Product Engineering and Development upon completion of five years of study.

In Academic Year F23/W24, this SUGS option will be made available to undergraduate students that are currently eligible for the existing BME SUGS (MSE) program: Biomedical Engineering, Cellular and Molecular Biomedical Science (CMBS), Chemical Engineering, Electrical Engineering and Computer Science, Industrial and Operations Engineering, Material Science Engineering, Mechanical Engineering, Nuclear Engineering & Radiological Sciences, and Robotics. As the AMPED program becomes established, the Department of Biomedical Engineering may seek agreements from other departments across the College of Engineering (CoE) to support expansion of the SUGS program, as appropriate.

The graduate program in Biomedical Engineering is well established and thriving, with approximately 75 Master's students in the current program cohort. Based on previous SUGS enrolments in the MPD concentration, we expect strong demand for the AMPED SUGS program from undergraduate CoE students. In addition, the undergraduate student population in BME continues to grow, and therefore we expect the AMPED SUGS program to continue to find success in the future. The BME Department is creating new initiatives to increase the diversity of its programs, including through a 2022 CoE DEI Faculty grant that will support diverse, equitable, and inclusive recruiting to the AMPED program.

The new AMPED SUGS program in Biomedical Engineering will allow students to double count a maximum of 6 credits from their Bachelor's degree towards a 27 credit Master's (MEng) degree. In addition, a SUGS student may transfer a maximum of 3 credits to their graduate degree, so long as those transfer credits were not used for their undergraduate degree. This leaves 18-21 credits required to complete their Masters, which can be accomplished in one year with two semesters of graduate coursework.

Students will be encouraged to indicate their interest in the SUGS program through communication with the Academic Advisor for Master's and SUGS Programs in Biomedical Engineering during their junior year, and will apply to the SUGS program early in their senior year. They will only accept applications for matriculation into the AMPED SUGS program in the Fall.

I look forward to the success of this exciting new program.

Sincerely,



Lola Eniola-Adefeso, Ph.D. (Fellow of AIMBE, BMES)
Associate Dean for Graduate & Professional Education
University Diversity and Social Transformation Professor of Chemical Engineering;
Biomedical Engineering; Macromolecular Science and Engineering
Director, Cell Adhesion and Drug Delivery Lab
Associate Director, NIH Cellular Biotechnology Training Grant
Deputy Editor for Science Advance

Sequential Undergraduate/Graduate Study (SUGS)

The College of Engineering (CoE) SUGS program was developed to provide a path for qualified CoE students to pursue a five-year combined Bachelor's/Master's degree.

The Advanced Medical Product Engineering and Development (AMPED) program in the Department of Biomedical Engineering (BME) will accept SUGS applications from undergraduates in the CoE and other eligible programs, leading to the Masters of Engineering (MEng) in Advanced Medical Product Engineering and Development.

The AMPED SUGS program allows students to double count a maximum of 6 credits from their Bachelor's degree at U of M Ann Arbor towards a 27-credit Master's of Engineering degree at U of M Ann Arbor. These 6 double-counted credits can come from courses that satisfy the undergraduate degree requirements and which also satisfy the AMPED program requirements (see Appendix for listing of courses in the AMPED curriculum). Students will discuss with both their SUGS advisor and Undergraduate Advisor to determine appropriate coursework for double counting. In addition, a SUGS student may transfer a maximum of 3 credits to their graduate degree. These transfer credits must be part of the approved AMPED curriculum and cannot be used for any portion of their undergraduate degree.

In summary, students admitted to the AMPED SUGS program have the opportunity to bring 6-9 credits taken during their undergraduate degree into their 27-credit graduate degree. This leaves 18-21 credits required to complete the Masters of Engineering, which can be accomplished in one academic year with two terms of graduate coursework.

Admissions Guidelines for the AMPED SUGS Program

- At the end of their junior year, students must meet with the Academic Advisor for SUGS programs in the BME Department to discuss the requirements and process for admission to the AMPED SUGS program. The student will then work with the advisor to outline a preliminary course plan of study and make the appropriate course selections. SUGS students do not dual register.
- The minimum cumulative GPA requirement at the time of application to the AMPED SUGS program is 3.2.
- After the consultation with an Academic Adviser, the student must apply for SUGS during their senior year by completing a CoE graduate application. See below for information on the application process.
- The AMPED SUGS program is only available to students receiving their undergraduate and graduate degrees at the University of Michigan Ann Arbor campus.
- AMPED SUGS students pursue the Masters of Engineering curriculum described here: <https://sites.google.com/umich.edu/bme-amped/curriculum>
- A maximum of 6 credits can be double-counted between the undergraduate and graduate degrees, even if the total credits for the specific courses to be double-counted adds to more than 6 credit hours. However, the balance of the credit remaining after 6 credits are double-counted cannot be counted toward any other Rackham degree requirement. For example, if a student wants to double count 2 courses and the total credits for the 2 courses equals 7, then the CoE will double count the maximum of 6 credits. The 1 remaining credit cannot count toward another graduate degree requirement but can count toward an

undergraduate degree requirement. The double-counted courses will appear on the undergraduate transcript. Double-counted credits can only come from graduate-level seminars, advanced math, and/or general/technical electives.

- The AMPED program will allow a maximum of 3 credits to be transferred into the CoE graduate degree, in addition to the 6 double-counted credits. These transfer credits cannot be used for any portion of the undergraduate degree. The transfer credit will appear on the graduate transcript.
- An AMPED SUGS student may bring a maximum of 9 double-counted and transferred credits into the CoE graduate degree.
- All double-counted and transferred courses must have grades of "B" or above and be able to fit into the AMPED MEng degree audit.
- SUGS students must enroll in the CoE graduate program for a minimum of two full terms (at least 9 credits per term), paying full-time CoE graduate tuition.
- Deferment of admission is allowed only in highly exceptional cases. AMPED SUGS students must enroll in the CoE graduate program in the Fall term immediately following the last Winter term in their undergraduate degree. A student wishing to defer admission for medical/personal/etc. reasons must submit a petition to the AMPED program.
- The SUGS program is not available for students pursuing a dual-degree in either their undergraduate or graduate program.
- Should an AMPED SUGS student seek admission to a PhD program, the standard criteria and application materials would be required.

Financial Assistance

• Graduate Student Instructor (GSI) positions may be available through the BME Department. The GSI selection process is highly competitive, and generally occurs in March for the Fall term and in October for the Winter term. Domestic students are eligible to apply for GSI positions beginning their first term of enrollment. International students who have passed the UM Oral English Test are eligible to apply beginning their second term. In general, the order of preference for GSI positions from highest to lowest is: PhD students, then full-time Masters students, then SUGS students.

AMED SUGS Application Process

The CoE Graduate Program at the University of Michigan regulates all CoE graduate admissions. The AMPED Program will review all application materials and will make admission recommendations, which will be officially confirmed by the CoE following review of the applicant's degree qualifications and transcripts. For detailed information on the AMPED program's minimum admissions criteria and application procedures, please visit:

<https://sites.google.com/umich.edu/bme-amped/apply>

Application Deadlines:

- Applications to the AMPED SUGS program will be reviewed monthly on a rolling basis, starting on February 1 and with a final application deadline of July 1. Prospective students are encouraged to apply early, as there may be enrollment limits in some courses or programs. The AMPED SUGS program requires matriculation in the Fall term in order to accommodate the core course sequence.

Application Fee:

- U.S. Citizens and Permanent Residents: \$75
- Non-Residents: \$90

Application Package:

- The online CoE graduate program application can be found at:
<https://www.engin.umich.edu/admissions-aid/graduate-professional/apply/>
- Applicants are required to create an Apply-Web account before filling out the online application. Please adhere to the relevant deadlines when applying to the program.
- Letters of Recommendation: The electronic submission of 3 recommendation letters is required. Letters can be provided by university professors, employers, or others familiar with the student's academic and/or professional achievements and promise.
- Statement of Purpose: Provide a concise, well-written statement about an applicant's academic and research background, career goals, and how the AMPED graduate program will help meet career and educational objectives.
- Personal Statement: Include an essay about how an applicant's background and life experiences have motivated the decision to pursue a graduate degree at the University of Michigan. This essay may address cultural, geographical, financial, educational or other opportunities and challenges. For example, if an applicant grew up in a community where educational, cultural, or other opportunities were either especially plentiful or especially lacking, they might discuss the impact this had on their development and interests. This essay should be a discussion of the journey that has led to the decision to seek a graduate degree.
- Curriculum Vitae or Resume: Provide a summary of the applicant's educational background, professional experience, and skills.
- An email notification will be sent from the AMPED program to applicants 1-3 weeks after the submission of the online application. The requested information should be filled out to avoid delays in application processing.

Admission Decisions:

- Admission decisions are made and communicated to prospective AMPED SUGS students beginning in mid-February and continuing on a rolling basis through July.
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APPENDIX

Advanced Medical Product Engineering & Development (AMPED) Curriculum

The design and development of medical devices and systems is unique in the way they are regulated and structured. Biomedical engineers can play key roles at all stages of medical product development, from needs finding and concept generation to design, prototyping, testing, fabrication, and commercialization. The goal of the AMPED program is to provide students with the practical knowledge and skills needed to bring new and improved medical devices to the clinic, in the context of the current healthcare environment. The program comprises core content in product realization (design-build-test), quality systems, risk management, and regulatory structures. In addition, the curriculum includes courses on advanced topics in medical product development, as well as career progression and leadership. Participants also have the opportunity to take elective courses that further their competency in medical product development. The AMPED Master of Engineering (M.Eng.) program is a professional degree for engineers who want to make an impact in the medical technology industry. *Advisor: Prof. Jan Stegemann*

CONCENTRATION CORE (all courses are required):

BIOMEDE 651	Product Realization Practicum I (2) (Fall)
BIOMEDE 652	Product Realization Practicum II (2) (Winter)
BIOMEDE 653	Quality Risk, and Regulatory (2) (Fall)
BIOMEDE 655	Professional and Leadership Development I (2) (Fall)
BIOMEDE 656	Professional and Leadership Development II (2) (Winter)
BIOMEDE 658	Advanced Medical Product Development (2) (Winter)

SEMINAR AND RESPONSIBLE CONDUCT OF RESEARCH (both courses are required):

BIOMEDE 500	Biomedical Engineering Seminar (1) (Fall or Winter)
BIOMEDE 550	Ethics and Enterprise (1) (Fall)

NOTES: BIOMEDE 550 satisfies UM Responsible Conduct of Research and Scholarship (RCRS) requirement.

STATISTICS (choose one course):

BIOMEDE 503	Statistical Methods for Biomedical Engineering (3) (Winter)
BIOSTAT 602	Biostatistical Inference (4) (Winter)
BIOSTAT 650	Applied Statistics I: Linear Regression (4) (Fall)
BIOSTAT 651	Applied Statistics II: Extensions for Linear Regression (3) (Winter)
EECS 501	Probability and Random Processes (4) (Winter)
IOE 461	Quality Engineering Principles and Analysis (3) (Fall)
IOE 465	Design of Experiment (3) (Winter)
IOE 466	Statistical Quality Control (3) (Fall and Winter)
STATS 470	Introduction to the Design of Experiments (4) (Fall)
STATS 500	Statistical Learning I: Regression (3) (Fall)
STATS 513	Regression and Data Analysis (3) (Winter)
STATS 525	Probability Theory (3) (Fall)

NOTE: BME graduate students can only take EECS 501 in the winter term.

TECHNICAL ELECTIVES:

Students must take sufficient technical elective credits to reach at least the 27 credits overall required for the M.Eng. degree. No more than 2 credits of seminar courses may be applied to the degree.

BIOMEDE 499.002	Clinical Observation and Needs Finding (2) (Fall)
BIOMEDE 504	Cellular Biotechnology (3) (Winter)
BIOMEDE 523	Business of Biology (2.25) (Fall)
ARTDES 652	Design in the 21 st Century
BA523	Comprehensive Healthcare Strategies
BE 608	Health Care Markets and Public Policies (1.5) (Fall)
BIOINF 622	Translational Research (2) (Fall)
CHE 517	Biopharmaceutical Engineering (3) (Winter)
ENTR 500	An Introduction to Innovation: Tools for Career Success (3) (Fall)
ENTR 520	Technology-Inspired Business Models (3) (Fall)
ENTR 530	Innovation & IP Strategy (3) (Fall)
ENTR 540	Business Math for Innovators (1.5) (Winter)
ENTR 550	Interpersonal Skills: Leveling Up to Leadership (3) (Fall)
ENTR 560	Project Management and Consulting (3) (Fall and Winter)
ES 512	Business Basics for Graduate Engineers (3) (Winter)
ES 720	Commercialization of Biomedicine (1.5) (Winter)
HS 650	Data Science and Predictive Analytics (4) (Fall)
IOE 461	Quality Engineering Principles
IOE 491.083	Leadership in the Digital Age (2) (Fall)
IOE 548	Integrated Product Development (3) (Fall)
IOE 561	Risk Analysis
IOE 570	Design of Experiments
ISD 527	Designing in Quality: A Design for Six Sigma (3) (Winter)
MECHENG 599.003	Additive Manufacturing Theory and Practice (3) (Winter)

KEY AND ADDITIONAL NOTES:

Course Department & Number Course Name (# of credits) (term offered)

Students are responsible for checking the Office of the Registrar's [Schedule of Classes](#) to ensure that their selected courses are offered and fit their schedule.

Courses with 499/599 designation are in pilot phase and may not be offered in the term indicated.



Course Approval Request Form

Office of the Registrar, University of Michigan

1210 LSA Building
500 S. State Street
Ann Arbor, MI 48109-1382
Phone: 734.763.2113
Fax: 734.936.3148
ro.curriculum@umich.edu
ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2023-01-24
Effective Term: Fall 2024

<input type="checkbox"/>	Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only	RO USE ONLY Date Received: Date Completed: Completed By:
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CURRENT LISTING

REQUESTED LISTING

<input type="checkbox"/>	Dept (Home): Chemical Engineering			Dept (Home): Chemical Engineering		
	Subject: CHE			Subject: CHE		
	Catalog: 230			Catalog: 230		
	<input type="checkbox"/> Course is Cross-Listed with Other Departments			<input type="checkbox"/> Course is Cross-Listed with Other Departments		
<input type="checkbox"/>	Department	Subject	Catalog Number	Department	Subject	Catalog Number
<input checked="" type="checkbox"/>	Course Title (full title) Material and Energy Balances			Course Title (full title) Introduction to Material and Energy Balances		
<input type="checkbox"/>	Abbreviated Title (20 char) Mat&Energy Balances			Abbreviated Title (20 char) Mat&Energy Balances		
<input checked="" type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) An introduction to material and energy balances in chemical engineering applications, including environmental and biological systems. Systematic Engineering problem solving, the equilibrium concept in single phase or multiple phase systems, first law of thermodynamics, heats of reaction. Introduction to chemical engineering as a profession.					
<input type="checkbox"/>	Full Term Credit Hours			Half Term Credit Hours		
	Undergraduate Min: 4	Graduate Min:		Undergraduate Min:	Graduate Min:	
	Undergraduate Max: 4	Graduate Max:		Undergraduate Max:	Graduate Max:	
<input type="checkbox"/>	Course Credit Type Undergraduate Student					
<input type="checkbox"/>	Repeatability <input type="checkbox"/> Course is Repeatable for Credit <input type="checkbox"/> Course is Y graded Maximum number of repeatable credits: _____ <input type="checkbox"/> Can be taken more than once in the same term					

Subject: Chemical Engineering Catalog: 230

<input type="checkbox"/>	Grading Basis		
	<input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration	Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent	Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent
	Grading		
	<input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only		

	CURRENT LISTING	REQUESTED LISTING
<input type="checkbox"/>	Advisory Prerequisite (254 char)	Advisory Prerequisite (254 char)
<input type="checkbox"/>	Enforced Prerequisite (254 char) ENGR 100 and (ENGR 101 or 151) and CHEM 130 and (MATH 116 or 119 or 156 or 176 or 186 or 296 or 121); (C- or better) Minimum grade requirement: C-	Enforced Prerequisite (254 char) ENGR 100 and (ENGR 101 or 151) and CHEM 130 and (MATH 116 or 119 or 156 or 176 or 186 or 296 or 121); (C- or better) Minimum grade requirement: C-
<input type="checkbox"/>	Credit Exclusions	Credit Exclusions
<input checked="" type="checkbox"/>	Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Discussion <input type="checkbox"/> Independent Study	Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
		Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer
Cognizant Faculty Member Name: Jouha Min		Cognizant Faculty Member Title: ChE Asst. Professor

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)

Contact Person: Barbara Mintz

Email: bgmintz@umich.edu

Phone: 734-678-2239

CoE Curriculum

Committee Representative:

S. Albayrak

Print: Saadet Albayrak-Guralp

Date: 1/30/23

CoE Curriculum Committee Chair:

Print:

Date:

Home Department Chair:

Sharon Glotzer

Print: Sharon Glotzer

Date: 2/15/2023

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

DEPARTMENTAL/COLLEGE USE ONLY

Current:Course Description

An introduction to material and energy balances in chemical engineering applications, including environmental and biological systems. Engineering problem-solving, the equilibrium concept, first law of thermodynamics. Introduction to chemical engineering as a profession.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (discussion)

1

Contact hours (lab)**Requested:**Course Description

An introduction to material and energy balances in chemical engineering applications, including environmental and biological systems. Systematic Engineering problem solving, the equilibrium concept in single phase or multiple phase systems, first law of thermodynamics, heats of reaction. Introduction to chemical engineering as a profession.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (discussion)

1

Contact hours (lab)**Additional Info:**Submitted by:

Home dept

Describe how this course fits with the degree requirements:

Degree Requirement

Special resources of facilities required for this course:Supporting statement:

The course description has been updated to better reflect the current offering of the course content and structure.



Course Approval Request Form

Office of the Registrar, University of Michigan

1210 LSA Building

500 S. State Street

Ann Arbor, MI 48109-1382

Phone: 734.763.2113

Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2023-01-25

Effective Term: Winter 2024

<input type="checkbox"/>	Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only	RO USE ONLY Date Received: Date Completed: Completed By:
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CURRENT LISTING

REQUESTED LISTING

<input type="checkbox"/>	Dept (Home): Chemical Engineering Subject: CHE Catalog: 341	Dept (Home): Chemical Engineering Subject: CHE Catalog: 341												
<input type="checkbox"/>	<input type="checkbox"/> Course is Cross-Listed with Other Departments	<input type="checkbox"/> Course is Cross-Listed with Other Departments												
<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number				<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number			
Department	Subject	Catalog Number												
Department	Subject	Catalog Number												
<input type="checkbox"/>	Course Title (full title) Fluid Mechanics	Course Title (full title) Fluid Mechanics												
<input type="checkbox"/>	Abbreviated Title (20 char) Fluid Mechanics	Abbreviated Title (20 char) Fluid Mechanics												
<input checked="" type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Fluid mechanics for chemical engineers. Mass, momentum, and energy balance on static and flowing systems. Laminar and turbulent flow in pipes, equipment, and porous media. Advanced topics including boundary layers, potential and irrotational flows, non-Newtonian fluids, and microfluidic systems.													
<input type="checkbox"/>	Full Term Credit Hours Undergraduate Min: 4 Graduate Min: Undergraduate Max: 4 Graduate Max:	Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max:												
<input type="checkbox"/>	Course Credit Type Undergraduate Student													
<input type="checkbox"/>	Repeatability <input type="checkbox"/> Course is Repeatable for Credit <input type="checkbox"/> Course is Y graded Maximum number of repeatable credits: <input type="checkbox"/> Can be taken more than once in the same term													

Subject: Chemical Engineering Catalog: 341	
<input type="checkbox"/>	Grading Basis <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory Add Consent <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Department Consent <input type="checkbox"/> Business Administration <input type="checkbox"/> Instructor Consent Grading <input checked="" type="checkbox"/> No Consent <input type="checkbox"/> Not for Credit Drop Consent <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Department Consent <input type="checkbox"/> Degree Credit Only <input type="checkbox"/> Instructor Consent <input type="checkbox"/> <input checked="" type="checkbox"/> No Consent

	CURRENT LISTING	REQUESTED LISTING
<input type="checkbox"/>	Advisory Prerequisite (254 char)	Advisory Prerequisite (254 char)
<input checked="" type="checkbox"/>	Enforced Prerequisite (254 char) (PHYSICS 140 or 160) and (MATH 215 or 255 or 285) and CHE 230 Minimum grade requirement: C-	Enforced Prerequisite (254 char) (PHYSICS 140 or 160) and (MATH 215 or 285), preceded or accompanied by CHE 230 and (MATH 216 or 286) Minimum grade requirement: C-
<input type="checkbox"/>	Credit Exclusions	Credit Exclusions

<input checked="" type="checkbox"/>	Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Discussion <input type="checkbox"/> Independent Study	Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Terms Typically Offered <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer
Cognizant Faculty Member Name: Mark Burns		Cognizant Faculty Member Title: T.C .Chang Professor of Engineering	

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)

Contact Person: Barbara Mintz Email: bgmintz@umich.edu Phone: 734-678-2239

CoE Curriculum Committee Representative: S. Albayrak Print: Saadet Albayrak-Guralp Date: 1/30/23

CoE Curriculum Committee Chair: _____ Print: _____ Date: _____

Home Department Chair: Sharon Glotzer Print: Sharon Glotzer Date: 2/15/2023

Cross-Listed Department Chair: _____ Print: _____ Date: _____

Cross-Listed Department Chair: _____ Print: _____ Date: _____

Cross-Listed Department Chair: _____ Print: _____ Date: _____

DEPARTMENTAL/COLLEGE USE ONLY

Current:Course Description

Fluid mechanics for chemical engineers. Mass, momentum, and energy balances on finite and differential systems. Laminar and turbulent flow in pipes, equipment, and porous media. Polymer processing and boundary layers. Potential, two-phase, and non-Newtonian flow.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (discussion)

1

Contact hours (lab)**Requested:**Course Description

Fluid mechanics for chemical engineers. Mass, momentum, and energy balance on static and flowing systems. Laminar and turbulent flow in pipes, equipment, and porous media. Advanced topics including boundary layers, potential and irrotational flows, non-Newtonian fluids, and microfluidic systems.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (discussion)

1

Contact hours (lab)**Additional Info:**Submitted by:

Home dept

Describe how this course fits with the degree requirements:

Degree Requirement

Special resources of facilities required for this course:Supporting statement:

The course description has been updated to better reflect the current offering of the course content and structure. Adding Math 216 as a co-requisite.



Course Approval Request Form

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Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2023-01-24

Effective Term: Fall 2024

<input type="checkbox"/>	Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only	RO USE ONLY Date Received: Date Completed: Completed By:
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CURRENT LISTING

REQUESTED LISTING

<input type="checkbox"/>	Dept (Home): Chemical Engineering Subject: CHE Catalog: 342	Dept (Home): Chemical Engineering Subject: CHE Catalog: 342												
<input type="checkbox"/>	<input type="checkbox"/> Course is Cross-Listed with Other Departments	<input type="checkbox"/> Course is Cross-Listed with Other Departments												
<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number				<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number			
Department	Subject	Catalog Number												
Department	Subject	Catalog Number												
<input type="checkbox"/>	Course Title (full title) Mass and Heat Transfer	Course Title (full title) Mass and Heat Transfer												
<input type="checkbox"/>	Abbreviated Title (20 char) Mass&Heat Transfer	Abbreviated Title (20 char) Mass&Heat Transfer												
<input checked="" type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Theories and applications of mass and heat transport phenomena. Fick's law and Fourier's Law. Steady and unsteady diffusion and conduction. Mass and heat transfer coefficients. Simultaneous momentum and mass/heat transfer. Heat exchangers. Condensation and boiling. Radiation, Kirchoff's law and view factors. Ion diffusion in solution. Mass transfer in polymer membranes.													
<input type="checkbox"/>	Full Term Credit Hours Undergraduate Min: 4 Graduate Min: Undergraduate Max: 4 Graduate Max:	Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max:												
<input type="checkbox"/>	Course Credit Type Undergraduate Student													
<input type="checkbox"/>	Repeatability <input type="checkbox"/> Course is Repeatabile for Credit <input type="checkbox"/> Course is Y graded Maximum number of repeatable credits: <input type="checkbox"/> Can be taken more than once in the same term													

Subject: Chemical Engineering Catalog: 342

<input type="checkbox"/>	Grading Basis		
	<input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only	Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent	Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent

	CURRENT LISTING	REQUESTED LISTING																					
<input type="checkbox"/>	Advisory Prerequisite (254 char)	Advisory Prerequisite (254 char)																					
<input type="checkbox"/>	Enforced Prerequisite (254 char) ChE 230 and ChE 341 and (Math 216 or 256 or 286 or 316); (C- or better) Minimum grade requirement: C-	Enforced Prerequisite (254 char) ChE 230 and ChE 341 and (Math 216 or 256 or 286 or 316); (C- or better) Minimum grade requirement: C-																					
<input type="checkbox"/>	Credit Exclusions	Credit Exclusions																					
<input checked="" type="checkbox"/>	<table border="0" style="width: 100%;"> <tr> <td style="width: 33%;">Course Components</td> <td style="width: 33%;">Graded Component</td> <td style="width: 34%;">Terms Typically Offered</td> </tr> <tr> <td><input checked="" type="checkbox"/> Lecture</td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/> Fall</td> </tr> <tr> <td><input type="checkbox"/> Seminar</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Winter</td> </tr> <tr> <td><input type="checkbox"/> Recitation</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Spring</td> </tr> <tr> <td><input type="checkbox"/> Lab</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Summer</td> </tr> <tr> <td><input checked="" type="checkbox"/> Discussion</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/> Spring/Summer</td> </tr> <tr> <td><input type="checkbox"/> Independent Study</td> <td><input type="checkbox"/></td> <td></td> </tr> </table>	Course Components	Graded Component	Terms Typically Offered	<input checked="" type="checkbox"/> Lecture	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Fall	<input type="checkbox"/> Seminar	<input type="checkbox"/>	<input type="checkbox"/> Winter	<input type="checkbox"/> Recitation	<input type="checkbox"/>	<input type="checkbox"/> Spring	<input type="checkbox"/> Lab	<input type="checkbox"/>	<input type="checkbox"/> Summer	<input checked="" type="checkbox"/> Discussion	<input type="checkbox"/>	<input type="checkbox"/> Spring/Summer	<input type="checkbox"/> Independent Study	<input type="checkbox"/>		
Course Components	Graded Component	Terms Typically Offered																					
<input checked="" type="checkbox"/> Lecture	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Fall																					
<input type="checkbox"/> Seminar	<input type="checkbox"/>	<input type="checkbox"/> Winter																					
<input type="checkbox"/> Recitation	<input type="checkbox"/>	<input type="checkbox"/> Spring																					
<input type="checkbox"/> Lab	<input type="checkbox"/>	<input type="checkbox"/> Summer																					
<input checked="" type="checkbox"/> Discussion	<input type="checkbox"/>	<input type="checkbox"/> Spring/Summer																					
<input type="checkbox"/> Independent Study	<input type="checkbox"/>																						
Cognizant Faculty Member Name: Jovan Kamcev Cognizant Faculty Member Title: ChE Asst. Professor																							

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)

Contact Person: Barbara Mintz Email: bgmintz@umich.edu Phone: 734-678-2239

 CoE Curriculum Committee Representative: *S. Albayrak* Print: Saadet Albayrak-Guralp Date: 1/30/23

CoE Curriculum Committee Chair: _____ Print: _____ Date: _____

Home Department Chair: *Sharon Glotzer* Print: Sharon Glotzer Date: 2/15/2023

Cross-Listed Department Chair: _____ Print: _____ Date: _____

Cross-Listed Department Chair: _____ Print: _____ Date: _____

Cross-Listed Department Chair: _____ Print: _____ Date: _____

DEPARTMENTAL/COLLEGE USE ONLY

Current:Course Description

Theories and applications of mass and heat transport phenomena. Fick's law. Steady and unsteady diffusion. Mass transfer coefficients. Simultaneous momentum and mass transfer. Fourier's law. Steady and unsteady thermal conduction. Heat transfer coefficients. Heat exchangers. Condensation and boiling. Radiation, Kirchoff's law and view factors.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (recitation)

1

Contact hours (lab)**Requested:**Course Description

Theories and applications of mass and heat transport phenomena. Fick's law and Fourier's Law. Steady and unsteady diffusion and conduction. Mass and heat transfer coefficients. Simultaneous momentum and mass/heat transfer. Heat exchangers. Condensation and boiling. Radiation, Kirchoff's law and view factors. Ion diffusion in solution. Mass transfer in polymer membranes.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (recitation)

1

Contact hours (lab)**Additional Info:**Submitted by:

Home dept

Describe how this course fits with the degree requirements:

Degree Requirement

Special resources of facilities required for this course:Supporting statement:

The course description has been updated to better reflect the current offering of the course content and structure.



Course Approval Request Form

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Ann Arbor, MI 48109-1382

Phone: 734.763.2113

Fax: 734.936.3148

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ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
 Modification of Existing Course
 Deletion of Existing Course

Date of Submission: 2023-01-24

Effective Term: Fall 2024

<input type="checkbox"/>	Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only	RO USE ONLY Date Received: Date Completed: Completed By:
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CURRENT LISTING

REQUESTED LISTING

<input type="checkbox"/>	Dept (Home): Chemical Engineering Subject: CHE Catalog: 466	Dept (Home): Chemical Engineering Subject: CHE Catalog: 466												
<input type="checkbox"/>	<input type="checkbox"/> Course is Cross-Listed with Other Departments	<input type="checkbox"/> Course is Cross-Listed with Other Departments												
<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number				<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number			
Department	Subject	Catalog Number												
Department	Subject	Catalog Number												
<input type="checkbox"/>	Course Title (full title) Process Dynamics and Control	Course Title (full title) Process Dynamics and Control												
<input type="checkbox"/>	Abbreviated Title (20 char) Proc Dyn & Control	Abbreviated Title (20 char) Proc Dyn & Control												
<input checked="" type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Introduction to process control in chemical engineering. Control architecture design, notation, and implementation. Mathematical modeling and analysis of open-loop and closed-loop process dynamics. Applications to the control of level, flow, heat exchangers, reactors, and elementary multivariable systems. Optimization and model predictive control.													
<input type="checkbox"/>	Full Term Credit Hours Undergraduate Min: 3 Graduate Min: Undergraduate Max: 3 Graduate Max:	Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max:												
<input type="checkbox"/>	Course Credit Type Undergraduate Student													
<input type="checkbox"/>	Repeatability <input type="checkbox"/> Course is Repeatable for Credit <input type="checkbox"/> Course is Y graded Maximum number of repeatable credits: <input type="checkbox"/> Can be taken more than once in the same term													

Subject: Chemical Engineering Catalog: 466

<input type="checkbox"/>	Grading Basis	Add Consent	Drop Consent
	<input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only	<input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent	<input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent

	CURRENT LISTING	REQUESTED LISTING
<input type="checkbox"/>	Advisory Prerequisite (254 char)	Advisory Prerequisite (254 char)
<input type="checkbox"/>	Enforced Prerequisite (254 char) ChE 343 and 344 Minimum grade requirement: C-	Enforced Prerequisite (254 char) ChE 343 and 344 Minimum grade requirement: C-
<input type="checkbox"/>	Credit Exclusions	Credit Exclusions
<input type="checkbox"/>	Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study	Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
		Terms Typically Offered <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer
Cognizant Faculty Member Name: Andrew Allman		Cognizant Faculty Member Title: ChE Asst Professor

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)

Contact Person: Barbara Mintz

Email: bgmintz@umich.edu

Phone: 734-678-2239

CoE Curriculum

Committee Representative:

S. Albayrak

Print: Saadet Albayrak-Guralp

Date: 1/30/23

CoE Curriculum Committee Chair:

Print:

Date:

Home Department Chair:

Sharon Glotzer

Print: Sharon Glotzer

Date: 2/15/2023

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

DEPARTMENTAL/COLLEGE USE ONLY

Current:Course Description

Introduction to process control in chemical engineering. Control architecture design, notation, and implementation. Mathematical modeling and analysis of open-loop and closed-loop process dynamics. Applications to the control of level, flow, heat exchangers, reactors, and elementary multivariable systems. Statistical process control concepts.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (recitation)Contact hours (lab)**Requested:**Course Description

Introduction to process control in chemical engineering. Control architecture design, notation, and implementation. Mathematical modeling and analysis of open-loop and closed-loop process dynamics. Applications to the control of level, flow, heat exchangers, reactors, and elementary multivariable systems. Optimization and model predictive control.

Class Length

Full term

Contact hours (lecture):

3

Contact hours (recitation)Contact hours (lab)**Additional Info:**Submitted by:

Home dept

Describe how this course fits with the degree requirements:

Degree Requirement

Special resources of facilities required for this course:Supporting statement:

The course description has been updated to better reflect the current offering of the course content and structure.



Course Approval Request Form
Office of the Registrar, University of Michigan

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ro.curriculum@umich.edu
ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
- Modification of Existing Course
- Deletion of Existing Course

Date of Submission: 2022-09-28
Effective Term: Winter 2024

<input checked="" type="checkbox"/>	Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only	RO USE ONLY Date Received: Date Completed: Completed By:
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CURRENT LISTING

REQUESTED LISTING

<input type="checkbox"/>	Dept (Home): Mechanical Engineering Subject: MECHENG Catalog: 517	Dept (Home): Mechanical Engineering Subject: MECHENG Catalog: 517												
<input type="checkbox"/>	<input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments	<input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments												
<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td>Macromolecular Science and Engineering -</td> <td>MACROMOL</td> <td>- 517</td> </tr> </tbody> </table>	Department	Subject	Catalog Number	Macromolecular Science and Engineering -	MACROMOL	- 517	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td>Macromolecular Science and Engineering -</td> <td>MACROMOL</td> <td>- 517</td> </tr> </tbody> </table>	Department	Subject	Catalog Number	Macromolecular Science and Engineering -	MACROMOL	- 517
Department	Subject	Catalog Number												
Macromolecular Science and Engineering -	MACROMOL	- 517												
Department	Subject	Catalog Number												
Macromolecular Science and Engineering -	MACROMOL	- 517												
<input checked="" type="checkbox"/>	Course Title (full title) Mechanics of Polymers I	Course Title (full title) Mechanics of Soft Materials												
<input checked="" type="checkbox"/>	Abbreviated Title (20 char) Mech of Polymers I	Abbreviated Title (20 char) Mech of Soft Matls												
<input checked="" type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Selected topics in the mechanics of soft materials, including nonlinear elasticity, nonlinear viscoelasticity, and (visco)plasticity in amorphous and crystalline polymers. Applications include elastomers, thermoplastics, thermosets, vitrimers, hydrogels, proteins, and biological networks, cells, and tissues.													
<input type="checkbox"/>	Full Term Credit Hours Undergraduate Min: 3 Graduate Min: 3 Undergraduate Max: 3 Graduate Max: 3	Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max:												
<input checked="" type="checkbox"/>	Course Credit Type Rackham Graduate Student, Non-Rackham Graduate Student, Undergraduate Student, Rackham Graduate Student with Additional Work													
<input type="checkbox"/>	Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits:													
	<input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term													

Subject: Mechanical Engineering Catalog: 517

<input type="checkbox"/>	Grading Basis		
	<input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration Grading <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only	Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent	Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent

CURRENT LISTING**REQUESTED LISTING**

<input checked="" type="checkbox"/>	Advisory Prerequisite (254 char) MECHENG 511 or permission of instructor and graduate standing	Advisory Prerequisite (254 char) MECHENG 511 or Permission of Instructor
<input type="checkbox"/>	Enforced Prerequisite (254 char) Minimum grade requirement:	Enforced Prerequisite (254 char) Minimum grade requirement:
<input type="checkbox"/>	Credit Exclusions	Credit Exclusions
<input type="checkbox"/>	Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study	Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
		Terms Typically Offered <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer
Cognizant Faculty Member Name: Ellen Arruda & Jon Estrada		Cognizant Faculty Member Title:

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)

Contact Person:

Email:

Phone:

CoE Curriculum

Committee Representative:

Xiaogan Liang

Print: Xiaogan Liang

Date: 2/21/2023

CoE Curriculum Committee Chair:

Print:

Date:

Home Department Chair:

Kazuhiro Saitou

Print: Kazuhiro Saitou

Date: 2/20/2023

Cross-Listed Department Chair:

Kim Jinsang

Print: Jinsang Kim

Date: 2/13/23

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**Course Description

Mechanics of Polymers I

Course Description

Selected topics in the mechanics of soft materials, including nonlinear elasticity, nonlinear viscoelasticity, and (visco)plasticity in amorphous and crystalline polymers. Applications include elastomers, thermoplastics, thermosets, vitrimers, hydrogels, proteins, and biological networks, cells, and tissues.

Class Length

Full term

Class Length

Full term

Contact hours (lecture):Contact hours (lecture):

3

Contact hours (recitation)Contact hours (recitation)Contact hours (lab)Contact hours (lab)**Additional Info:**Submitted by:

Home dept

Describe how this course fits with the degree requirements:Special resources of facilities required for this course:Supporting statement:

We are requesting this change as we are combining the contents of MECHENG 517 and 617 into one course. The new title better reflects the contents of the new combined course. We will be sending another CARF for the deletion of MECHENG 617



Course Approval Request Form
Office of the Registrar, University of Michigan

1210 LSA Building
500 S. State Street
Ann Arbor, MI 48109-1382
Phone: 734.763.2113
Fax: 734.936.3148
ro.curriculum@umich.edu
ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

Action Requested

- New Course
- Modification of Existing Course
- Deletion of Existing Course

Date of Submission: 2022-12-12
Effective Term: Winter 2024

<input checked="" type="checkbox"/>	Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only	RO USE ONLY Date Received: Date Completed: Completed By:
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CURRENT LISTING

REQUESTED LISTING

<input type="checkbox"/>	Dept (Home): Mechanical Engineering Subject: MECHENG Catalog: 617	Dept (Home): Subject: Catalog:												
<input type="checkbox"/>	<input type="checkbox"/> Course is Cross-Listed with Other Departments	<input type="checkbox"/> Course is Cross-Listed with Other Departments												
<input type="checkbox"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number				<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number			
Department	Subject	Catalog Number												
Department	Subject	Catalog Number												
<input type="checkbox"/>	Course Title (full title) Mech of Polymers II	Course Title (full title)												
<input type="checkbox"/>	Abbreviated Title (20 char) Mech of Polymers II	Abbreviated Title (20 char)												
<input type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Mech of Polymers II													
<input type="checkbox"/>	Full Term Credit Hours Undergraduate Min: Graduate Min: 3 Undergraduate Max: Graduate Max: 3	Half Term Credit Hours Undergraduate Min: Graduate Min: Undergraduate Max: Graduate Max:												
<input type="checkbox"/>	Course Credit Type Rackham Graduate Student													
<input type="checkbox"/>	Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits:													
	<input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term													

Subject: Mechanical Engineering Catalog: 617

<input type="checkbox"/>	Grading Basis		
	<input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration	Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent	Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent
<input type="checkbox"/>	Grading		
	<input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only		

CURRENT LISTING**REQUESTED LISTING**

<input type="checkbox"/>	Advisory Prerequisite (254 char) Mech. Eng. 511, 517, or permission of Instructor.	Advisory Prerequisite (254 char)						
<input type="checkbox"/>	Enforced Prerequisite (254 char) Minimum grade requirement:	Enforced Prerequisite (254 char) Minimum grade requirement:						
<input type="checkbox"/>	Credit Exclusions	Credit Exclusions						
<input type="checkbox"/>	<table border="0"> <tr> <td>Course Components</td> <td>Graded Component</td> <td>Terms Typically Offered</td> </tr> <tr> <td> <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study </td> <td> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </td> <td> <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer </td> </tr> </table>	Course Components	Graded Component	Terms Typically Offered	<input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer	
Course Components	Graded Component	Terms Typically Offered						
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Cognizant Faculty Member Name: Ellen Arruda		Cognizant Faculty Member Title:						

SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)

Contact Person:

Email:

Phone:

CoE Curriculum

Committee Representative: *Xiaogan Liang (SLB)* Print: Xiaogan Liang Date: 3/1/2023

CoE Curriculum Committee Chair:

Print:

Date:

Home Department Chair:

Kazuhiro Saitou

Print: Kazuhiro Saitou

Date: 2/20/2023

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

DEPARTMENTAL/COLLEGE USE ONLY

Current:**Requested:**

Course Description
Mech of Polymers II

Course Description

Class Length
Full term

Class Length

Contact hours (lecture):
3

Contact hours (lecture):

Contact hours (recitation)

Contact hours (recitation)

Contact hours (lab)

Contact hours (lab)

Additional Info:

Submitted by:
Home dept

Describe how this course fits with the degree requirements:

Special resources of facilities required for this course:

Supporting statement:

We are combining the contents of this course with MECHENG 517 and this course number is no longer needed.