The University of Michigan
College of Engineering
Curriculum Committee

Agenda
January 13, 2004
1:30-3:00 p.m.
GM Room
Fourth Floor Lurie Engineering Center

1. Approval of Minutes from December 16, 2003 Meeting
2. Revisit C- College Rule for Common Core Courses
3. Discussion on MDDP Agreement with Bus Admin
4. Program Change for AOSS
5. SGUS AOSS/Space Engineering
6. CS-LSA Proposed Changes for LSA to Consider
7. Course Approval Forms

University of Michigan
College of Engineering
Curriculum Committee Meeting
Tuesday December 16, 2003
1:30-3:00 p.m.
Lurie Engineering Center GM Room
Minutes

Greg Hulbert called the meeting to order at 1:40 p.m.

Members Present: G.Hulbert, C. Cesnik, E. Chan, J.Fessler, J. Holloway, J. Horton, Y.Liu, S. Montgomery, M. Parsons, J. Patel, H. Peng, R. Robertson, P. Samson, S. Takayama, L. Thompson

Members Absent: W. Hansen(CEE), ,S. Pang, J. Patel (EECS), H. Peng (INTER-PRO), R. Robertson ((MSE), S. Takayama (BME), J. Williams

Guests: Susan Bitzer (for S. Takayama), Melissa Eljamal

Motion to approve the minutes of the last meeting

The minutes of the last meeting were approved

Greg Hulbert introduced and welcomed Jimmie Horton, the new undergraduate student representative.

International Programs – Melissa Eljamal

Melissa Eljamal, from the Office of International Programs in Engineering, handed out a packet with the ***Proposed Changes to International Programs Curricular Offerings***.
She talked about the Program in Global Engineering, an undergraduate program, put in place in 2001, and approved by this Committee. This program was designed to help students to focus their degree requirements in terms of Humanities, Social Science and free electives so they would be able to focus on international issues.
There are two routes—one in which the students take a foreign language, and one without one.
The proposed changes to the Program in Global Engineering are:

1. Decrease credit level requirement for completion of the Program in Global Engineering from 24 to 22 credits.
2. Study abroad credit for academic internships overseas.

Susan Montgomery moved to approve going from 24 to 22 credit hours and opening up the Program to many regions.
Discussion.
A new (amended) motion was made to approve going from 24 to 22 credit hours. The Committee will wait for a course approval form for the other issue.

Program Change for AOSS

Perry Samson handed out information regarding this change... The AOSS Department has gone through a review of itself at the request of the Dean. The outcome included a new chairman, new website, and a new curriculum...
They would like to create a next generation of AOSS scientists. to meet the needs of the Country in a unique way. They also want to create a collaborative degree program with LS&A., through Geology.
The handouts included: Proposed AOSS Undergraduate Curriculum – College & Core
Proposed AOSS Undergraduate Curriculum – Meteorology Concentration
Proposed AOSS Undergraduate Curriculum – Climate Physics Concentration
Proposed AOSS Undergraduate Curriculum – Space Weather Concentration
There will be about 56 course changes – a new growth for the AOSS Department.
Perry was asked about the AOSS plan for ABET accreditation. He said they are in the process of identifying the outcomes going toward that goal and deciding the merit and value of going forward with this process. Perry sits on the ABET Committee.
AOSS also hope to make a program jointly with LS&A.
Levi Thompson suggested a minor in AOSS for LS&A students.
It was decided to table the Program change at this time to wait for complete information in terms of the courses,

Course Approvals

Greg Hulbert called for a motion to approve the following courses. This was moved and seconded.
Motion Carried (approved) (With the expectation that required changes to be forthcoming)

AOSS 102	New Course
AOSS 111	Deletion
AOSS 203	Deletion
AOSS 305	Deletion
AOSS 310	Deletion
AOSS 311	Deletion
AOSS 335	Deletion
AOSS 350	New Course
AOSS 380	New Course
AOSS 399	Deletion
AOSS 407	Deletion
AOSS 410	New Course
AOSS 412	Deletion
AOSS 414	Modification – Changed Course Description
AOSS 422	Deletion
AOSS 424	Deletion
AOSS 425	Deletion
AOSS 432	Deletion
AOSS 440	New Course

AOSS 450	New Course
AOSS 454	Deletion
AOSS 460	Deletion
AOSS 461	Deletion
AOSS 466	Deletion
AOSS 470	New Course
AOSS 747	Modification – Changed Title; Changed Course Description
AOSS 749	Modification – Changed Title; Changed Course Description

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SGUS AOSS/Space Engineering

Perry Samson handed out a Program description and noted that AOSS wants to provide students the opportunity to receive a graduate degree in that field. Last year they created an SGUS program in Space Science, now they would like to create an SGUS program in Space Engineering. and a Master of Engineering in Space Engineering. The Master's degree in Remote Sensing will be eliminated. It was noted that the credit hours should change from 31 to 30.
Jeanne Murabito noted that the word 'Simultaneous' in SGUS has been changed to *'Sequential'*. Perry said he will do the necessary edits and bring the Proposal back to the Committee.

The 'C-'Rule will be re-visited at the next meeting in January, do to time constraints.

Adjournment: Motion to adjourn was made and seconded
Motion carried (approved)

Next Meeting
Tuesday, January 13, 2004
1:30-**3:00** p.m.
GM Room – Fourth Floor LEC

January 2, 2004

TO: College of Engineering Curriculum Committee

FROM: Professor Toby J. Teorey

RE: Proposed Changes to the CS-ENGR Program in EECS

The ABET evaluation for Computer Science -Engineering (CS-ENGR) conducted Nov. 2-4, 2003 resulted in a number of "concerns", some of which need to be addressed to assure accreditation of CS-ENGR at the ABET meeting in July 2004 (see Appendix). The following proposal explicitly addresses Concerns 1, 2, and 3, while future teaching practices will address Concerns 4, 5, and 6. This proposal was approved by the CSE Faculty (in EECS) on December 12, 2003.

PROPOSAL FOR CHANGES IN THE CS-ENGR PROGRAM

1. Increase the Upper Level CS Technical Electives from 10 to 16. Change the name to "Advanced CS Technical Electives."

We need to control the use of advanced and well-established CS courses up to 16 credits and not allow any substitutions from other programs. ABET requires 16 credits of upper level CS courses and a minimum of 40 credits of CS courses total.

2. Eliminate the Upper Level Flexible Technical Electives, moving 6 credits to Upper Level CS Tech Electives and 2 credits to Flexible Technical Electives.

There is no longer any need for this category of tech elective. Advanced courses in Math, ECE, IOE, or Physics can still be used for Flexible Technical Elective.

3. Eliminate the Engineering Breadth Elective (4 credits) in CS-ENGR and add 4 credits to the Flexible Technical Electives.

This is not an ABET requirement for CS programs, and CS-LSA never had this requirement. This is an opportunity to align the two programs more closely.

4. Increase the Flexible Technical Electives from 8 to 14 credits. Also, require at least 2 credits of Flexible Technical Electives to be from CS courses at the 200-level or higher, bringing the total CS credits to 40.

Results from the re-allocaiton of 2 credits of Upper Level Flexible Technical Electives and 4 credits of Engineering Breadth Elective.

5. Delete EECS 401 as a group option for probability and statistics. This course does not cover statistics and is mainly used by dual majors with CE or EE. Stat 412 and IOE 265 currently cover both probability and statistics, and Math 425 will be offering a 1 credit statistics lab.

Summary of Proposed Changes in CS-ENGR

Current Requirements

Core CS Requirements	22 credits	(203,280,281,370,376,496)
Upper Level CS Tech Electives	10 credits	
Upper Level Flexible Tech Electives	8 credits	
Flexible Tech Electives	8 credits	
Engineering Breadth Elective	4 credits	
Free (unrestricted) Electives	15 credits	
Total technical course credits	52 (total required CS credits is 32)	

Proposed Requirements

Core CS Requirements	22 credits	(EECS 203,280,281,370,376,496)
Advanced CS Technical Electives*	16 credits	
Flexible Technical Electives**	14 credits	
Free (unrestricted) Electives	15 credits	
Total technical course credits	52 (total required CS credits is 40)	

*A minimum of 16 credits of advanced CS courses must be chosen from a fixed list of well established courses at the 300, 400, and 500 levels, excluding 398, 498, 598, 499, and 599 (see current list plus EECS 373 and 381).

**May include any 200, 300, 400, or 500 level CS courses, including 398, 498, 598, 499, and 599 (up to 4 credits of independent study). May also include any engineering, mathematics, or science courses (see current list) deemed appropriate for CS students. At least two credits must be in CS courses.

Note: These changes will apply to all students who declare CS-ENGR on or after September 1, 2004.

APPENDIX: ABET Verbal Feedback from the Nov. 2-4, 2003 Evaluation of the CS-ENGR and CS-LSA Programs in EECS

CONCERN #1. ABET requires each student to take at least 40 credit hours of CS courses, and we can only guarantee 32 credit hours. Virtually all our students take over 40 credit hours, but we have to prove that 100% of our students take this many by making it a hard requirement.

CONCERN #2. ABET requires 16 credit hours in advanced CS courses, and we can only guarantee 12 credit hours (10 hours of upper level CS tech electives and EESC 496 for 2 credit hours). Many students opt to take math, physics, or IOE courses for the upper level flexible tech electives. Also, our program allows breadth or depth, but some students could choose to have no breadth at all, which violates the spirit of the ABET requirements.

CONCERN #3. ABET requires some exposure to both probability and statistics. This is satisfied with the current Stat 412 and IOE 265 options, but Math 425 and EECS 401 only cover probability theory.

CONCERN #4. The ABET evaluators claimed that our coverage of the theory and concepts of programming languages are not covered sufficiently. Our basic programming courses do cover this to some degree, but quickly move toward a specific language syntax, such as C++.

CONCERN #5. The ABET evaluators did not like the fact that we did not require either programming language theory nor operating systems theory, and that this lack of breadth was a problem.

CONCERN #6. The ABET evaluators felt that while written communications is covered in several of our courses, the sample student work they saw had no detailed evaluation of English in the written papers for EECS courses, only for Tech Comm courses. They would like to see a more strongly graded approach to written work in general.

DEFICIENCY IN THE CS-LSA PROGRAM.
ABET Standards IV-12 and IV-13 require the CS program to "include at least 12 semester hours of science", and it "must include the equivalent of a 2-semester sequence in a laboratory science for science or engineering majors." The current CS-LSA program only requires 7 credits of natural science (NS) and no laboratory courses.

(orig)

Sample Schedule
B.S.E. Computer Science

	Credit Hours	Terms 1	2	3	4	5	6	7	8
Subjects Required by all programs (55 hrs.)									
Mathematics 115, 116, 215, and 216	16	4	4	4	4	-	-	-	-
ENGR 100	4	4	-	-	-	-	-	-	-
ENGR 101	4	-	4	-	-	-	-	-	-
[1]Chemistry 125/130 or Chemistry 210/211	5	5	-	-	-	-	-	-	-
Physics 140 with Lab 141; 240 with Lab 241	10	-	5	5	-	-	-	-	-
Humanities and Social Science	16	4	4	-	4	4	-	-	-
Program Subjects (28 hrs.)									
EECS 203, Discrete Mathematics	4	-	-	4	-	-	-	-	-
EECS 280, Programming and Elem. Data Structures	4	-	-	4	-	-	-	-	-
EECS 281, Data Structures & Algorithms	4	-	-	-	4	-	-	-	-
EECS 370, Intro. to Computer Architecture	4	-	-	-	-	4	-	-	-
[2]EECS 401 or MATH 425 or STAT 412 or IOE 265	3	-	-	-	3	-	-	-	-
EECS 376, Foundations of Computer Science	4	-	-	-	-	-	4	-	-
[3]TCHNCLCM 281	1	-	-	-	1	-	-	-	-
[3]TCHNCLCM 496 and EECS 496	4	-	-	-	-	-	-	4	-
Technical Electives (30 hrs.)									
[4]Flexible Technical Electives	8	-	-	-	-	4	4	-	-
[5]Upper Level CS Electives	10	-	-	-	-	-	-	8	2
[6]Upper Level Flexible Technical Electives	8	-	-	-	-	-	-	-	8
[7]Engineering Breadth Elective	4	-	-	-	-	-	4	-	-
Free Electives (15 hrs.)	15	-	-	-	-	3	4	4	4
Total	**128**	**17**	**17**	**17**	**16**	**15**	**16**	**16**	**14**

[1]***Chemistry:*** Students who qualify are encouraged to take Chem 210 (4 hrs.) & Chem 211 (1 hr.) as a replacement for Chem 130 (3 hrs.) and Chem 125 (2 hrs.).

[2]***Probability/Statistics Course:*** EECS 401 and IOE 265 are 4 credit courses; if one of these is elected, the extra credit is counted toward free electives.

[3]***Technical Communication:*** TCHNCLCM 281 must be taken with EECS 281. TCHNCLCM 496 must be taken with EECS 496 and a Major Design Experience (MDE) course.

[4]***Flexible Technical Electives:*** Computer science courses* at the 300+ level, or approved courses at the 200+ level that are required by a program/concentration in Engineering, Math, or Science. Upper Level CS or Upper Level Flexible Technical Electives can also be used as Flexible Technical Electives. See the EECS Undergraduate Advising Office for the current list.

[5]***Upper Level CS Electives:*** Computer science courses* at the 400-level or higher (excluding EECS 499). This must include at least one Major Design Experience (MDE) course. See the Undergraduate Advising Office for the current list. Preapproved MDE courses include EECS 481, 483, 494, and 497. Other courses may be acceptable with prior approval of the Chief Program Advisor.

[6]***Upper Level Flexible Technical Electives:*** Any Upper Level CS Elective or an approved non-CS course (typically 400+). See the EECS Undergraduate Advising Office for the current list.

[7]***Engineering Breadth Elective:*** a 200-level course required by another program in Engineering or a 300-level course in Engineering that does not revolve around computing.

****Computer Science Courses:*** EECS courses listed in the Computer Science section of the LSA Bulletin.

A maximum of 4 credits of EECS 499 may be applied to Technical Elective Requirements and only in the area of Flexible Technical Electives. Anything beyond 4 credits will be applied toward Free Electives.

Sample Schedule
B.S.E. Computer Science (Proposed)

	Credit Hours	Terms 1	2	3	4	5	6	7	8
Subjects Required by all programs (55 hrs.)									
Mathematics 115, 116, 215, and 216	16	4	4	4	4	-	-	-	-
ENGR 100	4	4	-	-	-	-	-	-	-
ENGR 101	4	-	4	-	-	-	-	-	-
[1]Chemistry 125/130 or Chemistry 210/211	5	5	-	-	-	-	-	-	-
Physics 140 with Lab 141; 240 with Lab 241	10	-	5	5	-	-	-	-	-
Humanities and Social Science	16	4	4	-	4	4	-	-	-
Program Subjects (28 hrs.)									
EECS 203, Discrete Mathematics	4	-	-	4	-	-	-	-	-
EECS 280, Programming and Elem. Data Structures	4	-	-	4	-	-	-	-	-
EECS 281, Data Structures & Algorithms	4	-	-	-	4	-	-	-	-
EECS 370, Intro. to Computer Architecture	4	-	-	-	-	4	-	-	-
[2]MATH 425 or STAT 412 or IOE 265	3	-	-	-	3	-	-	-	-
EECS 376, Foundations of Computer Science	4	-	-	-	-	-	4	-	-
EECS 496, Major Des Experience Professionalism	2	-	-	-	-	-	-	2	-
[3]TCHNCLCM 281	1	-	-	-	1	-	-	-	-
[3]TCHNCLCM 496	2	-	-	-	-	-	-	2	-
Technical Electives (30 hrs.)									
[4]Flexible Technical Electives	14	-	-	-	-	4	4	-	6
[5]Advanced CS Technical Electives	16	-	-	-	-	-	4	8	4
Free Electives (15 hrs.)	15	-	-	-	-	3	4	4	4
Total	**128**	**17**	**17**	**17**	**16**	**15**	**16**	**16**	**14**

[1]***Chemistry:*** Students who qualify are encouraged to take Chem 210 (4 hrs.) & Chem 211 (1 hr.) as a replacement for Chem 130 (3 hrs.), Chem 125 (1 hr.), and Chem 126 (1 hr.)

[2]***Probability/Statistics Course:*** IOE 265 is a 4 credit course; if this is elected, the extra credit is counted toward free electives.

[3]***Technical Communication:*** TCHNCLCM 281 must be taken with EECS 281. TCHNCLCM 496 must be taken with a Major Design Experience (MDE) course.

[4]***Flexible Technical Electives (FTEs):*** Computer science courses* at the 200+ level, or approved courses at the 200+ level that are required by a program/concentration in Engineering, Math, or Science. Advanced CS Technical Electives can also be used as FTEs. See the EECS Undergraduate Advising Office for the current list. At least 2 credits in CS.

[5]***Advanced CS Technical Electives:*** Computer science courses* at the 300-level or higher (excluding EECS 398, 498, 499, 598, 599). This may include an approved Major Design Experience (MDE) course. See the Undergraduate Advising Office for the current list. Preapproved MDE courses include EECS 481, 482, 483, 494, and 497. Other courses may be acceptable with prior approval of the Chief Program Advisor.

****Computer Science (CS) Courses:*** A complete list of CS courses is available in the EECS undergraduate advising office, 3415 EECS.

A maximum of 4 credits of EECS 499 may be applied to Flexible Technical Electives. Anything beyond 4 credits will be applied toward Free Electives.

January 2, 2004

TO: College of Literature, Science, and the Arts Curriculum Committee

FROM: Professor Toby J. Teorey
Chair, Computer Science Curriculum Subcommittee (EECS)

RE: Proposed Changes to the CS-LSA Program

The ABET/CAC accreditation evaluation for Computer Science - LSA (CS-LSA) and Computer Science – Engineering (CS-ENGR) conducted Nov. 2-4, 2003 resulted in six "concerns" for both CS programs, and a "deficiency" for the CS-LSA program. The following proposal explicitly addresses Concerns 1, 2, and 3, while future teaching practices will address Concerns 4, 5, and 6. Our interpretation of the ABET rules is such that we need to modify our programs for at least several of the concerns to assure future accreditation

Part of this proposal (Items 1-4 below) that pertains to both CS-ENGR and CS-LSA was approved by the CSE Faculty (in EECS) on December 12, 2003, and is proceeding to the College of Engineering Curriculum Committee for consideration in January 2004.

The "deficiency" in the CS-LSA program is as follows: ABET Standards IV-12 and IV-13 require all CS programs to "include at least 12 semester hours of science", and it "must include the equivalent of a 2-semester sequence in a laboratory science for science or engineering majors." The current CS-LSA program only requires 7 credits of natural science (NS) and no laboratory courses. Without a correction to this "deficiency" the CS-LSA program cannot be accredited. Item 5 in the proposal addresses this problem.

Responding to this ABET deficiency by imposing the NS laboratory requirement would have at least two effects:
(a) It would definitely reduce the number of technical electives available to LSA students relative to Engineering students (see summary of credits below);
(b) Since the only science areas that have courses that meet the ABET laboratory sequence requirement are the traditional sciences such as the "hard sciences" (and possibly Biology), it could change the make-up of the CS-LSA major population.

That is, this requirement could put barriers in the way of students who want to combine a CS degree with studies in such non-hard-science areas such as Economics, Sociology, Psychology, Linguistics, or Mathematics, all of which have increasing synergies with CS. Many of us feel that this laboratory science requirement is an anachronism that is out of step with the broadening applications of computer technology to a wide variety of fields. Thus item 5 will require discussion about the basic goals of the LSA degree program and consideration of whether the value of an engineering-oriented accreditation is worth the narrowing of the CS program in LSA.

For this reason, we would like your immediate consideration of the changes in Items 1-4, and the beginning of a discussion on Item 5.

PROPOSAL FOR CHANGES IN THE CS-LSA PROGRAM

1. Increase the Upper Level CS Technical Electives from 10 to 16. Change the name to "Advanced CS Tech Electives."

We need to control the use of advanced and well-established CS courses up to 16 credits and not allow any substitutions from other programs. ABET requires 16 credits of upper level CS courses and a minimum of 40 credits of CS courses total.

2. Eliminate the Upper Level Flexible Technical Electives, moving 6 credits to Upper Level CS Technical Electives and 2 credits to Flexible Technical Electives.

There is no longer any need for this category of technical elective. Advanced courses in Math, ECE, IOE, or Physics can still be used for Flexible Technical Elective.

3. Increase the Flexible Technical Electives from 8 to 10 credits. Also, require at least 2 credits of Flexible Technical Electives to be from CS courses at the 200-level or higher, bringing the total CS credits to 40.

This maintains a consistent total of 48 technical credits with the current program, but guarantees 40 credits of required CS courses.

4. Delete EECS 401 as a group option for probability and statistics. This course does not cover statistics and is mainly used by dual majors with CE or EE. Stat 412 and IOE 265 currently cover both probability and statistics, and Math 425 will be offering a 1 credit statistics lab.

5. Within the 10 credits of Flexible Technical Electives, require 5 credits of natural science (NS) in addition to 7 credits of NS already required by LSA – to satisfy ABET 12 credit science requirement (including a sequence of two laboratory science courses).

This is a critical change necessary for ABET/CAC accreditation for CS-LSA.

Summary of Proposed Changes in CS-LSA

Current Requirements

Core CS Requirements	22 credits	(203,280,281,370,376,496)
Upper Level CS Tech Electives	10 credits	
Upper Level Flexible Tech Electives	8 credits	
Flexible Tech Electives	8 credits	
Total technical course credits	48 (total required CS credits is 32)	

Proposed Requirements

Core CS Requirements	22 credits	(EECS 203,280,281,370,376,496)
Advanced CS Tech Electives*	16 credits	
Flexible Tech Electives**	10 credits	(a minimum of 2 must be in CS)
Total technical course credits	48 (total required CS credits is 40)	

*A minimum of 16 credits of advanced CS courses must be chosen from a fixed list of well established courses at the 300, 400, and 500 levels, excluding 398, 498, 598, 499, and 599 (see current list plus EECS 373 and 381).

**May include any 200, 300, 400, or 500 level CS courses, including 398, 498, 598, 499, and 599 (up to 4 credits of independent study). May also include any engineering, mathematics, or science courses (see current list) deemed appropriate for CS students. At least two credits must be in CS courses. Require a minimum of 5 credits of natural science (NS) and a minimum of 2 credits of CS.

Note: These changes will apply to all students who declare CS-LSA on or after September 1, 2004.

Summary of Similar Proposed Changes in CS-ENGR

Current Requirements

Core CS Requirements	22 credits	(203,280,281,370,376,496)
Upper Level CS Tech Electives	10 credits	
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Flexible Tech Electives	8 credits	
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APPENDIX

ABET Verbal Feedback from the Nov. 2-4, 2003 Evaluation of the CS-ENGR and CS-LSA Programs in EECS

CONCERN #1. ABET requires each student to take at least 40 credit hours of CS courses, and we can only guarantee 32 credit hours. Virtually all our students take over 40 credit hours, but we have to prove that 100% of our students take this many by making it a hard requirement.

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CONCERN #5. The ABET evaluators did not like the fact that we did not require either programming language theory nor operating systems theory, and that this lack of breadth was a problem.

CONCERN #6. The ABET evaluators felt that while written communications is covered in several of our courses, the sample student work they saw had no detailed evaluation of English in the written papers for EECS courses, only for Tech Comm courses. They would like to see a more strongly graded approach to written work in general.

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COURSE APPROVAL FORMS

For January 13, 2004 CoE CC Meeting

AOSS 320 (X-Listed with GEO SCI 3200 New Course

AOSS 321 (X-Listed with GEO SCI 321) New Course

AOSS 462 Modification – Changing Pre-Requisites from: AOSS 305 ***to: AOSS 350.***

AOSS 469 (X-Listed with NAME 469) Deletion

AOSS 480 (X-Listed with GEOSCI 480) Deletion

CHE 530 (X-Listed with BIOINFO 530) Modification – Changing Title, Changing Description.

NAME 320 Modification – Changing Pre-Requisites from: ME 211 or ME 240 or permission of instructor ***to: MATH 215 AND ME 211 or ME 240, or permission of instructor.***

NAME 332 Modification – Changing Pre-Requisites from: NA 331 ***to: NA 331 and PHYS 240.***

THE UNIVERSITY OF MICHIGAN – COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number **1212**

Action Requested

- ⊙ New Course
- ○ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Date 11/18/2003
Effective Fall 2004

A. CURRENT LISTING

Home Department | Div # | Course Number

Cross Listed Course Information

Course Title

TITLE ABBRE-VIATION		
	Time Sched Max = 19 Spaces	
	Transcript Max = 20 Spaces	

Course Description

PROGRAM OUTCOMES:
☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements ○ Degree Requirement ○ Tech Elective ● Core Course ○ Other ○ Free Elective

Prerequisites ○ Enforced ○ Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min ____ Max ____
Contact Hrs/Wk ____
Number of Wks ____

B. REQUESTED LISTING

Home Department: Atmospheric, Oceanic, & Space Sciences | Div #: AOSS | Course Number: 320

Cross Listed Course Information: Geological Sciences | GEOSCI | 320

Course Title: Earth Systems Evolution

TITLE ABBRE-VIATION		
	Time Sched Max = 19 Spaces	Earth Sys Evolution
	Transcript Max = 20 Spaces	Earth Sys Evolution

Course Description for Official Publication (Max = 50 words)
Introduction to the physics and chemistry of Earth. Gravitational energy, radiative energy, Earth's energy budget, and Earth tectonics are discussed along with chemical evolution and biogeochemical cycles. The connections among the carbon cycle, silicate weathering, and the natural greenhouse effect are discussed. Required for AOSS/GS-321, which introduces Earth system dynamics.

PROGRAM OUTCOMES:
☒ a ☐ b ☒ c ☐ d ☒ e ☒ f ☒ g ☒ h ☐ i ☒ j ☐ k

Degree Requirements ○ Degree Requirement ○ Tech Elective ● Core Course ○ Other ○ Free Elective

Prerequisites: Chem 130, Math 116 ⊙ Enforced ○ Advised

Credit Restrictions

Level of Credit
☒ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min 4 Max 4
Contact Hrs/Wk 4
Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation:
Is this course repeatable? ○ Yes ○ No
Maximum Hours? ____ Maximum Times? ____
Can it be repeated in the same term? ○ Yes ○ No

Class Type(s) ☒ Lec ☐ Rec ☐ Sem ☐ Lab ☐ Dis ☐ Ind ☐ Other ____

Graded Section ⊙ Lec ○ Rec ○ Sem ○ Lab ○ Dis ○ Ind ○ Other

Grading ☒ A-E ☐ CR/NC ☐ S/U ☐ P/F ☐ Y

Location ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Printing Information (Optional) ☒ Print the course in the Bulletin ☒ Print the course in the Time Schedule

Terms & Freq. of Offering ■ I ☐ II ☐ IIIa ☐ IIIb ☐ III ■ Yearly ☐ Alter Years ☐ Even Years ☐ Odd Years
Half term ☐ 1st ☐ 2nd

Cognizant Faculty Member: John R. Barker, Henry Pollack - GS | Title: Professor, Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval
☐ Curriculum Comm.
☐ Faculty
☐ Rackham
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ■ Home Dept. ☐ Cross-listed Dept.
Name, Signature & Department
Home Dept. AOSS Perry Samson
Cross-listed Dept(s). GS

Form Number

1212

SUPPORTING STATEMENT

The course will be conducted with three 1-hour lectures each week, plus a Recitation Section which occasionally will be used to conduct a laboratory. Most of the time, the Recitation Section will be used to review and emphasize important concepts presented in the lecture, as well as to facilitate work by teams on team projects.

Grading will be based on two mid-term exams, a final Exam and a team project, which will include preparing a poster presentation. Homework exercises will be assigned but not graded; solutions will be distributed and discussed in the Recitation Section.

The material will be presented at a level consistent with the textbooks by Richard Turco ("Earth Under Seige", Oxford university Press, 1997), Kump et al. ("The Earth System", Prentice Hall, 1999), and William Ruddiman ("Earth's Climate, Past and Future", W. H. Freeman, 2001). Additional lecture and laboratory materials will be developed by the instructors to emphasize quantitative concepts and ongoing research related to earth systems science.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

Course Outline (Weekly)

1) Accretion of Earth. Heat gains, heat losses, time scales.

2) Broad differentiation of Earth, segregation of metal and silicate into mantle and core.

3) Early atmosphere: chemical considerations: H2O, CH4, CO2, noble gases and relevance to early greenhouse.

4) Stellar evolution, solar radiation through time, faint early sun. and the compensating greenhouse effect

5) Radiative energy balance and earth's surface temperature: transition of control from internal energy to solar energy.

6) Late stage impacts, origin of the moon, blow-off of early atmosphere; loss of volatiles from Earth's interior, development of a new atmosphere.

7) Continued differentiation: creation of continental crust and ocean basins.

8) Plate tectonics and the cooling of Earth; evolution of lithospheric plate size and thickness.

9) Life and the influence of oxygen on weathering and on the atmosphere and oceans; oxidation potentials and equilibrium constants

10) The Carbon Cycle and evolution from domination by methane to domination by carbon dioxide; effects of the coupled carbonate-silicate biogeochemical cycle.

11) Biosphere Connections to the atmosphere, oceans, and lithosphere

12) The Greenhouse Effect; radiative energy balance, feedback mechanisms, and links to the carbon cycle.

13) Atmospheric Chemical Cycles.

14) Recap of Biogeochemical and Atmospheric Cycles

Course Outcomes

a) The course will begin the process of teaching students how to synthesize their knowledge in order to understand a complex system.

b) Some of the course will be concerned with interpreting earth systems data.

c) this is not a design course, but students will be introduced to formulating models of radiative energy balance (e.g. weeks 5 and 12).

d) Students will participate in teams on the team project.

e) In this beginning course, formulation of problems and solutions will be introduced.

f) The importance of science and engineering in solving societal problems will be a theme of this whole program. This will help to convey the responsibilities of scientists and engineers.

g) Students will work together to prepare poster presentations.

h) The importance of science and engineering in solving societal problems will be a theme of this whole program. (See (f).)

i) The fact that this is a rapidly evolving field emphasizes that students need to develop general skills for a life of learning.

j) See (f) and and (h).

k) This course is only a starting point for developing engineering skills and tools.

THE UNIVERSITY OF MICHIGAN – COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number **1203**

Action Requested

- ⊙ New Course
- ○ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Date 11/5/2003
Effective Fall 2004

A. CURRENT LISTING

Home Department | Div # | Course Number

Cross Listed Course Information

Course Title

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	
	Transcript Max = 20 Spaces	

Course Description

PROGRAM OUTCOMES:
☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

Prerequisites ○ Enforced ○ Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min Max
Contact Hrs/Wk
Number of Wks

B. REQUESTED LISTING

Home Department: Atmospheric, Oceanic, & Space Sciences | Div #: AOSS | Course Number: 321

Cross Listed Course Information: Geological Sciences | GEOSCI | 321

Course Title: Earth System Dynamics

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	Earth System Dynam
	Transcript Max = 20 Spaces	Earth System Dynam

Course Description for Official Publication (Max = 50 words)
This course will describe the major wind systems and ocean currents that are important to climate studies. The primary equations will be developed and simple solutions derived that will explain many of these motions. The relations among the dynamics and other parameters in the climate system will be illustrated by examples from both paleo and present day systems.

PROGRAM OUTCOMES:
☒ a ☐ b ☐ c ☐ d ☒ e ☐ f ☐ g ☐ h ☐ i ☒ j ☒ k

Degree Requirements ○ Degree Requirement ○ Tech Elective ⊙ Core Course ○ Other ○ Free Elective

Prerequisites Math 216 ⊙ Enforced ○ Advised

Credit Restrictions

Level of Credit
☒ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min 4 Max 4
Contact Hrs/Wk 4
Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation:
Is this course repeatable? ○ Yes ⊙ No
Maximum Hours? ..... Maximum Times? .....
Can it be repeated in the same term? ○ Yes ○ No

Class Type(s) ☒ Lec ☐ Rec ☐ Sem ☐ Lab ☐ Dis ☐ Ind ☐ Other ____

Graded Section ⊙ Lec ○ Rec ○ Sem ○ Lab ○ Dis ○ Ind ○ Other

Grading ☒ A-E ☐ CR/NC ☐ S/U ☐ P/F ☐ Y

Location ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Printing Information (Optional) ☒ Print the course in the Bulletin ☒ Print the course in the Time Schedule

Terms & Freq. of Offering ☐ I ■ II ☐ IIIa ☐ IIIb ☐ III ■ Yearly ☐ Alter Years ☐ Even Years ☐ Odd Years

Half term ☐ 1st ☐ 2nd

Cognizant Faculty Member: Joyce Penner AOSS — Title: Professor
Chris Poulsen Geological Sciences — Assistant Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval
☐ Curriculum Comm.
☐ Faculty
☐ Rackham
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ■ Home Dept. ☐ Cross-listed Dept.
Name, Signature & Department
Home Dept. AOSS Perry Samson
Cross-listed Dept(s). GEOSCI

Form Number

1203

SUPPORTING STATEMENT

This course is the second of a two semester sequence in the core of AOSS. it also serves to introduce the students to Earth System Science and Engineering, a new program being jointly developed by the Engineering College (through AOSS) and the College of Literature, Science and the Arts (through Geological Sciences).

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

Course Objectives, i.e., the instructor should

1. Review the relevant physics to prepare the students to understand the dynamics of the oceans and atmosphere.
2. Describe the wind and current systems.
3. Analyze the equation of motion appropriate to the atmosphere and oceans.
4. Introduce and justify approximations to the equation of motion allowing simple solutions to be developed for the winds and currents.
5. Show how present day and paleo climate problems are affected by large scale winds and currents.

Course Outcomes, i.e. the student should

1. Be familiar with the directions and speeds and names of the large scale winds and ocean currents, including both surface and thermocline currents.
2. Be able to explain how the winds and currents are produced.
3. Be able to explain how these winds and currents affect climate.
4. Understand the derivations of the equations explaining the winds and currents and be able to solve simple problems.
5. Be able to describe the natural variability of the climate system.

Assessment Tools

Two mid-Term Exams
Homework Assignments
Final Exam

Topics for new class, Earth Systems Dynamics

This course will build on the material learned in Earth System Evolution and will emphasize "motion" in the Earth system, i.e., winds and currents and how they affect climate. To this end, it is necessary to know how pressure, temperature and density vary in both systems and simple relationships among these variables.

Week 1: Static descriptions of the atmosphere and oceans: pressure, density, temperature, ideal gas law, hydrostatic equilibrium

What causes the large scale winds and currents? Primarily the Earth's rotation, solar radiation, and density gradients

Week 2: Review of Earth's rotation and how it has changed over geologic time. Why does the Earth rotate? Recap of radiation from 1st term: Beer's law, Blackbody radiation; Absorption, reflection and transmission; Earth's radiation budget; Sensible and latent heats; dry and moist lapse rate; buoyancy; air and water masses; simple climate model and climate sensitivity

What are the major wind systems and ocean currents? This section helps us to understand what we are trying to explain with the analysis to follow.

Week 3: Description of the major wind systems and ocean currents (surface and thermohaline) and simple explanations. How do they influence regional climate?

What do the equations look like that will allow us to explain the winds and currents? How can we simplify these equations to arrive at solutions that will approximate the motions that we observe?

Week 4: Equations of motion and the forcings (advection, pressure gradient, centrifugal, Coriolis, turbulent drag

Week 5 through 8: Elementary solutions applicable to both the oceans and atmosphere: Geostrophic flow, Gradient flow, Thermal wind and Density currents, Ekman motion

Of major concern is the transport of heat from the equator to the pole by both the atmosphere and oceans. How is this accomplished?

Week 9 through 11: Differential heating; heat and momentum transport; Jet stream; westward intensification of ocean currents; Barotropic instability and Rossby waves; Baroclinic Instability and Planetary waves

How does the climate system vary naturally?

Week 12 through 14: seasonal, annual, century (ENSO, NPO, NAO, etc.; changes with projected climate change) - millennial to Milankovitch and BYA. - tectonic: gateways, barriers, high plateaus

THE UNIVERSITY OF MICHIGAN – COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Print

Form Number 1277

Action Requested

- ○ New Course
- ◉ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Date 1/5/2004
Effective Fall 2004

A. CURRENT LISTING

Home Department | Div # | Course Number

Cross Listed Course Information

Course Title

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	
	Transcript Max = 20 Spaces	

Course Description

PROGRAM OUTCOMES:
☐a ☐b ☐c ☐d ☐e ☐f ☐g ☐h ☐i ☐j ☐k

Degree Requirements ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

X Prerequisites AOSS 305
○ Enforced ○ Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min Max

Contact Hrs/Wk ____ Number of Wks ____

C. Repeatability (Indi Research, Dir. Study, Dissertation:
Is this course repeatable? ○ Yes ⊙ No
Maximum Hours? ____ Maximum Times? ____
Can it be repeated in the same term? ○ Yes ○ No

Class Type(s) ☒ Lec ☐ Rec ☐ Sem ☒ Lab ☐ Dis ☐ Ind ☐ Other ____

Graded Section ⊙ Lec ○ Rec ○ Sem ○ Lab ○ Dis ○ Ind ○ Other ____

Grading ☒ A-E ☐ CR/NC ☐ S/U ☐ P/F ☐ Y

Location ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

B. REQUESTED LISTING

Home Department: Atmospheric, Oceanic and Space Sciences | Div #: AOSS | Course Number: 462

Cross Listed Course Information

Course Title: Instrumentation for atmospheric and Space Sciences

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	Instruments ATM SPA
	Transcript Max = 20 Spaces	Instruments ATM SPA

Course Description for Official Publication (Max = 50 words)
Introduction to fundamentals of atmospheric, space-based, and meteorological instrumentation. Includes basics of electronic sensors, optics, lasers, radar, data acquisition/management, error analysis, and data presentation. Consists of two lectures and one lab each week, and a team-based term project.

PROGRAM OUTCOMES:
☒a ☐b ☐c ☒d ☒e ☐f ☒g ☐h ☐i ☒j ☒k

Degree Requirements ○ Degree Requirement ○ Tech Elective ⊙ Core Course ○ Other ○ Free Elective

Prerequisites AOSS 350
○ Enforced ⊙ Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☒ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min 4 Max 4

Contact Hrs/Wk 5 Number of Wks 14

Printing Information (Optional) ☒ Print the course in the Bulletin ☒ Print the course in the Time Schedule

Terms & Freq. of Offering ☐ I ■ II ☐ IIIa ☐ IIIb ☐ III ■ Yearly ☐ Alter Years ☐ Even Years ☐ Odd Years

Half term ☐ 1st ☐ 2nd

Cognizant Faculty Member: Perry Samson Title Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval
☐ Curriculum Comm. ____
☐ Faculty ____
☐ Rackham ____
☐ Cross listed Unit 1 ____
☐ Cross listed Unit 2 ____

Submitted By: ■ Home Dept. ☐ Cross-listed Dept.
Name, Signature & Department
Home Dept. AOSS Perry Samson
Cross-listed Dept(s). ____

Form Number

1277

SUPPORTING STATEMENT

AOSS 305 was eliminated as part of AOSS redesign, material integrated into other courses which included AOSS 350.

Are any special resources or facilities required for this course? ☐ Yes ☐ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN – COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number **1256**

Action Requested

- ○ New Course
- ○ Modification of Existing Course
- ⊙ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Date 12/8/2003
Effective Fall 2004

A. CURRENT LISTING

Home Department: Atmospheric, Oceanic, & Space Sciences — Div #: AOSS — Course Number: 469

Cross Listed Course Information: NAME — NAME 469

Course Title: Underwater Operations

TITLE ABBREVIATION		
Time Sched Max = 19 Spaces	Underwater Ops
Transcript Max = 20 Spaces	Underwater Ops

Course Description:
Survey of manned undersea activities in oceanography and ocean engineering. The tools of underwater operations; decompression chambers, habitats, submarines, diving apparatus; pertinent design criteria and applications as based on human hyperbaric physiology and performance. Topics in research diving for engineering and ocenographic students.

PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

Prerequisites ○ Enforced ⊙ Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☒ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min 3 Max 3
Contact Hrs/Wk 3
Number of Wks 14

C. Repeatability (Indi Research, Dir. Study, Dissertation:
Is this course repeatable? ○ Yes ⊙ No
Maximum Hours? ..... Maximum Times? .....
Can it be repeated in the same term? ○ Yes ○ No

Class Type(s) ☒ Lec ☐ Rec ☐ Sem ☐ Lab ☐ Dis ☐ Ind ☐ Other ____

Graded Section ⊙ Lec ○ Rec ○ Sem ○ Lab ○ Dis ○ Ind ○ Other

Grading ☒ A-E ☐ CR/NC ☐ S/U ☐ P/F ☐ Y

Location ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

B. REQUESTED LISTING

Home Department — Div # — Course Number

Cross Listed Course Information

Course Title

TITLE ABBREVIATION	
Time Sched Max = 19 Spaces	
Transcript Max = 20 Spaces	

Course Description for Official Publication (Max = 50 words)

PROGRAM OUTCOMES: ☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

Prerequisites ○ Enforced ○ Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min ___ Max ___
Contact Hrs/Wk ___
Number of Wks ___

Printing Information (Optional) ☒ Print the course in the Bulletin ☒ Print the course in the Time Schedule

Terms & Freq. of Offering ☐ I ■ II ☐ IIIa ☐ IIIb ☐ III ■ Yearly ☐ Alter Years ☐ Even Years ☐ Odd Years

Half term ☐ 1st ☐ 2nd

Cognizant Faculty Member: Lee Somers — Title: Lecturer

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval
☐ Curriculum Comm.
☐ Faculty
☐ Rackham
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ■ Home Dept. ☐ Cross-listed Dept.
Name, Signature & Department
Home Dept. AOSS Perry Samson
Cross-listed Dept(s). NAME

Form Number

1256

SUPPORTING STATEMENT

Instructor has retired

Are any special resources or facilities required for this course? ☐ Yes ☐ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN – COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number **1205**

Action Requested

- ○ New Course
- ○ Modification of Existing Course
- ◉ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Date 11/6/2003
Effective Spring-Summer

A. CURRENT LISTING

Home Department: Atmospheric, Oceanic, & Space Sciences — Div #: 241 — Course Number: 480

Cross Listed Course Information: Geological Sciences — 377 — 480

Course Title: The Planets: Compsition, Structure and Evolution

TITLE ABBREVIATION		
Time Sched Max = 19 Spaces	The Planets
Transcript Max = 20 Spaces	The Planets

Course Description:
Origin and distribution of material in the solar system, gross composition and radial distribution of material in the planets and satellites; gravity fields and their relationship to shape and internal density distribution magnetism; origin and significance of surface topography; thermal, ionospheric and extended structure of planetary atmospheres; energetics and dynamics of planetary interiors and atmospheres, thermal histories and evolution of solid interiors, devolatilization, origin and evolution of atmospheres.

PROGRAM OUTCOMES:
☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

Prerequisites ○ Enforced ○ Advised

Credit Restrictions

Level of Credit
☒ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours: Min 3 — Max 3
Contact Hrs/Wk 3
Number of Wks 14

B. REQUESTED LISTING

Home Department — Div # — Course Number

Cross Listed Course Information

Course Title

TITLE ABBREVIATION	
Time Sched Max = 19 Spaces	
Transcript Max = 20 Spaces	

Course Description for Official Publication (Max = 50 words)

PROGRAM OUTCOMES:
☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

Prerequisites ○ Enforced ○ Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours: Min — Max
Contact Hrs/Wk
Number of Wks

C.

Repeatability (Indi Research, Dir. Study, Dissertation:
Is this course repeatable? ○ Yes ◉ No
Maximum Hours? ..... Maximum Times? .....
Can it be repeated in the same term? ○ Yes ○ No

Class Type(s) ☒ Lec ☐ Rec ☐ Sem ☐ Lab ☐ Dis ☐ Ind ☐ Other ____

Graded Section ◉ Lec ○ Rec ○ Sem ○ Lab ○ Dis ○ Ind ○ Other _

Grading ☒ A-E ☐ CR/NC ☐ S/U ☐ P/F ☐ Y

Location ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Printing Information (Optional) ☒ Print the course in the Bulletin ☒ Print the course in the Time Schedule

Terms & Freq. of Offering ☐ I ■ II ☐ IIIa ☐ IIIb ☐ III ■ Yearly ☐ Alter Years ☐ Even Years ☐ Odd Years

Half term ☐ 1st ☐ 2nd

Cognizant Faculty Member: Sushil Atreya — Title: Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval
☐ Curriculum Comm.
☐ Faculty
☐ Rackham
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ■ Home Dept. ☐ Cross-listed Dept.
Name, Signature & Department
Home Dept. AOSS Perry Samson
Cross-listed Dept(s). GEO SCI

Form Number

1205

SUPPORTING STATEMENT

Eliminated as part of AOSS redesign, material integrated into other courses.

Are any special resources or facilities required for this course? ☐ Yes ☐ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Form Number **1197**

Action Requested

- ○ New Course
- ⊙ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Date 10/27/2003
Effective Fall 2004

A. CURRENT LISTING

Home Department: Chemical Engineering | Div #: | Course Number: 530

Cross Listed Course Information: Bioinformatics 530

X Course Title: Bioinformatics and Gene Expression - Data Warehousing and Data Mining Perspectives

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	BIOINFO & GENE EXP DW
	Transcript Max = 20 Spaces	Bioinfo & Gene Exp DW

X Course Description:
This course is designed for students interested in learning basics of the rich data emanating from recent genomic and high throughput expression technologies. Introductory background on molecular biology, algorithms, and expression technologies will be covered. The focus of this course will be relating gene expression data to biological functions drug discovery. Issues in building enterprise data warehouse and data mining tools will also be discussed.

PROGRAM OUTCOMES:
☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements: ○ Degree Requirement ⊙ Tech Elective ○ Core Course ○ Other ○ Free Elective

Prerequisites: ○ Enforced ⊙ Advised

Credit Restrictions

Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☐ All Credit types ☐ Rckhm Grad w/add'l Work

Credit Hours: Min ___ Max ___ | Contact Hrs/Wk ___ | Number of Wks ___

C. Repeatability (Indi Research, Dir. Study, Dissertation:
Is this course repeatable? ○ Yes ⊙ No
Maximum Hours? ___ Maximum Times? ___
Can it be repeated in the same term? ○ Yes ○ No

Class Type(s): ☒ Lec ☐ Rec ☐ Sem ☒ Lab ☒ Dis ☐ Ind ☐ Other ___

Graded Section: ⊙ Lec ○ Rec ○ Sem ○ Lab ○ Dis ○ Ind ○ Other

Grading: ☒ A-E ☐ CR/NC ☐ S/U ☐ P/F ☐ Y

Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

B. REQUESTED LISTING

Home Department: Chemical Engineering | Div #: CHE | Course Number: 530

Cross Listed Course Information: Bioinformatics 530

Course Title: Introduction to Bioinformatics, Systems Biology and Predictive Modeling

TITLE ABBREVIATION		
	Time Sched Max = 19 Spaces	INTRO BIOINF SYS BIO
	Transcript Max = 20 Spaces	Intro Bioinf Sys Bio

Course Description for Official Publication (Max = 50 words):
This course introduces the characteristics of genomic and other high throughput expression technologies. Background on molecular biology, algorithms and relational databases will be covered and the focus will be (i) Relationship between emerging technology data and biological functions and (ii) Application of systems biology and predictive modeling in drug discovery.

PROGRAM OUTCOMES:
☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements: ○ Degree Requirement ⊙ Tech Elective ○ Core Course ○ Other ○ Free Elective

Prerequisites: ○ Enforced ○ Advised

Credit Restrictions

Level of Credit: ☐ Undergrad only ☐ Rackham Grad ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad ☒ All Credit types ☐ Rckhm Grad w/add'l Work

Credit Hours: Min 3 Max 3 | Contact Hrs/Wk 3 | Number of Wks 14

Printing Information (Optional): ☒ Print the course in the Bulletin ☒ Print the course in the Time Schedule

Terms & Freq. of Offering: ■ I ☐ II ☐ IIIa ☐ IIIb ☐ III | Half term ☐ 1st ☐ 2nd
■ Yearly ☐ Alter Years ☐ Even Years ☐ Odd Years

Cognizant Faculty Member: Ronald Larson, Chemical Engineering — Title: Chair
David States (Bioinformatics) — Director

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval
☐ Curriculum Comm.
☐ Faculty
☐ Rackham
☐ Cross listed Unit 1

Submitted By: ■ Home Dept. ☐ Cross-listed Dept.
Name, Signature & Department
Home Dept: Ronald Larson, Chemical Engineering
Cross-listed Dept(s): David States (Bioinformatics)

☐ Cross listed Unit 2

Form Number

1197

SUPPORTING STATEMENT

We would like to change the title and scope of this course because the focus of bioinformatics research has shifted toward "Systems Biology" in recent years. Two recent announcements from MIT (http://web.mit.edu/newsoffice/nr/2003/nih.html) and Harvard (http://www.sciencedaily.com/releases/2003/09/030924054642.htm) exemplified this trend. Some of the new material proposed for this course was included in a 2003 U-M bioinformatics short course in July and the feedback was very positive.

The instructor uses recent journal articles and other publications rather than a textbook due to the rapid-changing research landscape in this area of study.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements

Course name of ChE 530 / Bioinf 530:

Introduction to Bioinformatics, Systems Biology and Predictive Modeling

Description:

This course, ChE 530 / Bioinf 530, is designed for graduate students interested in learning basics of the rich data sets emanating from recent genomic and other high throughput expression technologies, and their relevance in modern drug discovery. Introductory background on molecular biology, algorithms, various emerging technologies and relational databases will be covered and the focus of this course will be (i) Relationship between emerging technology data and biological functions and (ii) Application of systems biology and predictive modeling in drug discovery. For Bioinformatics and Chemical Engineering students, not only they can learn up-to-date emerging technologies that have changed the fundamentals of biomedical research and drug discovery, but also acquire necessary scientific knowledge and professional skills for their career advancement.

1) **Tentative syllabus:**

a) Course introduction b) Molecular biology primer	Week #1 (9/4)
c) Algorithm primer	Week #2 (9/11)
d) Resources (databases and tools) for Bioinformatics, Gene Expression, Systems Biology and Predictive Modeling e) Introduction of emerging technologies (I) i) RNA profiling[1]	Week #3 (9/18)
f) Introduction of emerging technologies (II) i) Proteomics[2] ii) Metabonomics / Metabolomics	Week #4 (9/25)
g) Data mining and Systems Biology	
i) Data characteristics and dimensions ii) Pattern recognition and unsupervised classification[3]	Week #5 (10/2)
iii) **Pattern recognition and supervised classification[4]**	Week #6 (10/9)
iv) Computer Lab / Data mining[5]	Week #7 (10/16)
v) Database primer, data warehousing and data mining	Week #8 (10/23)
vi) Biological pathways and functional annotation	Week #9 (10/30)
vii) Systems biology and complex system modeling[3]	Week #10 (11/6)
h) Special topical discussion	
i) ***In silico* drug discovery: Predictive ADME/Tox Modeling[4]** ii) Systems biology and drug discovery (TBD) iii) Information technology, high performance computing and drug discovery (TBD) iv) Object technology in Life Science research (TBD)	Week #11 (11/13)
i) Term paper discussion / presentation (I)	Week #12 (11/20)
j) Thanksgiving break	Week #13 (11/27)
k) Term paper discussion / presentation (II)	Week #14 (12/4)

2) **Time: 4:30-7:30 pm Thursday**
3) **Classroom: 3150 DOW**
4) **TA/GSI office hour:**
   a) Mr. Yu Chen (Ph. 647-2340)
   b) 3:00 – 5:00 pm, Tuesday & 1:00 – 3:00 pm Thursday
   c) 5631 Medical Science II (Medical campus, Bioinformatics computer lab)

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[1] Guest lecturer: Dr. Steven Madore, Group leader, Expression Profiling Group, Pfizer Global R & D
[2] Guest lecturer: Dr. Joseph Paulauskis, Director, Genomic Pathology, Pfizer Global R & D
[3] Major revision in 2003
[4] New in 2003
[5] **5631 Medical Science II (Medical campus, Bioinformatics computer lab)**

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Print

Form Number 1280

Action Requested

- ○ New Course
- ◉ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Date 1/5/2004
Effective Fall 2004

A. CURRENT LISTING

Home Department | Div # | Course Number

Cross Listed Course Information

Course Title

TITLE ABBREVIATION: Time Sched (Max = 19 Spaces) / Transcript (Max = 20 Spaces)

Course Description

PROGRAM OUTCOMES:
☒ a ☐ b ☐ c ☐ d ☒ e ☐ f ☒ g ☐ h ☐ i ☒ j ☒ k

Degree Requirements ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

X Prerequisites ME 211 or ME 240, or permission of instructor.
○ Enforced ○ Advised

Credit Restrictions

Level of Credit
☐ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min ____ Max ____
Contact Hrs/Wk 4
Number of Wks 14

B. REQUESTED LISTING

Home Department: Naval Arcitecture and Marine Engineering | Div #: 284 | Course Number: 320

Cross Listed Course Information

Course Title: Marine Hydrodynamics I

TITLE ABBREVIATION: Time Sched (Max = 19 Spaces): Marine Hydro I; Transcript (Max = 20 Spaces): MAR HYDR I

Course Description for Official Publication (Max = 50 words)
Concepts and basic equations of marine hydrodynamics. Similitude and dimensional analysis, basic equations in integral form, continuity, and Navier-Stokes equations. Ideal fluid flow, Euler's equations, Bernoulli equation, free surface boundary value problems. Laminar and turbulent flows in pipes and around bodies.

PROGRAM OUTCOMES:
☒ a ☐ b ☐ c ☐ d ☒ e ☐ f ☒ g ☐ h ☐ i ☒ j ☒ k

Degree Requirements ◉ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

Prerequisites MATH 215, and ME 211 or ME 240, or permission of instructor.
◉ Enforced ○ Advised

Credit Restrictions

Level of Credit
☒ Undergrad only ☐ All Credit types
☐ Rackham Grad ☐ Rckhm Grad w/add'l Work
☐ Non-Rckhm Grad
☐ Ugrad or Rckhm Grad
☐ Ugrad or Non-Rckhm Grad

Credit Hours Min 4 Max 4
Contact Hrs/Wk 4
Number of Wks 14

C.

Repeatability (Indi Research, Dir. Study, Dissertation):
Is this course repeatable? ○ Yes ◉ No
Maximum Hours? ____ Maximum Times? ____
Can it be repeated in the same term? ○ Yes ○ No

Printing Information (Optional)
☒ Print the course in the Bulletin
☒ Print the course in the Time Schedule

Class Type(s) ☒ Lec ☐ Rec ☐ Sem ☐ Lab ☐ Dis ☐ Ind ☐ Other ____

Graded Section ◉ Lec ○ Rec ○ Sem ○ Lab ○ Dis ○ Ind ○ Other

Grading ☒ A-E ☐ CR/NC ☐ S/U ☐ P/F ☐ Y

Location ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

Terms & Freq. of Offering ■ I ☐ II ☐ IIIa ☐ IIIb ☐ III
■ Yearly ☐ Alter Years ☐ Even Years ☐ Odd Years
Half term ☐ 1st ☐ 2nd

Cognizant Faculty Member: Marc Perlin **Title** Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval
☐ Curriculum Comm.
☐ Faculty
☐ Rackham
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ■ Home Dept. ☐ Cross-listed Dept.
Name, Signature & Department
Home Dept. Michael G. Parsons, NA&ME
Cross-listed Dept(s).

Form Number

1280

SUPPORTING STATEMENT

To more accurately reflect the background required by students for this subject. The third semester of calculus is needed.

Are any special resources or facilities required for this course? ☐ Yes ☐ No

Detail the Special requirements

THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING
Course Approval Request
College Curriculum Committee, 1420 Lurie Engineering Center Building

Print

Form Number 1279

Action Requested

- ○ New Course
- ◉ Modification of Existing Course
- ○ Deletion of Course

Complete the following sections:
New Courses - B & C completely
Modifications - A modified information, B & C completely
Deletions - A & C completely

Date 1/5/2004
Effective Winter 2004

A. CURRENT LISTING

Home Department | Div # | Course Number

Cross Listed Course Information

Course Title: Marine Electrical Engineering

TITLE ABBREVIATION — Time Sched (Max = 19 Spaces): | Transcript (Max = 20 Spaces):

Course Description

PROGRAM OUTCOMES:
☐ a ☐ b ☐ c ☐ d ☐ e ☐ f ☐ g ☐ h ☐ i ☐ j ☐ k

Degree Requirements: ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

X Prerequisites: NA 331 ○ Enforced ○ Advised

Credit Restrictions

Level of Credit: ☐ Undergrad only ☐ All Credit types ☐ Rackham Grad ☐ Rckhm Grad w/add'l Work ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad

Credit Hours Min | Max

Contact Hrs/Wk ____ Number of Wks ____

C. Repeatability (Indi Research, Dir. Study, Dissertation:
Is this course repeatable? ○ Yes ○ No
Maximum Hours? ____ Maximum Times? ____
Can it be repeated in the same term? ○ Yes ○ No

Class Type(s): ☒ Lec ☐ Rec ☐ Sem ☐ Lab ☐ Dis ☐ Ind ☐ Other

Graded Section: ○ Lec ○ Rec ○ Sem ○ Lab ○ Dis ○ Ind ○ Other

Grading: ☒ A-E ☐ CR/NC ☐ S/U ☐ P/F ☐ Y

Location: ☒ Ann Arbor ☐ Biological Station ☐ Camp Davis ☐ Extension

B. REQUESTED LISTING

Home Department: Naval Architecture & Marine Engineering | Div #: 284 | Course Number: 332

Cross Listed Course Information

Course Title

TITLE ABBREVIATION — Time Sched (Max = 19 Spaces): Mar Electric Engin | Transcript (Max = 20 Spaces): Mar Electrical Engin

Course Description for Official Publication (Max = 50 words)
Electrical circuit analysis. Electromagnetic interactions. Principles, characteristics, and properties of transformers, and DC and AC motors. Power electronics. Integrated marine electrical plants. Electrical power distribution, and control. Circuit protection. Introduction to fuel cells.

PROGRAM OUTCOMES:
☒ a ☐ b ☒ c ☐ d ☒ e ☐ f ☐ g ☐ h ☐ i ☒ j ☒ k

Degree Requirements: ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other ○ Free Elective

Prerequisites: NA 331, PHYS 240 ○ Enforced ○ Advised

Credit Restrictions

Level of Credit: ☒ Undergrad only ☐ All Credit types ☐ Rackham Grad ☐ Rckhm Grad w/add'l Work ☐ Non-Rckhm Grad ☐ Ugrad or Rckhm Grad ☐ Ugrad or Non-Rckhm Grad

Credit Hours Min: 3 | Max: 3

Contact Hrs/Wk: 3 Number of Wks: 14

Printing Information (Optional): ☒ Print the course in the Bulletin ☒ Print the course in the Time Schedule

Terms & Freq. of Offering: ☐ I ■ II ☐ IIIa ☐ IIIb ☐ III ■ Yearly ☐ Alter Years ☐ Even Years ☐ Odd Years

Half term: ☐ 1st ☐ 2nd

Cognizant Faculty Member: Jing Sun Title: Associate Professor

Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty

Approval
☐ Curriculum Comm.
☐ Faculty
☐ Rackham
☐ Cross listed Unit 1
☐ Cross listed Unit 2

Submitted By: ■ Home Dept. ☐ Cross-listed Dept.
Name, Signature & Department
Home Dept. Michael G. Parsons, NA&ME
Cross-listed Dept(s).

Form Number

1279

SUPPORTING STATEMENT

To more accurately reflect the background required by students for this subject. Introduction to electricity and magnetism is needed for the course.

Are any special resources or facilities required for this course? ☐ Yes ☒ No

Detail the Special requirements