

# Course Schedule - Fall 2004

## Chemical and Biomolecular Engineering

### 101 ***Hidden World of Engineering*** Credit: 3 hours.

(CH E 101) Tells the stories of everyday objects: bathtubs, pop cans and screws. These simple objects shape our lives, yet are engineering masterpieces. To unveil this hidden world the course uses a humanistic approach. Designed to appeal to all majors, it uses human stories - filled with failures and triumphs - to reveal the methods of engineers. The course enchants with tales of ancient steel making, today's pop cans, huge stone monuments, and salt. The course will change how a student looks at his or her world. Several sessions focus on women engineers and the environment.

This course satisfies the General Education Criteria for a Physical Sciences course.

CRN	Type	Section	Time	Days	Location	Instructor
40973	lecture	FR	11:00 AM - 12:20 PM	TR	room 217 Noyes Laboratory	Hammack, W
40973: Physical Sciences course.						
29896	lecture	SO	11:00 AM - 12:20 PM	TR	room 217 Noyes Laboratory	Hammack, W
29896: Physical Sciences course.						

### 199 ***Undergraduate Open Seminar*** Credit: 1 to 5 hours.

(CH E 199) May be repeated.

CRN	Type	Section	Time	Days	Location	Instructor
10480	independent study		ARRANGED			
10480: Departmental Approval Required						

### 201 ***Cooperative Education Planning*** Credit: 0 hours.

(CH E 201) Same as CHEM 291. See CHEM 291.

CRN	Type	Section	Time	Days	Location	Instructor
36306	discussion-recitation	1	ARRANGED			Williams, D

### 202 ***Cooperative Education Practice*** Credit: 0 hours.

(CH E 202) Same as CHEM 293. See CHEM 293.

CRN	Type	Section	Time	Days	Location	Instructor
36312	practice	1	ARRANGED			Williams, D

**210 CHBE Internship** Credit: 0 hours.

(CH E 210) Full-time practice of chemical science in an off-campus industrial setting or research laboratory environment. Summary report required. May be repeated. Approved for S/U grading. Prerequisite: Completion of freshman year or equivalent, or consent of Director of Cooperative Education in Chemical and Biomolecular Engineering.

CRN	Type	Section	Time	Days	Location	Instructor
29898	discussion-recitation	1	ARRANGED			Mirarefi, A

**221 Principles of CHE** Credit: 3 hours.

(CH E 261) Lectures and problems on material and energy balances. Prerequisite: CHEM 104 or 204; credit or concurrent registration in CS 101.

Students must register for one lecture-discussion and one quiz section.

CRN	Type	Section	Time	Days	Location	Instructor
31555	lecture-discussion	AE1	02:00 PM - 02:50 PM	MW	room 213 Gregory Hall	Strano, M
31556	quiz	AQ1	02:00 PM - 02:50 PM	F	room 162 Noyes Laboratory	Strano, M
31558	quiz	AQ2	02:00 PM - 02:50 PM	F	room 217 Noyes Laboratory	Strano, M
31559	quiz	AQ3	02:00 PM - 02:50 PM	F	room 132 Davenport Hall	Strano, M
31560	quiz	AQ4	02:00 PM - 02:50 PM	F	room 136 Davenport Hall	Strano, M

**297 Individual Study Sophomores** Credit: 1 to 3 hours.

Individual study of problems related to Chemical and Biomolecular Engineering. May be repeated to a maximum of 6 hours. Prerequisite: Sophomore standing and consent of instructor.

CRN	Type	Section	Time	Days	Location	Instructor
39548	independent study		ARRANGED			
39548: Departmental Approval Required						

**397 Individual Study for Juniors** Credit: 1 to 3 hours.

Individual study of problems related to Chemical and Biomolecular Engineering. May be repeated to a maximum of 6 hours. Prerequisite: Junior standing and consent of instructor.

CRN	Type	Section	Time	Days	Location	Instructor
39580	independent study		ARRANGED			
39580: Departmental Approval Required						

**421 Momentum and Heat Transfer** Credit: 4 hours.

(CH E 371) Introduction to fluid statics and dynamics; dimensional analysis; design of flow systems; introduction to heat transfer; conduction, convection, and radiation. Prerequisite: CHBE 221 or consent of instructor.

Students must register for one discussion and one lecture section.

CRN	Type	Section	Time	Days	Location	Instructor
31561	discussion-recitation	AD1	01:00 PM - 01:50 PM	F	room 164 Noyes Laboratory	Kenis, P
31564	discussion-recitation	AD2	12:00 PM - 12:50 PM	F	room 161 Noyes Laboratory	Kenis, P
41667	discussion-recitation	AD5	01:00 PM - 01:50 PM	F	room 136 Davenport Hall	Kenis, P
41708	discussion-recitation	AD6	01:00 PM - 01:50 PM	F	room 136 Burrill Hall	Kenis, P
31577	lecture	AL1	08:30 AM - 09:50 AM	TR	room 116 Roger Adams Laboratory	Kenis, P

**430 Unit Operations Laboratory** Credit: 4 hours.

(CH E 374) Experiments and computation in fluid mechanics, heat transfer, mass transfer, and chemical reaction engineering. Exercises in effective Chemical and Biomolecular Engineering communications. Prerequisite: CHBE 422; credit or concurrent registration in CHBE 424; senior standing in Chemical and Biomolecular Engineering.

This course satisfies the General Education Criteria for a Advanced Composition course.

CRN	Type	Section	Time	Days	Location	Instructor
31592	laboratory	AB2	01:00 PM - 06:00 PM	T	room 8 Roger Adams Laboratory	Miletic, M
31592: Advanced Composition course.						
31595	laboratory	AB3	01:00 PM - 06:00 PM	W	room 8 Roger Adams Laboratory	Miletic, M

31595: Advanced Composition course.						
31600	laboratory	AB4	01:00 PM - 06:00 PM	R	room 8 Roger Adams Laboratory	Miletic, M
31600: Advanced Composition course.						
31604	quiz	AQ1	04:00 PM - 04:50 PM	M	room 161 Noyes Laboratory	Miletic, M
31604: Advanced Composition course.						

#### 431 **Process Design** Credit: 4 hours.

(CH E 377) Capstone design course where students apply principles from previous courses to the design of complete chemical process systems. Topics include: techniques used in the synthesis and analysis of chemical processes, process simulation and optimization, effective communication in a chemical process engineering environment. Prerequisite: CHBE 422; credit or concurrent registration in CHBE 424.

This course satisfies the General Education Criteria for a Advanced Composition course.

Registration limited to Senior Chemical Engineering Majors.

CRN	Type	Section	Time	Days	Location	Instructor
29899	conference	AC1	ARRANGED			Miletic, M
29899: Advanced Composition course.						
29900	lecture	AL1	09:00 AM - 09:50 AM	MWF	room 161 Noyes Laboratory	Miletic, M
29900: Advanced Composition course.						

#### 440 **Process Control and Dynamics** Credit: 4 hours.

(CH E 389) Techniques used in the analysis of process dynamics and in the design of process control systems; includes Laplace transforms, stability analysis, and frequency response methods. Laboratory emphasizes on-line data acquisition and control. Prerequisite: CHBE 421 and senior standing in Chemical and Biomolecular Engineering; MATH 385; CS 101.

Students must register for one lab and one lecture section.

CRN	Type	Section	Time	Days	Location	Instructor
36103	laboratory	AB1	12:00 PM - 02:50 PM	W	room 112 Roger Adams Laboratory	Braatz, R
36105	laboratory	AB2	03:00 PM - 05:50 PM	W	room 112 Roger Adams Laboratory	Braatz, R
36108	laboratory	AB3	12:00 PM - 02:50 PM	R	room 112 Roger Adams Laboratory	Braatz, R
36137	laboratory	AB4	03:00 PM - 05:50	R	room 112 Roger	Braatz, R

			PM		Adams Laboratory	
36100	lecture	AL1	11:00 AM - 11:50 AM	MWF	room 217 Noyes Laboratory	Braatz, R

**452 Chemical Kinetics & Catalysis** Credit: 3 hours.

(CH E 387) Problems in chemical kinetics; techniques for the prediction and measurement of rates of reactions; and homogeneous and heterogeneous catalysis chain reactions. Prerequisite: CHEM 442 or CHBE 321.

CRN	Type	Section	Time	Days	Location	Instructor
29902	lecture	A	03:00 PM - 03:50 PM	MWF	room 162 Noyes Laboratory	Masel, R; White, R

**457 Microelectronics Processing** Credit: 3 hours.

(CH E 393) Introductory survey of chemical processing principles applied to microelectronic fabrication. Key concepts originate from chemical kinetics; thermodynamics; mass and energy balances; transport of mass, momentum and heat; and process synthesis and integration. Prerequisite: Junior or senior standing in Chemical and Biomolecular Engineering, Electrical and Computer Engineering, or Materials Science and Computer Engineering.

CRN	Type	Section	Time	Days	Location	Instructor
29903	lecture	A	10:30 AM - 11:50 AM	TR	room 161 Noyes Laboratory	Alkire, R; Younker, J

**471 Biochemical Engineering** Credit: 3 to 4 hours.

(CH E 365) Applications of chemical engineering principles to biological processes. Topics include enzyme mechanisms and kinetics, bioreactor design, cellular growth and metabolism, fermentation, and bioseparations. 3 undergraduate hours. 4 graduate hours. Prerequisite: Junior, senior, or graduate standing, or consent of instructor.

CRN	Type	Section	Time	Days	Location	Instructor
41112	lecture	1	10:00 AM - 10:50 AM	MWF	room 124 Burrill Hall	Pack, D

**473 Biomolecular Engineering** Credit: 3 to 4 hours.

(CH E 385) Fundamental principles of biomolecular engineering and its applications in pharmaceutical, agriculture, chemical and food industries. Topics include gene discovery, rational design, directed evolution, pathway engineering, and functional genomics and proteomics. 3 undergraduate hours. 4 graduate hours.

CRN	Type	Section	Time	Days	Location	Instructor
29901	lecture	A	09:00 AM - 10:20 AM	TR	room 161 Noyes Laboratory	Zhao, H

**497 Individual Study for Seniors** Credit: 1 to 3 hours.

Individual study of problems related to Chemical and Biomolecular Engineering. 3 undergraduate hours. May be repeated to a maximum of 6 hours. Prerequisite: Senior standing and consent of instructor. No graduate credit.

CRN	Type	Section	Time	Days	Location	Instructor
39629	independent study		ARRANGED			
39629: Departmental Approval Required						

**499 Senior Thesis** Credit: 1 to 6 hours.

(CH E 292) Limited in general to seniors in the curriculum in chemical and biomolecular engineering. Any others must have the consent of the head of the department. Each student taking the course must register in a minimum of 5 hours either in one term or divided over two terms. A maximum registration of 10 hours in two terms is permitted. In order to receive credit, a thesis must be presented by each student registered in CHBE 499. No graduate credit.

CRN	Type	Section	Time	Days	Location	Instructor
10482	independent study		ARRANGED			
10482: Departmental Approval Required						

**521 Applied Mathematics in CHBE** Credit: 3 or 4 hours.

(CH E 466) Development of mathematical models and a survey of modern mathematical methods currently used in the solution of chemical and biomolecular engineering problems; topics include the application of vectors and matrices, partial differential equations, numerical analysis, and methods of optimization in Chemical and Biomolecular Engineering. Prerequisite: Consent of instructor.

CRN	Type	Section	Time	Days	Location	Instructor
29905	lecture	A	09:00 AM - 09:50 AM	MWF	room 196 Lincoln Hall	Higdon, J

**565 CHBE Seminar** Credit: 1 hours.

(CH E 465) Required of all graduate students whose major is Chemical and Biomolecular Engineering. Approved for both letter and S/U grading. Prerequisite: CHBE 422.

CRN	Type	Section	Time	Days	Location	Instructor
29904	lecture-discussion	A	03:00 PM - 03:50 PM	T	room 116 Roger Adams Laboratory	Leckband, D

**593 Individual Study** Credit: 0 to 4 hours.

(CH E 496) Study under the supervision of a staff member in areas not covered in course offerings. Approved for both letter and S/U grading. Prerequisite: Consent of the staff member under whom the study is to be made.

CRN	Type	Section	Time	Days	Location	Instructor
10484	independent study		ARRANGED			
10484: Instructor Approval Required						

**594 Special Topics** Credit: 1 to 4 hours.

(CH E 469) Various advanced topics; generally taken during the second year of graduate study. Typical topics include turbulence, hydrodynamic instability, process dynamics, interfacial phenomena, reactor design, cellular bioengineering, properties of matter at high pressure, and phase transitions. May be repeated. Prerequisite: Consent of instructor.

CRN	Type	Section	Time	Days	Location	Instructor
31609	lecture	A	10:30 AM - 11:50 AM	TR	room 161 Noyes Laboratory	Alkire, R; Younker, J
31609: Topic: Chemistry and Transport in Microelectronics Processing. Meets with CHBE 457.						
31610	lecture	B	09:00 AM - 10:20 AM	TR	room 161 Noyes Laboratory	Zhao, H
31610: Topic: Biomolecular Engineering. Meets with CHBE 473.						
31572	lecture	D	09:00 AM - 10:20 AM	TR	room 4101 Materials Science and Eng Bld	Schweizer, K
31572: Topic: Dynamics of Complex Fluids Same as MSE 598						
40683	lecture	NS	02:30 PM - 03:50 PM	MW	room 215 Davenport Hall	Sahinidis, N
40683: 4 hours Topic: Computational Aspects of the Simplex Algorithm.						

**597 Special Problems** Credit: 2 to 16 hours.

(CH E 497) Individual work on problem-oriented projects not included in theses. This could be research, engineering design, or professional work in chemical and biomolecular engineering which has educational values. The work must be done under the supervision of a staff member with the approval of the department head. Approved for both letter and S/U grading.

CRN	Type	Section	Time	Days	Location	Instructor
10498	independent		ARRANGED			

	study					
10498: Instructor Approval Required						

**598 *Research Seminar*** Credit: 0 to 4 hours.

(CH E 498) Discussion of recent developments of importance to different areas of chemical and biomolecular engineering research. The course is divided into a number of sections, and subject matter differs from section to section and from time to time. May be repeated. Approved for both letter and S/U grading. Prerequisite: Consent of instructor.

CRN	Type	Section	Time	Days	Location	Instructor
10501	independent study		ARRANGED			
10501: Instructor Approval Required						

**599 *Thesis Research*** Credit: 0 to 16 hours.

(CH E 499) Candidates for the master's degree who elect research are required to write a thesis. A thesis is always required for the Doctor of Philosophy. Not all candidates for thesis work necessarily are accepted. Any student whose major is in another department must receive permission from the head of the Department of Chemical and Biomolecular Engineering to register in this course. Approved for both letter and S/U grading.

CRN	Type	Section	Time	Days	Location	Instructor
10503	independent study		ARRANGED			
10503: Instructor Approval Required						