#### The University of Michigan College of Engineering Curriculum Committee

Agenda
March 4, 2003
1:30-3:30 p.m.
GM ROOM
Fourth Floor Lurie Engineering Center

- 1. Approval of Minutes from March 4, 2003 Meeting
- 2. ME Thermal/Fluids/Heat Transfer Sequence Greg Hulbert
- 3. Report on Data to Support Undergraduate Curriculum Decision Making Jeanne Murabito and Honor Passow
- 4. Professional Outcome Reports Brief Discussion
- 5. Chemical Engineering Items Information Only
- 6. Course Approval Forms

## University of Michigan College of Engineering Curriculum Committee Meeting Tuesday February 11, 2003 1:30-3:00 p.m. Lurie Engineering Center GM Room Minutes

Armin Troesch called the meeting to order at 1:45 p.m.

Members Present: A. Troesch, J. Fessler, P. Friedmann W. Hansen, G. Herrin, J.Holloway, G.Hulbert, H. Peng, S.Montgomery, R. Robertson S. Takayama, G.Tyson

Members Absent, V. Chung, S. Pang, P. Samson (AOSS),

Guest: Bill Kuhn (AERO)

#### Motion to approve the minutes of the last meeting

Regarding ENG 195 it was noted to change the wording from: Guy Meadows (who teaches one of the sections of Engineering 195) to Guy Meadows (who is associated with Engineering 195).

The minutes of the last meeting were approved

#### Proposal for New SGUS Program in AOSS - Sample Schedule

Bill Kuhns (Graduate Program Advisor) talked about his handout – Sample AOSS Schedule – which was requested at the last meeting, since Perry Samson had been called out of town. Armin Troesch asked for a motion to approve this Program with what was presented last week and this week.

Motion carried (approved).

#### **HU/SS Proposed Revisions – Jeanne Murabito**

Jeanne Murabito handed out the proposed wording for HU/SS. Jeanne noted that at the last meeting, Susan Montgomery had brought up some changes from the College of Engineering/LS&A joint meeting. The first change is that American Culture and Classical Studies were moved up to the Humanities (per LS&A's suggestion). The other two changes were under Definitions and Exceptions: that numbers 1 and 2 supercede number 3. Jeanne noted that if there were no objections, this revision will be going into the next College of Engineering Bulletin. Susan Montgomery wanted to change numbers 1 and 2 to read: Any courses designated as HU or SS, regardless of any additional designation. Jeanne noted that this would be clearer. It was agreed that the Committee will understand it this way, and more importantly, the students will understand this better.

In number 3, the first sentence will be changed to: Courses not covered by 1 and/or 2 that are designated . . .

Armin Troesch asked for a motion to approve this new wording.

Armin noted that this is not a change in policy, but a clarification. **Motion carried (approved.)** 

#### Professional Outcomes - Jeanne Murabito

Jeanne Murabito passed out 2 handouts (Data to Support Undergraduate Curricular Decision Making, and Response to Questions) in addition to the Professional Outcomes Reports (one to each department representative). These Professional Outcomes Reports were what each department submitted last year.

Since Jeanne Murabito and Armin Troesch are turning in a report to Levi Thompson within a month, Jeanne needs any changes back by March 3. Jeanne will also be sending each department representative an electronic copy of their Professional Outcomes Report either today or tomorrow. Armin noted that the conclusion of the Professional Outcomes Reports is that the College is strong in some areas and weak in others. Jeanne and Armin will put some information together which will highlights some conclusions which will be put into a draft to Levi Thompson.

Armin said regarding the purpose of putting this information together, that this is in response to Levi, but it has to do with ABET accreditation.

#### <u>First Year Review Report – Gary Herrin</u>

Gary Herrin talked about the First Year Review Report that he had sent out to all the Committee Members. He noted that the **First Year Courses Review Committee** served for a year and put a lot of time into this, trying to reshape Engineering 100, 101, and 195. He stated that this report was extremely controversial—which is what these reviews should be. There has been a lot of response to this report already, and he shared some of those changes. One of the early conclusions that this Committee reached was the Engineering students can't write very well. Now they are documenting how well Engineering students are learning how to write (Which is what ABET wants). Gary noted that most of the Alumni surveyed regarding this graduated before Curriculum 2000, so those students never attended Engineering 100, 101 or 195. Gary said he would like more current data than is reflected in the Senior Surveys.

Gary said that Engineering 195 is a 'free –elective' and he wants to propose to the Curriculum Committee that this course be made a 'regular' course.

Armin noted that there will be an Engineering Program Curriculum Committee, with James Holloway as one of the members, also the coordinators for Engineering 100 and Engineering 101, and possibly one or two people from this Committee.

Susan Montgomery suggested a motion that Engineering 100, 101 and 195 are valuable courses in the College of Engineering and should be supported. Armin suggested changing the motion to recognize the value of the Engineering Programs in the College, particularly Engineering 100, 101, and 195.

After some discussion as to whether or not this was appropriate for the Curriculum Committee to be involved in endorsing a program, Susan withdrew her motion.

Armin stated that this issue will be brought up at the next Faculty Meeting.

#### ME Thermal/Fluids/Heat Transfer Sequence - Discussion

Greg Hulbert talked about his information handout, which was included in the CoE CC Meeting packet. The process will be for this to go the Mechanical Engineering Faculty for vote this month and then to the College of Engineering Curriculum Committee Meeting March 4, and the Engineering Faculty meeting March 18.

#### IOE Sample Schedule - Gary Herrin

Gary Herrin talked about his handout, which was included in the CoE CC Meeting packet. He stated that this is just for information.

The Sample Schedule lists the correct credit totals students earn for Phys 140, 141, 240, 241, and Chem 125/130. The current listing in the CoE Bulletin from Fall 2000 through 2002/2003 reflects the credit totals for Physics and Chemistry that were anticipated for Curriculum 2000, but never materialized. The changes listed officially reduce their 'advertised' free electives from 12 to 9 credits, which has been the reality since Fall 2000.

Jeanne Murabito noted, when asked, that the Curriculum Committee doesn't need to approve this, since this is not really a change.

#### **EE Degree Program changes - Discussion**

Jeff Fessler told the Committee that the ECE faculty approved two "program changes" for the Electrical Engineering degree that will affect footnotes in the bulletin.

- 1. EECS 497 was eliminated from the long list of MDE courses in footnote 6 since it has turned out to be just a software course.
- 2. The restriction: "At most 4 credits of undergraduate probability may be applied to the EE degree." was added.

The EECS department chose to go the latter route because trying to preclude EECS 401/ Math425/ IOE 265 / etc. via the course approval form was too painful. So they just put it in the degree requirements.

#### Course Approvals

Withdrawn: AERO 285

Tabled: ENGR 4XX

New Course

TECH COMM 400

Deletion

TECH COMM 450

Modification – Changing Course Description

TECH COMM 475

Modification – Changing Course Description

TECH COMM 486

Deletion

TECH COMM 490

Deletion

TECH COMM 497

Deletion

TECH COMM 499

Deletion

Armin Troesch called for a motion to approve the following course modifications, deleted courses, and new course. This was moved and seconded.

**Motion Carried (approved)** 

AERO 483

Modification – Changing Pre-Requisites

BIOMED E 548

Deletion

CHEM E 557

New Course

EECS 401 EECS 501 Modification – Changing Credit Restrictions Modification – Changing Credit Restrictions

Adjournment:

Motion to adjourn was made and seconded

Motion carried (approved)

**Next Meeting** 

Tuesday, March 4, 2003

1:30-3:30 p.m. GM Room-LEC

## CHEMICAL ENGINEERING DEPARTMENT TECHNICAL ELECTIVE REQUIREMENT – For students who completed ChE 230 F'01 or later February 2003

#### **TECHNICAL ELECTIVE RULES**

The ChE curriculum requires 6 credits of technical electives, to include:

A minimum of 2 credits of engineering elective, with the other 4 credits coming from engineering electives, advanced math electives, or advanced science electives.

In addition, at least one course must be outside of Chemical Engineering, and research credits cannot be used to fulfill all 6 credits of the requirement.

#### **ENGINEERING ELECTIVES**

Engineering courses must be at the 200 level or higher and with sufficient rigor, e.g. seminar courses and 1 credit programming courses don't count. Courses in AOSS are not considered engineering courses for this purpose.

Here is a sampling of popular engineering electives:

BME 401	4	Human Body: its Structure & Function	CEE 582	3	Environmental Microbiology
BME 519	4	Bioengineering Physiology	CEE 586	3,4	Industrial Ecology
ChE 444	3	Applied Chemical Kinetics	CEE 686	<sup>′</sup> 3	Case Studies in Environ. Sustainability
ChE 470	3	Colloids and Interfaces	IOE 201	2	Economic Decision Making
ChE 472	4	Polymer Science and Engineering	IOE 202	2	Operations Modeling
ChE 490	1-6	Directed Study, Res., Special Probs	IOE 265	4	Probability and Statistics for Engineers
ChE 517	3	Biochemical Science and Technology	MSE 242	4	Physics of Materials
ChE 518	3	Quantitative Cell Biology	MSE 350	4	Principles of Engineering Materials
ChE 519	3	Pharmaceutical Engineering	MSE 413	3	Polymeric Materials
ChE 530	3	Bioinformatics and Gene Expression	MSE 414	3	Applied Polymer Processing
CEE 260	3	Environmental Principles	ME 211	4	Introduction to Solid Mechanics
CEE 581	4	Aquatic Chemistry			

#### **ADVANCED MATH ELECTIVES**

M-4-054

The non-engineering courses listed below have previously been approved as Advanced Math electives

Math 354	3	Fourier Analysis and its Applications.
Math 371/Engr 371	3	Numerical Methods for Engineers and Scientists.
Math 417	3	Matrix Algebra I.
Math 425/Stats 425	3	Introduction to Probability.
Math 450	4	Advanced Mathematics for Engineers I.
Math 454	3	Boundary Value Problems for PDEs
Math 462	3	Mathematical Models.
Math 463	3	Mathematical Modeling in Biology.
Math 471	3	Introduction to Numerical Methods.
Stats 412	3	Fourier Analysis and its Applications.

The following Engineering courses might also be of interest to those interested in a mathematics emphasis:

ChE 507	3	Mathematical Modeling in Chemical Engineering
ChE 508	3	Advanced Numerical Methods
ChE 508	3	Advanced Numerical Methods
CEE 303	4	Computational Methods for Engineers and Scientists
IOE 366	2	Linear Statistical Models (ChE 360 fulfills preregs)
IOE 465	4	Design and Analysis of Experiments

#### **ADVANCED SCIENCE ELECTIVES**

The courses listed below have previously been approved as Advanced Science electives

	pheric,	Oceanic and Space			
<u>Sciences</u>			CHEM - Ch	nemistry	
AOSS 300	3	Global environmental impact of technological change	CHEM 420 CHEM 451	3 4	Intro. organic □hem
AOSS 304	3	The atmospheric and oceanic environ.	CHEM 461 CHEM 463	3 3	Intro. biochemistry Physical Chemistry I Physical Chemistry II
AOSS 430	3	Thermo. of the atmosphere	CHEM 511	3	Materials Chemistry
AOSS 432	3	Environmental radiative proc.		· ·	materials chemistry
AOSS 459	3	Principles & Applications of Radio and Remote Sensing	EIHLTH - E	nviron'l ar	nd Industrial Health (Public Health)
AOSS 463	3	Air pollution meteorology	EIHLTH 54	7	Food Science
AOSS 464	3	The space environment			
AOSS 467	3	Biogeochemical cycles	EST - Envir	onmental :	Studies
AOSS 475	3	Earth-ocean-atmosphere			<u> </u>
		interactions	EST 353	3	Energy, entropy and environment
AOSS 479	3	Atmospheric chemistry		J	Energy, criticipy and environment
AOSS 480	3	The Planets: Composition,	GS - Geolog	nical Scien	nces
		Structure, and Evolution	<u> </u>	giodi Coloi	1000
			GS 425	3	Environmental geochemistry
BIO - Biology			40 720	0	Environmental geochemistry
			PHYS - Phy	veice	
BIOL 207	4	Introductory microbiology	11110-111	<u>y3103</u>	
BIOL 305,6	4,3	Genetics; Lab	PHYS 340/1	1 20	Movee that and light hat
BIOL 307,8	3,3	Development Biology; Lab	PHYS 390	- ,	Waves, Heat, and Light; Lab
BIOL 310	4	Intro. biochemistry	PHYS 401	3	Introduction to Modern Physics
BIOL 311	4	Intro. biochemistry, self-paced		3	Intermediate Mechanics
BIOL 320	3	Cellular physiology	PHYS 402	3	Light
BIOL 324	3	Biology of Cancer	DUADMOE	Db a	
BIOL 390	4	Evolution	PHARMCE	<u> </u>	aceutics
BIOL 330	4	Molecular Endocrinology	DUADNOC		<b>D</b>
BIOL 428	4	Cell Biology	PHARMCE	U 3	Pharmaceutics and biopharm. 1:
BIOL 483	3		432		Introduction to dosage forms
DIOL 403	3	Limnology: Freshwater ecology			
BC - Biological	Chemi	stry - Medical School			
BC 415/515	3,4	Intro. biochemistry			
			1		

The following Engineering courses might also be of interest to those interested in a science emphasis:

#### BME - Biomedical Engineering

BME 418	4	Quantitative Cell Biology	CEE 581	3	Aquatic Chemistry
CHE - Chemica	l Engir	neering	CEE 582 CEE 586 /NRE 557	3 3,4	Environmental Microbiology Industrial Ecology
CHE 444	3	Applied Chemical Kinetics			
CHE 470	3	Colloids and Interfaces	MSE - Materials	Scien	ce and Engineering
CHE 472	4	Polymer Science and Engin.			SO GITO ELIGINIOUTING
CHE 519	3	Pharmaceutical Engineering	MSE 410	3	Design and Applications of
CHE 538	3	Statistical and Irreversible	(BME 410)	•	biomaterials
		Thermodynamics	MSE 413 (ChE 413)	3	Polymer materials

CEE - Civil and Environmental Engineering

## CHEMICAL ENGINEERING DEPARTMENT BIOLOGY/LIFE SCIENCE REQUIREMENT- For students who completed ChE 230 F'01 or later February 2003

The courses listed below have been approved as Biology/Life Science electives.

Course	Credits	Title	Prerequisites
BIO - Biology			
BIOL 162 BIOL 207	5 4	Introductory biology Introductory microbiology	Prior or concurrent enrollment in Chem 130 Biol. 162, or AP Bio level background
BC - Biological C	Chemistry -	Medical School	
BC 415/515	3,4	Intro. biochemistry	Two terms of organic chem. No credit granted to those who have completed or are enrolled in Biol. 310 or 311 or BC 451/452.

#### Fulfilling the biology/life science requirement at another school:

If you are searching for a course at another school to fulfill this requirement, a good starting point is the course that is the prerequisite for biochemistry. To check whether a course at another school has already been approved as fulfilling this requirement, check the course equivalency database available at:

http://www.engin.umich.edu/students/prospective/undergraduate/admissions/transfer/external/database/

Courses that have been approved as fulfilling our bio/life science elective are labeled as such in this database. Courses not listed on this database need the approval of Dr. Montgomery to be used to fulfill this requirement.

Check web for updates at www.engin.umich.edu/dept/cheme

#### Proposed ChE curriculum, Winter 2003

#### Subjects required by all programs

Mathematics 115+,116+,215,216+

Engineering 100, Introduction to Engineering

Engineering 101, Computing +

Chemistry 130+

Physics 140/141+, 240 /241

Humanities and Social Sciences

(to include a course in economics)

#### **Advanced Science**

Biology / life science elective (1)

Chem 210, 211, Struct and Reactiv I and Lab +

Chem 215,216, Struct and Reactiv II and Lab +

Chem 261, Chemical Principles +

Chem 241/2 Analytical Chemistry

#### **Related Technical Subjects**

Materials elective (MSE 250)

Technical Electives (2)

#### **Program Subjects**

ChemE 230, Material & Energy Balances +

ChemE 330, Thermodynamics +

ChemE 341, Fluid Mechanics +

ChemE 342, Heat and Mass Transfer +

ChemE 343, Separation Processes +

ChemE 344, Reaction Engr and Design +

ChemE 360, ChemE Lab I +

ChemE 460, ChemE Lab II

ChemE 466, Process Control and Dynamics

ChemE 487, Chem Proc Sim and Design

#### Free Electives

#### Total

Hours	1	2	3	4	5	6	7	8
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128	16	17	16	17	15	15	15	17

<sup>(1)</sup> See department for list of courses that satisfy the Biology/Life Science elective requirement.

<sup>(2)</sup> Technical electives must include a minimum of 2 credits of engineering elective, with the other 4 credits coming from engineering electives, advanced science, or advanced math courses. See department for list of courses that meet the engineering electives, advanced science and advanced math requirements. At least one course must be outside of Chemical Engineering. Engineering courses are to be at the 200 or higher level. Courses in AOSS are not considered engineering courses for this purpose. See department for other exceptions.

<sup>(+)</sup> Students must earn a "C-" or better in prerequisite courses indicated by the (+)

#### **COURSE APPROVAL FORMS**

#### Sub-Committee Review for March 4, 2003 CoE CC Meeting

AERO 536 New Course

BME 533 (Cross-listed with Kines(home department) New Course

BME 556 Modification - Prerequisite added—Sr. Standing, enforced; Level of

Credit changed to ugrad or Rckhm Grad; Changing Terms

CHE 487 Modification – Prerequisite changed from MSE 250, preceded or

accompanied by CHE 344 to CHE 360, MSE 250 preceded or

accompanied by CHE 344

CEE 522 New Course

EECS 467(Cross-listed with ME 467 & MFG 467)

Deletion

EECS 568(Cross-Listed with MFG 570 Deletion

ME 235 New Course

ME 320 New Course

ME 335 New Course

MSE 480(Cross-Listed with MFG 480) Modification – Changing Terms

MSE 489(Cross-Listed with MFG 489) Modification – Changing Terms

TECH COMM 400 Deletion

TECH COMM 450 Modification – Changing Course Description

TECH COMM 475 Deletion

TECH COMM 486 Deletion

TECH COMM 490 Deletion

TECH COMM 497 Deletion

TECH COMM 499 New Course

#### THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING **Course Approval Request**

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Numbe 1026

Action Requested

New CourseModification of Existing CourseDeletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Deletions - A & C completely

Date 1/29/2003 Effective Fall 2003

	A. CURRENT LISTING	B. REQUESTED LISTING
	Home Department Div # Course Number	Home Department Div # Course Number Aerospace Engineering 235 536
	Cross Listed Course Information	Cross Listed Course Information
	Course Title	Course Title Electric Propulsion
	TITLE Time Sched Max = 19 Spaces VIATION Transcript	TITLE ABBRE- MAX = 19 Spaces  Transcript  Transcript  Time Sched Max = 19 Spaces  Electric Propulsion
	VIATION Transcript Max = 20 Spaces	VIATION Hax = 20 Spaces Electric Propulsion
	Course Description	Course Description for Official Publication (Max = 50 words) Introduction to electric propulsion with an overview of electricity and magnetism, atomic physics, non-equilibrium flows and electrothermal, electromagnetic, and electrostatic electric propulsion systems.
	PROGRAM OUTCOMES:	PROGRAM OUTCOMES: ⊠a □b □c □d ⊠e □f □g □h □i ⊠j ⊠k
	Degree Requirements O Degree Requirement O Tech Elective O Core Course O Free Elective	Degree Requirements  O Degree Requirement O Tech Elective O Other
	Prerequisites	O Free Elective Prerequisites Aero 335, Senior Standing
$\equiv$	© Enforced © Advised  Credit	© Enforced © Advised  Credit
	Restrictions  Level of Credit Credit Hours Contact	Restrictions  Level of Credit Credit Contact
	□ Undergrad only □ All Credit types □ Rackham Grad w/add'l Work □ Non-Rckhm Grad □ Ugrad or Rckhm Grad □ Ugrad or Non-Rckhm Grad	Undergrad only All Credit types All Cred
C.	Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? O Yes O No Maximum Hours? Maximum Times? Can it be repeated in the same term? O Yes O No	Printing Information (Optional) Print the course in the Bulletin Print the course in the Time Schedule
	Class         Graded         ⊙ Lec         Grading           Type(s)         ☒ Lec         Section         ◯ Rec         Location           ☐ Rec         ◯ Sem         ☒ A-E         ☐ CF/NC         ☒ Ann Athor	Terms & ■   □     □     □       □
	Sem	Cognizant Faculty Alec Gallimore Title Associate Professor Member:
	Approval	Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty
	Curriculum Comm.	Submitted By: ■ Home Dept. □ Cross-listed Dept.  Name, Signature & Department  Lamp Dept.  Lamp Royal Agreement Find
	Faculty Rackham Cross listed Unit 1 Cross listed Unit 2	Home Dept Jain Boyd, Aerospace Eng Cross-listed Dept(s).

Form Number	
1026	

#### SUPPORTING STATEMENT

Over the past twenty years, Electric Propulsion (EP) has transitioned from a spacecraft propulsion concept of the future to an enabling technology for humankind's space enterprise. EP represents the largest segment of the annual Joint. Propulsion Conference, which is the world's largest dedicated to propulsion. Over one-hundred and fifty spacecraft (mostly communication satellites) now use some form of EP. EP's utility comes from the fact that by using spacecraft power to energize and accelerate propellant instead of relying on combustion, as does a conventional rocket motor, EP devices generate thrust at considerably higher exhaust velocities than chemical rockets. EP's higher exhaust velocity (typically an order of magnitude greater) means that a spacecraft can complete a given mission using far less propellant or be accelerated to much greater speeds than is possible with chemical propulsion. The former means that a satellite can be made lighter or for the same mass, more capable (i.e., replace propellant with more payload), while the latter means that probes (and eventually people) can be sent to distant destinations quicker or can embark on missions not possible or practical with chemical propulsion; e.g., comet sample return mission.
A large fraction of future ecientific commercial and military encourant will use a same form of ED. ED.
A large fraction of future scientific, commercial, and military spacecraft will use some form of EPEP represents one of the largest growth industries in aerospace engineering and is one of the most popular subjects among engineering students across the nationIndustry and the government need students who are knowledgeable about EP
Our propulation ourrigation ourrently consists of Assa 205 (and assault) in the state of the sta
Qur.propulsion.curriculum.currently.consists.of.Aero.335.(undergraduate.air-breathing.and.rocket.propulsion), Aero.530.(graduate.air-breathing.propulsion), and Aero.535.(graduate.rocket.propulsion)Aero.students.have.often.taken.NERS.490, which is an advanced fusion.space.propulsion.course.that is taught by <i>Emeritus</i> Professor.Terry.KammashAero.536.(EP).represents.the.next.logical.progression.in.Aero's.propulsion.curriculum.and.fills.in.the.gap.between.Aero.535.and.NERS.490.
Are any special resources or facilities required for this course? ☐ Yes ☒ No
Detail the Special requirements

Aero 536: Electric Propulsion	
COURSE #: 536	COURSE TITLE: ELECTRIC PROPULSION
TERMS OFFERED: Fall	PREREQUISITES: Aero 335, Senior Standing
INSTRUCTOR(S): Gallimore	SCIENCE/DESIGN: 3/0
CATALOG DESCRIPTION: Introduction to electric propulsion	COURSE TOPICS:
with an overview of electricity and magnetism, atomic physics, non-	1. Basic orbital mechanics and astrodynamics
equilibrium flows and electrothermal, electromagnetic, and	2. Electricity and magnetism
electrostatic electric propulsion systems.	3. Atomic and ionization physics
	4. Kinetic theory and non-equilibrium flows
	5. Arc/discharge and plasma physics
	6. Electrothermal propulsion (resistojets, arcjets, & inductively-
	heated engines)
	7. Electromagnetic propulsion (PPTs & MPDTs
	8. Electrostatic propulsion (Hall thrusters, ion engines, colloid
	accelerators, & FEEP)

	1. Review the aspects of electricity and magnetism that are most relevant to electric propulsion (EP)
COURSE OBJECTIVES*	<ol> <li>Introduce students to the basics of atomic physics as it pertains to EP</li> <li>Introduce students to the basics of kinetic theory and non-equilibrium flows as they pertain to EP</li> <li>Introduce students to the basics of plasma physics as it pertains to EP</li> </ol>
	5. Equip students with a general knowledge of EP systems and the tools needed to perform trades to match EP devices with mission requirements
	6. Familiarize students with the concept of electrothermal propulsion and the fundamentals, design, and performance characteristics of resistojets, arcjets, and microwave/ECR (electron cyclotron resonance) thrusters
	7. Familiarize students with the concept of electromagnetic propulsion and the fundamentals, design, and performance characteristics of pulsed plasma thrusters (PPTs) and magnetoplasmadynamic (MPD) thrusters
	8. Familiarize students with the concept of electrostatic propulsion and the fundamentals, design, and performance characteristics of Hall thrusters, ion thrusters, colloid thrusters, and field emission electric propulsion (FEEP) systems
	On completion of Aero 536, students can:
COURSE OUTCOMES*	
	1. Have a basic understanding of the concept of electric propulsion (EP) and which missions benefit most from it
	2. Have a basic understanding of plasma physics, atomic physics, arc/discharge physics, and non-equilibrium flows as they relate to EP
	3. Have an ability to use basic physics to analyze EP devices
	4. Know the basic operating principles of most EP devices
	5. Know the performance characteristics and basic interface requirements of most EP devices
	6. Match mission requirements and constraints to EP devices

ASSESSMENT	1. Written homework assignments
TOOLS	2. Mid term exam
	3. Final exam

Approved by Aero faculty: February 4, 2003

#### AERO 536 ELECTRIC PROPULSION

FALL TERM, 2003

Class Time & Place: Tuesdays & Thursdays, 1:30–3:00 PM, 1012 FXB

Professor Alec D. Gallimore 3037 FXB - 764-8224

alec.gallimore@umich.edu

Office Hours: Mondays & Wednesdays, 1:30-3:00 PM

#### **COURSE OUTLINE**

- 1. Introduction to and Survey of Electric Propulsion Systems (∼1 week)
- 2. Electricity and Magnetism, & Charged Particles (~2 weeks)
- 3. Kinetic Theory, Ionization of Gases, & Plasma Physics (~3 weeks)
- 4. Electrothermal Propulsion ( $\sim$ 2 weeks)
  - Resistojets
  - Electrical Discharges
  - Arcjets
  - $\mu$ wave & ECR Thrusters
- 5. Electromagnetic Propulsion (~2 weeks)
  - The Lorentz Force
  - Magnetoplasmadynamic (MPD) Thrusters
  - Pulsed Plasma Thrusters (PPTs)
- 6. Electrostatic Propulsion ( $\sim$ 4 weeks)
  - Hall Thrusters
  - Ion Engines
  - Field Emission Electric Propulsion (FEEP) (if time permits)
  - Colloid Thrusters (if time permits)

#### COURSE GRADING SCHEME & TENTATIVE DUE DATES

One (1) mid-term exam (on 10/18 in class)

Seven (7) homework assignments
(due on 9/20, 10/2, 10/11, 10/25, 11/8, 11/20, & 12/6)

Two-hour final exam (on 12/21, 1:30–3:30 PM)

40%

#### ADDITIONAL COMMENTS

- Course reading material will consist of a coursepack containing the following sources:
  - 1. Physics of Electric Propulsion by R. G. Jahn, McGraw-Hill Entire Book
  - 2. Introduction to Plasma Physics and Controlled Fusion by F. F. Chen, Plenum *Chapters 1-3*
  - 3. Electricity and Magnetism by E. M. Purcell, McGraw-Hill Chapters 1-3
  - 4. Introduction to Physical Gas Dynamics by W. G. Vincenti & C. H. Kruger, Jr. Chapters 1-2
- All assignments are due at the beginning of class. There is a 10% per day penalty for late assignments, late being defined as not given in by the start of class.
- If you cannot make my office hours, please feel free to come by my office at any time if you have questions. I maintain an "open-door" policy.
- I will try to use the internet as often as possible to distribute assignments and solutions.



Action Requested

## Course Approval Request Form

Date of Submission:

11/6/2002

Return to: The Office of the Registrar, 1553 LSA 1382 LSA, 763-2113

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# COURSE ANNOUNCEMENT: KIN 530 (fall 2001) Neuromechanics

This course focuses on interactions of the nervous and musculoskeletal systems during animal movement. Course material will include neural control of human movement. biological cybernetics, computer simulations of neuromechanical systems, and rehabilitation robotics. The three hour class will consist of MS PowerPoint lectures covering background material and critical analyses of current research. There is no required textbook for the class (Neuromechanics of Human Movement by Roger Enoka, 2001, is optional).

Instructor: Dan Ferris, Ph.D.

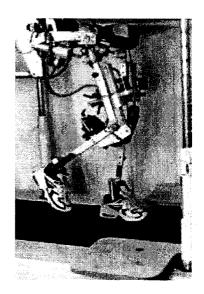
http://www-personal.umich.edu/~ferrisdp/

CCRB

ferrisdp@umich.edu

Credit Hours 3.0 Wednesdays from 6-9PM in 3733

Registration Code 18601



Specific topics to be covered: Muscle mechanics **Biological Sensors** CNS Planning of Movement **Neural Oscillators Legged Locomotion** NeuroRehabilitation Rehabilitation Robotics Computer Simulations Robotic Exoskeletons



SYLLABUS (Fall 2001)

KIN 530 SEM BIOMECHANICS (Neuromechanics)

Credit Hours 3.0

Registration Code 18601

Wednesdays from 6-9 PM in 3733 CCRB

Instructor: Dan Ferris, Ph.D. Office Hours: Wednesday 4-6 PM

Office Location: 3060D CCRB

This course focuses on interactions of the nervous and musculoskeletal systems during animal movement. Topics will include neural control of human movement, neurorehabilitation, rehabilitation robotics, and computer simulations of neuromechanical systems. Background material on topics will be presented each week in a lecture/open discussion format led by the instructor. Key research papers related to the topics will also be discussed.

#### **Optional Textbook**

Neuromechanics of Human Movement (2001) R. Enoka

This book is a good primer of biomechanics and neurophysiology for those wishing more of a background in either area.

#### List of books on reserve at Taubman Medical Library

Neuromechanics of Human Movement (2001) R. Enoka

Multiple Muscle Systems (1990) J. Winters and S. Woo

Biomechanics and Neural Control of Posture and Movement (2000) J. Winters and P. Crago Biological Neural Networks in Invertebrate Neuroethology and Robotics (1993) R.D. Beer, T.

McKenna, and R. Ritzmann

Neurons, Networks, and Motor Behavior (1997) P.S.G. Stein, S. Grillner, A. Selverston, and D. Stuart

Robo Sapiens: Evolution of a New Species (2000) P. Menzel and C.C. Mann

Nonlinear Dynamics and Chaos (1994) S.H. Strogatz

Spikes, Decisions, and Actions (1999) H.R. Wilson

Physiological Control Systems (2000) M.C.K. Khoo

Dynamic Modeling in the Health Sciences (1998) J.L. Hargrove

Mastering Simulink 4 (2001) J. Dabney and T. Harmon

There is a 3-day loan period on each of these books.

#### Grading

Class participation in discussions 33% Biweekly homework assignments 33% Project 34%

#### Biweekly homework assignments (to be completed in any order)

- 1. Choose a chapter from Multiple Muscle Systems (1990) and write a 1-3 page report summarizing the chapter or an aspect you found particularly interesting.
- 2. Choose a chapter from Biomechanics and Neural Control of Posture and Movement (2000) and write a 1-3 page report summarizing the chapter or an aspect you found particularly interesting.
- 3. Choose a chapter from Biological Neural Networks in Invertebrate Neuroethology and Robotics (1993) and write a 1-3 page report summarizing the chapter or an aspect you found particularly interesting.

- 4. Choose a chapter from Neurons, Networks, and Motor Behavior (1997) and write a 1-3 page report summarizing the chapter or an aspect you found particularly interesting.
- 5. Choose a section from Robo Sapiens: Evolution of a New Species (2000) and write a 1-3 page report summarizing the chapter or an aspect you found particularly interesting.
- 6. Choose one of the following books on modeling and write a 1-3 page book review on it: Nonlinear Dynamics and Chaos (1994); Spikes, Decisions, and Actions (1999); Physiological Control Systems (2000); Dynamic Modeling in the Health Sciences (1998); or Mastering Simulink 4 (2001).
- 7. Choose one of laboratories listed under the *Interesting Links* section of the UM HNL web page (http://www-personal.umich.edu/~ferrisdp/UMHNL.html). Complete the LAB WORKSHEET that can be downloaded from the KIN 530 UM Course Tools page (https://coursetools.ummu.umich.edu/).

#### Class project

The class project will consist of one of the following options: 1) build a computer model to simulate a neuromechanical system, test stated hypotheses about the behavior of the system, and prepare a 6 page research report on the results (using the format for IEEE meeting papers), 2) design and conduct an experiment on neuromechanical control of human/animal movement that tests stated hypotheses about neuromechanical control and prepare a 6 page research report on the results (using the format for IEEE meeting papers), 3) research a topic about neuromechanics and prepare an NIH F32 NRSA post-doctoral fellowship application.

#### **TOPICS AND PAPERS TO BE COVERED**

#### Muscle mechanics

- Review: Dickinson MH, Farley CT, Full RJ, Koehl MA, Kram R, Lehman S. How animals move: an integrative view. Science. 2000 Apr 7;288(5463):100-6.
- Huijing, P.A.J.B.M. (2000). Length, shortening velocity, activation and fatique are not independent factors determining muscle force exerted. In J.M. Winters & P.E. Crago (Eds.), Biomechanics and neural control of posture and movement. (pp. 83-90). New York: Springer-Verlag.
- Riewald SA, Delp SL. The action of the rectus femoris muscle following distal tendon transfer: does it generate knee flexion moment? Dev Med Child Neurol. 1997 Feb;39(2):99-105.
- Gerritsen KG, van den Bogert AJ, Hulliger M, Zernicke RF. Intrinsic muscle properties facilitate locomotor control a computer simulation study. Motor Control. 1998 Jul;2(3):206-20.

#### **Biological Sensors**

- Review: Bosco G, Poppele RE. Proprioception from a spinocerebellar perspective. Physiol Rev. 2001 Apr;81(2):539-68.
- Rothwell JC, Traub MM, Day BL, Obeso JA, Thomas PK, Marsden CD. Manual motor performance in a deafferented man. Brain. 1982 Sep;105 (Pt 3):515-42.
- Eng JJ, Hoffer JA. Regional variability of stretch reflex amplitude in the cat medial gastrocnemius muscle during a postural task. J Neurophysiol. 1997 Aug;78(2):1150-4.
- Bouyer LJ, Rossignol S. The contribution of cutaneous inputs to locomotion in the intact and the spinal cat. Ann N Y Acad Sci. 1998 Nov 16;860:508-12.
- Bosco G, Poppele RE, Eian J. Reference frames for spinal proprioception: limb endpoint based or joint-level based? J Neurophysiol. 2000 May;83(5):2931-45.

#### **CNS Planning of Movement**

- Review: Loeb GE. What might the brain know about muscles, limbs and spinal circuits? Prog Brain Res. 1999;123:405-9.
- Shadmehr R, Mussa-Ivaldi FA. Adaptive representation of dynamics during learning of a motor task. J Neurosci. 1994 May;14(5 Pt 2):3208-24.
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- H. Kazerooni. Human Power Extender: An example of human-machine interaction via the transfer of power and information signals, 5<sup>th</sup> International Workshop on Advanced Motion Control. Proceedings, 1988, p.565-572

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213.

http://www.darpa.mil/DSO/thrust/md/Exoskeletons/

Dan Ferris, Ph.D.

Human Neuromechanics Laboratory

Department of Movement Science

Division of Kinesiology

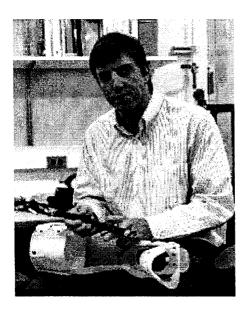
University of Michigan

401 Washtenaw Avenue Ann Arbor, MI 48109-2214

e-mail: ferrisdp@umich.edu

Phone: (734) 547-6876

Fax: (734) 936-1925



#### • Reserve interests

Neuromechanical control of movement.
Gait rehabilitation
Biorobotics
Motor adaptation to reduced gravity

Dr. Ferris is a biomechanist whose research focuses on how the nervous system and musculoskeletal system interact to produce coordinated movement. Using a combination of techniques from engineering mechanics, neurophysiology, and non-linear dynamics, he studies both basic science and applied health issues. Some of the fundamental questions his research addresses include:

How flexible are the neural networks that control human locomotion? Do the brain and spinal cord let the natural dynamics of the fimbs determine movement patterns?

Can we use robotic exoskeletons to improve gait rehabilitation after spinal cord injury or stroke?

The common goal of his research is to discover general principles of fecomotor control and apply them to improve human health.

Prof. Ferris directs the Human Neuromechanics Laboratory. Projects in

ine laboratory include designing pneumatically powered lower limb exoskeletons, constructing computer simulations of neuromechanical systems, and studying human motor adaptation to locomotion under simulated reduced gravity.

#### • Maucation

B.S., Wathernatics Education, University of Central Florida, Orlando, FL.

M.S., Exercise Physiology, University of Miami, Florida.
Ph.D., Human Biodynamics, University of California, Berkeley, CA.
Post-doc, Neurophysiology, University of California, Los Angeles, CA.

Post-doc, Bloengineering, University of Washington, Seattle, WA.

Prof. Ferris' cross-disciplinary approach to scientific research is reflected in his diverse academic background. He completed his declaral studies in blomachanics at UC Berkeley and has served as a post-declaral researcher in the UCLA Department of Neurology and the University of Washington Department of Electrical Engineering. White at UCLA, Dr. Ferris worked on clinical research testing new rehabilitation techniques for individuals with spinal cord injuries. Patients were supported in modified parachute harnesses while physical therapists helped move their limbs on a treadmili. He later moved to Washington in order to begin work on robotic devices to assist this type of locomotor rehabilitation.

#### • Teaching

Frof. Ferris teaches an undergraduate class in <u>Biomechanics of Human Movement (MVS 330)</u> and a graduate class on <u>Neuromechanics (KIN 530)</u>.

#### Grants and Publications

Prof. Ferris has received grants from the National Institutes of Health, NASA, and the Christopher Reeve Paralysis Foundation. He has published in the Journal of Physiology. Proceedings of the Royal Society of London: Biological Sciences, Journal of Experimental Biology, Journal of Applied Physiology, Exercise and Sport Sciences Reviews, and

Journal of Biomechanics.

#### Fuil Curriculum Vitae

### USEFULLINKS

This page was last updated on 6/3/2002.

#### THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING Course Approval Request

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form	Number
983	

#### **Action Requested**

New CourseModification of Existing CourseDeletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Deletions - A & C completely

Date 10/8/2002

Home Depa	artment	Div# Course Number	er Home Deg	partment		Div#	Course Number
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Cross Listed	Course Information		Cross Listed	Course Information			
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re 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 1069

#### Action Requested

New CourseModification of Existing CourseDeletion of Course

#### Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Date 2/21/2003 Effective Fall 2003

	A. CURRENT LISTING	
	Home Department Div # Course Number	Home Department Div # Course Number Chemical Engineering 245 487
	Cross Listed Course Information	Cross Listed Course Information
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$\Box$	Course Title	O Th.
Ш	Course Title	Course Title Process Simulation and Design
	TITLE Time Sched Max = 19 Spaces	TITLE Time Sched Max = 19 Spaces Proc Sim & Des
	VIATION Transcript Max = 20 Spaces	VIATION Transcript Max = 20 Spaces PROC SM/DS
	Course Description	Course Description for Official Publication (Max = 50 words)
		Process synthesis and design. Conceptual process design.
		Equipment sizing and cost estimation. Process and corporate
		economics. Safety, environmental and ethical issues. Process simulation with computer assistance. Design project with oral and
		technical reports. Technical communications.
·	PROGRAM OUTCOMES:	PROGRAM OUTCOMES:
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	Degree Requirements O Degree Requirement O Tech Elective O Core Course O Other	Degree Requirements  Degree Requirement Core Course Other
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	Credit Restrictions	Credit Restrictions
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_ 1	Repeatability (Indi Research, Dir. Study, Dissertation:	Printing Information ⊠ Print the course in the Bulletin
C.	Is this course repeatable? O Yes O No	(Optional)    Print the course in the Time Schedule
	Maximum Hours? Maximum Times?  Can it be repeated in the same term? O Yes O No	
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	☐ Lab ☐ Dis ☐ S/U ☐ Biological Station	Cognizant Faculty Phillip Savage Title Professor
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		Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty
ļ	Approval	Submitted By: Home Dept. Cross-listed Dept.
	Curriculum Comm.	Name, Signature & Department
_		Home Dept. Known Larson, Chemical Engineering
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		Form Number
		1069
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y special resources or facilities required for this	course? □ Yes ⊠ No	
	Lui les ex no	
the Special requirements		

#### THE UNIVERSITY OF MICHIGAN -- COLLEGE OF ENGINEERING **Course Approval Request**

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form	Number
1060	

#### 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

Date 2/13/2003 Effective Winter 2004

A. CL	JRRENT LISTING	B. RE	QUESTED LIST	ING		
Home Depa	rtment Div# Course Number	Home Depa Civil and E	artment Environmental Engi	neering	UIV #	Course Number 22
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Form	Number
1060	

#### **SUPPORTING STATEMENT**

Attached is a syllabus from the Winter Term 2002 when the proposed course was offered as an independent study. Approximately 1.1. students including audits attended the course. The general material in the course has been taught several times previously for one or two students as an independent study also. It is felt that there will be sufficient interest in the course for it to be offered on an alternate year basis. This subject is of considerable interest in the Civil Engineering. Hydraulics area but remediation of contaminated sediments is also a topical area in Environmental Engineering. Although the course does not focus on water quality aspects of the subject, a key issue with regards to contaminated sediments is deposition, resuspension and transport and those topics are included in the course
material
***************************************
Are any special resources or facilities required for this course?
Detail the Special requirements

#### **CEE 622 SEDIMENT TRANSPORT**

#### S.J. WRIGHT, EWRE, 764-7148 sjwright@engin.umich.edu Textbook - Sediment Transport, Theory and Practice, C.T. Yang Course Grade Based on 50% Assignments, 50% Final Exam

#### **Tentative Schedule** Reading Subject **Date** Introduction Jan. Ch. 1 9 **Sediment Properties** fall velocity 11 Cohesive Sediment - coagulation 14 Incipient Motion- noncohesive sediment 19-30 16 18 23 35-40 **Armoring** 25 Cohesive sediments Resistance to Flow - Rigid Boundary mechanics review 51-60 28 30 Bed forms, classification 60-68 Feb. 1 69-86 Resistance formulations 4 6 8 11 Comparison of different methods Sediment Transport Rates, description 122-138 13 Suspended Sediment 15 18 90-118 20 **Bed Load Formulations** 22 March 4 141-193 **Total Load Formulations** 6 8 11 229-237 13 Comparison of different methods Numerical Modeling of sediment transport, equations 15 Handouts Numerical models 18 Regime formulation 20 22 Geomorphology principles 25 27 29 **Stream Classification Systems** April Sources of Sediment - erosion formulations 3 5 8 Reservoir sedimentation 10 12 Sediment resuspension **Effect of Waves** 15 17

Final Examination: To be set

#### THE UNIVERSITY OF MICHIGAN - COLLEGE OF ENGINEERING Course Approval Request

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Number

#### **Action Requested**

New CourseModification of Existing CourseDeletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Deletions - A & C completely

Date 1/31/2003

Effective Winter 2003

	A. CURRENT LISTING						B. REQUESTED LISTING					
	Home Depar EECS	Home Department EECS			Course Number 467	Home Department					Course Number	
	Cross Listed Course Information ME 280 467 MFG 275 467					Cross Listed Course Information						
	Course Title Robotics: Theory, Design and Application							•	· · · · · · · · · · · · · · · · · · ·			
	TITLE ABBRE-	Time Sched Max = 19 Spaces	Robotics	,		TITLE ABBRE-	Time Sched Max = 19 Sp					
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	Course Description Basic concepts underlying the design and application of computer-controlled manipulators: Manipulator geometry, work volume, sensors, feedback control of manipulator linkages, kinematics, trajectory planning, programming, robot system architecture, design and application. Lab experiments cover kinematics, dynamics, trajectory planning, control of manipulators, and motion by fixed robots and mobile robots.						Course Description for Official Publication (Max = 50 words)					
	PROGRAM OUTCOMES:  a b c d e f g h i j k  Degree Requirements O Degree Requirement O Tech Elective O Other					PROGRAM OUTCOMES:						
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C.	Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? O Yes O No Maximum Hours? Maximum Times?  Can it be repeated in the same term? O Yes O No						Printing Information					
	Ctass					Terms & ■   □     □       □						
						Cognizant Faculty Lynn Conway Title Professor Member: Yoram Koren Professor						
	Approval					Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty						
							Submitted By: ■ Home Dept. □ Cross-listed Dept.  Name, Signature & Department  Home Dept. Jeff Fessler EECS /// Jcs/ 2003-1-3(					
	Faculty			<del></del> ,		Cross-listed D	~ <del>_</del>		// //	MM	<u> </u>	
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# Form Number

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Are any special resources or facilities required for this course?	
Detail the Special requirements	

College Curriculum Committee, 1420 Lurie Engineering Center Building



F	orm Number	
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### Action Requested

New CourseModification of Existing CourseDeletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Deletions - A & C completely

Date 1/31/2003 Effective Winter 2003

A. CI	URRENT LISTII	NG			B. <b>R</b> i	QUESTED LIS	STING		
Home Depa			Div# 252	Course Number 467	Home Dep	artment		Div#	Course Number
Cross Listed ME MFG	Course Information		280 275	467 467	Cross Listed	Course Information			
Course Title	s: Theory, Design	and Application			Course Title				
TITLE	Time Sched Max = 19 Spaces	Robotics		· · · · · · · · · · · · · · · · · · ·	TITLE ABBRE-	Time Sched Max = 19 Spaces			
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ls this co	Repeatability (Indi Research urse repeatable? Yes num Hours? Ma t be repeated in the same ter	⊙ No uximum Times?			Printing	Information	e course in the Bulletin e course in the Time Sched	lule	
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Approval Curric	ulum Comm ty -				Name, Signa Home I Cross-listed	ture & Department Dept. <u>Jeff Fessler</u>	10 11 11 11 11	- A	Z003-1 <i>-</i>
☐ Cross	listed Unit 1 -				•				

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SUPPORTING STATEMENT	
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books. We are submitting this again, the paper work for 467 was never	completed
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Are any special resources or facilities required for this course?	□ Yes □ No
Detail the Special requirements	
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College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Number 1025

#### 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 1/29/2003 Effective\_

Home Depar	tment		Div#	Course Number	Home Depa	rtment			Div#	Course Number
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VIATION	Max = 20 Spaces	Cont Micr Mfg			VIATION	Max = 20 Spaces				
Course Desc	cription		•		Course Desc	iption for Official Pu	ıblication (Ma	x = 50 words)		
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Detail the Specia				
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Detail the Specia				



College Of Engineering department of materials science and engineering

#### UNDERGRADUATE PROGRAM OFFICE

ANN ARBOR, MICHIGAN 48109-2136 (734) 764-3275 FAX (734) 763-4788

#### **MEMORAN DUM**

DATE: February 12, 2003

TO: CoE Curriculum Committee

FROM: Materials Science & Engineering Undergraduate Committee

SUBJECT: Two Course Approval Forms for Consideration

On behalf of the Materials Science and Engineering Undergraduate Committee, I am submitting the two Course Approval Forms attached for review and approval by the College of Engineering Curriculum Committee at their next meeting.

Both forms are only modifying the courses involved:

MSE 480 was previously offered in the Fall term only, and

MSE 489 was previously offered in the Winter term only.

The forms attached are modifications to reverse the terms these courses are offered:

MSE 480 offered only in the Winter term and MSE 489 offered only in the Fall term.

Respectfully,

Judith E. Hyde MSE Student Services Assistant

Cc: R.E. Robertson

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Number 1042

### Action Requested

New CourseModification of Existing CourseDeletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Date 2/3/2003

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	Design concepts. Engineering economics. Various design criteria, processes, and process control. Materials substitution. Competitive design. Case histories. Professional and ethical considerations. Written and oral presentations of solutions to design problems.				<ul> <li>Design concepts. Engineering economics. Various design criteria, processes, and process control. Materials substitution.</li> <li>Competitive design. Case histories. Professional and ethical considerations. Written and oral presentations of solutions to design problems.</li> </ul>					
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		um Comm.					ure & Department	/	)///	
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SUPPORTING STATEMENT
MSE 480 and MSE 489 are senior design courses that are required of all MSE students. The current schedule is 480 in
the Fall term and 489 in the Winter term. The current sequence makes it difficult for students to take MSE 435: Kinetics
and Transport in Materials Engineering before taking MSE 489, which is a process oriented design course. We
therefore are requesting that the sequence of MSE 489 and MSE 480 be reversed to correct this problem.
Are any special resources or facilities required for this course? ⊠ Yes □ No
. The difference of the differ
Detail the Special requirements
The students will need the use of laboratory and computer facilities for design information. Most needs will be met by CAEN and department facilities. Students will have to seek off-campus resources to solve some of their problems.

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Number 1041

### Action Requested

New CourseModification of Existing CourseDeletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Deletions - A & C completely

Date 2/3/2003 Effective\_

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	Course Title Materials	s Processing Des	ign			Course Title Materials	s Processing De	si		
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MSE 480 and MSE 489 are senior design courses that are required of all MSE students. The current schedule is 480 in
the Fall term and 489 in the Winter term. The current sequence makes it difficult for students to take MSE 435: Kinetics
and Transport in Materials Engineering before taking MSE 489, which is a process-oriented design course. We
therefore are requesting that the sequence of MSE 489 and MSE 480 be reversed to correct this problem.
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Are any special resources or facilities required for this course?
Detail the Special requirements
The students will need extensive use of laboratory and computer design facilities; including both hardware and software. Most needs will be met by CAEN and department facilities. Students may have to seek off-campus resources to solve some of their problems.

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Number 1045

#### Action Requested

New CourseModification of Existing CourseDeletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Deletions - A & C completely

Date 2/3/2003 Effective Spring 2003

A. <b>C</b>	URRENT LISTIN	G			B. RI	EQUESTED LIS	STING		
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Course Title					Course Title THERMO	DYNAMICS I			
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Restrictions					Restrictions				
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SUPPORTING STATEMENT  ME235 is the first in the new thermal, fluid, heat transfer sequence in the ME program. Additional supporting documentation for this program change is being provided to the College Curriculum Committee.
Are any special resources or facilities required for this course? □ Yes ☒ No
Detail the Special requirements

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Number 1044

#### Action Requested

New CourseModification of Existing CourseDeletion of Course

Complete the following sections: New Courses - B & C completely

Modifications - A modified information, B & C completely Deletions - A & C completely

Date <u>2/3/2003</u> Effective Winter 2004

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Cross Listed	Course Information		Cross Listed	Course Information					
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Course Title			Course Title						
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ME320 is the second course in the new thermal, fluids, heat transfer sequence in the ME program. Additional supporting
documentation for this program change is being provided to the College Curriculum Committee.
Are any special resources or facilities required for this course? ☐ Yes ☒ No
Detail the Special requirements
betail the Special requirements

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Number

#### Action Requested

New CourseModification of Existing CourseDeletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely Deletions - A & C completely

Effective Fall 2004

Date <u>2/3/2003</u>

	A. CURRENT LISTING	B. REQUESTED LISTING
$\neg \lceil$	Home Department Div # Course Number	Home Department Div # Course Number Mechanical Engineering 280 335
	Cross Listed Course Information	Cross Listed Course Information
	Course Title	Course Title Heat Transfer
f	TITLE Time Sched	TITLE ABBRE-
	VIATION Transcript Max = 20 Spaces	VIATION Transcript Heat Transfer  Course Description for Official Publication (Max = 50 words)
		Heat transfer by conduction, convection, radiation; heat storage, energy conversion; steady-state/transient conduction heat transfer; thermal circuit modeling; multidimensional conduction; surface radiation properties, enclosure radiation exchange; surface convection/fluid streams over objects, nondimensional numbers, laminar, turbulent, thermobuoyant flow, boiling and condensation; heat exchangers; design of thermal systems, solvers for problem solving/design.
Ì	PROGRAM OUTCOMES:	PROGRAM OUTCOMES:
-	□ a □ b □ c □ d □ e □ f □ g □ h □ i □ j □ k  Degree Requirements ○ Degree Requirement ○ Tech Elective ○ Core Course ○ Other	☑ a       ☐ b       ☒ c       ☐ d       ☒ e       ☐ f       ☐ g       ☒ h       ☒ i       ☒ j       ☐ k         Degree Requirements       O Degree Requirement       O Tech Elective         O Core Course       O Other
$\dashv$	O Free Elective Prerequisites	O Core Course O Free Elective  Prerequisites ME 320 O Enforced • Advised
	O Enforced O Advised  Credit Restrictions	Credit Restrictions
ᆀ	Level of Credit  Undergrad only Rackham Grad Non-Rickhm Grad Ugrad or Rickhm Grad Ugrad or Rickhm Grad Ugrad or Non-Rickhm Grad Ugrad or Non-Rickhm Grad Ugrad or Non-Rickhm Grad	Level of Credit  Undergrad only  Rackham Grad  Non-Rickhm Grad  Ugrad or Non-Rickhm Grad  Ugrad or Non-Rickhm Grad  Ugrad or Non-Rickhm Grad
c.	Repeatability (Indi Research, Dir. Study, Dissertation:  Is this course repeatable? O Yes O No  Maximum Hours? Maximum Times?  Can it be repeated in the same term? O Yes O No	Printing Information ⊠ Print the course in the Bulletin (Optional) ⊠ Print the course in the Time Schedule
	Class   Cla	Terms & ■ I ■ II □ IIIa □ IIIb □ III
	□ Sem         ○ Lab         □ CR/NC         ⊠ Ann Arbor           □ Lab         ○ Dis         □ S/U         □ Biological Station           □ Dis         ○ Ind         □ P/F         □ Camp Davis           □ Ind         ○ Other         □ Y         □ Extension           □ Other         □ Y         □ Extension	Cognizant Faculty Member:  Title Professor  Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty
Ĺ	Approval	Submitted By: Home Dept. Cross-listed Dept.
	Curriculum Comm.	Name, Signature & Department  Home Dept. Mechanical Engineering
	Faculty Rackham Cross listed Unit 1 Cross listed Unit 2	Cross-listed Dept(s).

SUPPORTING STATEMENT  ME335 is the third course in the new thermal, fluids, heat transfer sequence in the ME program, for this program change is being provided to the College Curriculum Committee	
	**************************************
Are any special resources or facilities required for this course?	
Detail the Special requirements	

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form	Number
1034	

### Action Requested

New Course
 Modification of Existing Course
 Deletion of Course

A. CURRENT LISTING

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Deletions - A & C completely

Date 1/31/2003

Effective Fall 2003

Technical Information and Communication Resources  True   Time Sched   Max = 19 Spaces   Tech Info Comm   ABBRE   Max = 19 Spaces   Max =	A. C	JRRENT LISTIN	G			B. RE	QUESTED LISTING				
Course Title   Time Stone   Technical Information and Communication Resources   Technical Information and Communication Resources   Technical Information	<b>—</b> !					Home Dep	artment		Div#	Course Number	
True State   True	Cross Listed	Course Information				Cross Listed	Course Information				
Max = 19 Spaces   Max = 20 S			d Communication Re	esource	es	Course Title					
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PROGRAM OUTCOMES:	1		Tec Info Com								
a b c d e f g h i j j k   Degree Requirements   Degree Requireme	This co- printed process	urse provides an electronic and ve to explore comn	rbal form and uses t	he info	rmation research		ription for Official Publication (Ma	c = 50 words)			
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Approval  Curriculum Comm.  Name, Signature & Department  Home Dept.  Leslie A. Olsen, Technical Communication  Cross-listed Dept(s).  Cross-listed Unit 1  Cross listed Unit 2	Type(s)	Lec Section Rec Sem Lab Dis	○ Rec         ⋈ A-E           ○ Sem         ⋈ CR/NC           ○ Lab         ⋈ CR/NC           ○ Dis         ⋈ S/U           ○ Ind         ⋈ P/F		Ann Arbor Biological Station Camp Davis	Freq. of Offering I Cognizant Fa Member:	Yearly Alter Years Evericuity Maurita H	en Years 🔲 Odd	Years Title	□ 2nd	
☐ Faculty Cross-listed Dept(s) ☐ Rackham ☐ Cross listed Unit 1 Cross listed Unit 2	• • •	llum Comm.			* *	Name, Signatu	Submitted By: Ma Home Dept. Cure & Department	Cross-listed Dep	t. Y	The state of	
	☐ Rackh	am isted Unit 1 -					•				

# Form Number

SUPPORTING STATEMENT	
This class is no longer offered. It has been replaced by other Communication Across the Curriculum courses	
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Are any special resources or facilities required for this course?	
The any special resources of facilities required for this course?	
Detail the Special requirements	
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College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Number

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 <u>1/31/2003</u>
Effective <u>Fall 2003</u>

	IRRENT LISTII	10				EQUESTED LIST				
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VIATION	Transcript Max = 20 Spaces				VIATION	Transcript Max = 20 Spaces	WWW Desigr	1		
Course Desc					Course Desc	ription for Official Publicat	ion (Max = 50 words)			
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necessar	y to design effe	ective WWW pag creating Web pag	es & Sites.	Practical skills	effective	WWW pages an	d sites, includin	g HTML, tool	s for crea	atin
animation	n. & multi-medi:	a. Theory include	ges, grapni es informat	ics, scripting, ion design visus	Web pag	ges, graphics, scr	ripting, animatio	n, and multin	nedia (pra	acti
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# Form Number

SUPPORTING STATEMENT Updating of wording to be more in keeping with the adopted style of no subjects or verbs.				
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	>>.			
Are any special resources or facilities required for this course?	☐ Yes ☐ No			
Detail the Special requirements				
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College Curriculum Committee, 1420 Lurie Engineering Center Building



Form	Number
1038	

Action Requested

New CourseModification of Existing CourseDeletion of Course

Complete the following sections: New Courses - B & C completely

Modifications - A modified information, B & C completely

Date 1/31/2003

M [				D	-ALIECTER			
A. CURRENT LISTING	<u> </u>			B. RE	QUESTED LIST	ING		
Home Department		Div#	Course Number	Home Dep	artment		Div#	Course Num
Technical Communication		291	475					
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Course Title				Course Title				
Directed Study	. •			I				
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VIATION Transcript				ABBRE-	Max = 19 Spaces			
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Course Description					iption for Official Publicat			
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Level of Credit		T 6 11111	Contact	Restrictions Level of Creat	die		<b>_</b>	
Undergrad only □ Ugrad or i	Non-Rckhm Grad	Credit Hours	Contact Hrs/Wk ARR	_ Undergrad		Non-Pokha Orad	Credit Hours	Contact
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				t turning th	formation  Print the (Optional)  Print the	course in the Bulletin course in the Time Scha	dule	
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We are deleting TC 475 and resubmitting our directed study course as Tescheme for courses.	
Are any special resources or facilities required for this course?	
Are any special resources of facilities required for this course?	☐ Yes ☐ No
Detail the Special requirements	

College Curriculum Committee, 1420 Lurie Engineering Center Building



F	orm	Number
<u> </u>		

1032

### Action Requested

O New Course Modification of Existing CourseDeletion of Course

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

Effective Fall 2003

Date 1/31/2003

	artment		Div#	Course Number	Home Dep	odmont		D: "	Course Numbe
	Communication		291	486	Home Dep	artment		Div#	Course Numbe
Cross Listed	Course Information				Cross Listed	Course Information			
Course Title					Course Title				
Design of	of Computer Doc	umentation				•			
TITLE ABBRE-	Time Sched Max = 19 Spaces	Design Comp	uter Doc		TITLE ABBRE-	Time Sched Max = 19 Spaces	****		
VIATION	Transcript Max = 20 Spaces	Computer Do	С		VIATION	Transcript Max = 20 Spaces			100
Course Des					Course Desc	ription for Official Publication (Max	= 50 words)		
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Degree Re	quirements O Degre	ee Requirement O Free Course O Tech	Elective O Ot	her	Degree Re	quirements O Degree Requirements O Core Course	nent O Free E O Tech E		
Prerequisite	es Senior or Graduate S	••		7.7.1	Prerequisites	○ Enforced ○ Advised		3.4	· ·
Credit Restrictions					Credit Restrictions	C Emilioca () Advised			
Level of Cre			Credit Hours	Contact	Level of Cre	dit	<del></del>	Credit Hours	Contact
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		Other Y	[] E	xtension		Attach nomination if Cognizant Fac	ulty is not a req	ular graduate facu	lty
Approval						submitted By:  Home Dept.  (			01/
☐ Curricul	um Comm.				Name, Signatur	e & Department			1/60.
☐ Faculty	_					pt. <u>Leslie A. Olsen, Tech</u>	inical Comm	iunication de	more
					Cross-listed De	spi(a).			
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☐ Cross li	sted Unit 1 — sted Unit 2 _			<del></del>				·	

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-orm	Numbe	er.

SUPPORTING STATEMENT
Deletion of the MS Program and Change to Communication Across Curriculum Program has removed, the need for this course. Also, this material is now covered in Tech Com 496 for CS+CSE students who were the primary enrollees in TC 486.
***************************************
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Are any special resources or facilities required for this course?
Detail the Special requirements
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College Curriculum Committee, 1420 Lurie Engineering Center Building



Form	Number
1033	

### Action Requested

New CourseModification of Existing CourseDeletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely Deletions - A & C completely

Date 1/31/2003 Effective Fall 2003

			4.0	Deletions -	A & C comple	tery		Diff	ctive	
A. CURRENT LISTING					B. REQUESTED LISTING					
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		Communication		291	490	Home Der	partment		Div#	Course Number
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	Course Des					Course Desc	ription for Official Publication	n (Max = 50 words)		
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			ow available to e							
	access t	o a wide variety	of resources and	d systems,	with primary					
		is on online net	works, and uses o	conferencir	ng, and databas	e				
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				Cognizant Faculty Maurita Holland Title						
		Ind Other	Other Y		xtension	Member:				
						Grad Course:	Attach nomination if Cogniza	ant Faculty is not a reco	ular graduate for	dby -
Ī	Approval					J		· · · · · · · · · · · · · · · · · · ·		""/\mathread \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
Commission Commission						ubmitted By: 🔣 Home Dept	Cross-listed Dept		TX 1 ///	
☐ Curriculum Comm.					Name, Signature	e & Department		1	~/.//////	
				Home De	pt. Leslie A. Olsen,	Technical Comm	unication	M 14 11 N/1		
	Faculty	<del>-</del>				Cross-listed De			1/2	$\sim\sim\sim\sim\sim\sim$
Rackham				5.000 Hateu De	-P-(U).		<del>`</del> _			
Cross listed Unit 1							·			
☐ Cross listed Unit 2										
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									60	
										~ ~

# Form Number

SUPPORTING STATEMENT
This class is no longer needed. Deletion of MS Program and change to Courses Across, the Curriculum Program has removed the need for this course.
Are any special resources or facilities required for this course?  □ Yes □ No
Detail the Special requirements

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form	Number
1030	

#### Action Requested

☐ Cross listed Unit 2

Complete the following sections: ○ New Course Date 1/31/2003 Modification of Existing Course New Courses - B & C completely Deletion of Course Modifications - A modified information, B & C completely Effective Fall 2003 Deletions - A & C completely B. REQUESTED LISTING A. CURRENT LISTING Course Number Course Number Div# Div# Home Department Home Department 291 497 Technical Communication Cross Listed Course Information Cross Listed Course Information Course Title Course Title Argument and Persuasion Time Sched Time Sched TITLE TITLE Argument An Pers. Max = 19 Spaces Max = 19 Spaces ABBRE-ABBRE-Transcript Transcript VIATION Argumnt & Prs. VIATION Max = 20 Spaces Max = 20 Spaces Course Description for Official Publication (Max = 50 words) Course Description A course in logical argument and its role in persuasive discourse, especially writing. The course focuses on the nature of a reasoned argument, the formulation and analysis of problems, and methods of selecting, arranging, writing, and editing information on the basis of the intended effect on a particular audience. PROGRAM OUTCOMES: PROGRAM OUTCOMES: □b □c □d □e □f □g □h □i □j □k O Degree Requirement O Free Elective O Other O Core Course O Tech Elective O Degree Requirement O Free Elective O Other **Degree Requirements Degree Requirements** O Core Course O Tech Elective Prerequisites Prerequisites Senior Standing ○ Enforced ○ Advised ○ Enforced ○ Advised Credit Credit Restrictions Restrictions Level of Credit **Level of Credit** Contact Credit Hours Credit Hours Contact Ugrad or Non-Rckhm Grad Undergrad only Hrs/Wk Undergrad only Ugrad or Non-Rckhm Grad Hrs/Wk Min Max Min Max ☐ All Credit types Rackham Grad ☐ All Credit types
☐ Rckhm Grad w/add'l Work Rackham Grad Number Rckhm Grad w/add'l Work Non-Rckhm Grad Non-Rckhm Grad Number Ugrad or Rckhm Grad of Wks Ugrad or Rckhm Grad of Wks Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable? O Yes O No Maximum Hours? Maximum Times? Can it be repeated in the same term? Yes O No Lec
 Rec
 Sem
 Lab
 Dis
 Ind
 Othe Half term 1 1st Terms & Mil Mil 口 illa 口 illb 口 lli Graded Class Grading ☐ Lec
☐ Rec
☑ Sem
☐ Lab
☐ Dis
☐ Ind
☐ Other Location Type(s) Offering ■ Yearly □ Alter Years □ Even Years □ Odd Years 🗵 A-E CR/NC
S/U
P/F
Y ☒ Ann Arbor☒ Biological Station Cognizant Faculty Leslie A. Olsen / Peter Klaver Title Director, Technical Camp Davis Member: Extension Other Grad Course: Attach nomination if Cognizant Faculty is not a regular graduate faculty Approval Submitted By: Home Dept. Cross-listed Dept. Name, Signature & Department ☐ Curriculum Comm. Leslie A. Olsen, Technical Communication Home Dept. ☐ Faculty Cross-listed Dept(s). Rackham ☐ Cross listed Unit 1

Form	Num	bei
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030		

SUPPORTING STATEMENT	
TC 498, 492, 497, and 450 used to satisfy the senior rhetoric requiremen	t in the college, with the implementation of the
Communication-Across-the-Curriculum Program (CAC) and Curriculum 2	2000, the old 1-course, senior rhetoric requirement has been
replaced by the CAC requirement in each department. TC 497 has not b	een offfered for many years. Flements of this course now
appear in all communication across the curriculum courses.	samano samaninany fastam mendenia, at mia copiae now
~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~	
***************************************	
	***************************************
Are any special resources or facilities required for this course?	
the same of the sa	☐ Yes ☒ No
Dotail the Special requirements	
Detail the Special requirements	

College Curriculum Committee, 1420 Lurie Engineering Center Building



Form Number

1035

#### Action Requested

New Course Modification of Existing Course O Deletion of Course

Complete the following sections:

New Courses - B & C completely

Modifications - A modified information, B & C completely

Deletions - A & C completely

Date 1/31/2003

Effective Fall 2003

	A CURRENT LISTING	B. REQUESTED LISTING	
	Home Department Div # Course Number	Home Department Div # Course Number Technical Communication 291 499	er
	Cross Listed Course Information	Cross Listed Course Information	
	Course Title	Course Title Scientific and Technical Communication	
	TITLE	TITLE ABBRE- VIATION Time Sched Max = 19 Spaces Transcript Max = 20 Spaces Sci/Tech Comm Sci/Tech Comm	
	Course Description	Course Description for Official Publication (Max = 50 words)  Conferences and tutorial sessions for students with special interest May be taken for 1-4 credit hours as arranged by the instructor, intended as substitutes for regularly scheduled classes.	 ∋sts No
	PROGRAM OUTCOMES:  a b c d e f g h i j k  Degree Requirements O Degree Requirement O Free Elective O Other O Core Course O Tech Elective	PROGRAM OUTCOMES:  a b c d e f g h i j k  Degree Requirements O Degree Requirement O Free Elective O Core Course O Tech Elective	 , }-
	Prerequisites  © Enforced ○ Advised	Prerequisites Permission of Technical Communication Faculty  • Enforced • Advised	
	Credit Restrictions	Credit Elective Credit Only Restrictions	
	Level of Credit Undergrad only Rackham Grad Non-Rckhm Grad Rockham Grad Wadd'i Work Ugrad or Rckham Grad Rockham Grad Rockham Grad Rockham Grad Wadd'i Work Rockham Grad Rockh	Level of Credit  Undergrad only  Undergrad only  Undergrad only  Credit Hours  Contact	RR
C.	Ugrad or Rckhm Grad  Repeatability (Indi Research, Dir. Study, Dissertation: Is this course repeatable?	Printing Information ☑ Print the course in the Bulletin (Optional) ☑ Print the course in the Time Schedule	
	Class Type(s)         Lec Rec Section         Graded Section         Lec Rec Section         Grading Rec Rec Section         Location             Sem   Lab   Lab   Dis   Dis   Dis   Ind   Dis   Ind   Dis   Dis   Dis   Dis Section           A-E   Location           Ann Arbor   Biological Station   Biological Station   Dis Section   Dis	Terms & I I II II III III III III III III II	
	Approval  Curriculum Comm.	Submitted By:  Home Dept.  Cross-listed Dept.  Name, Signature & Department	
	Faculty Rackham Cross listed Unit 1 Cross listed Unit 2	Home Dept. Leslie A. Olsen, Technical Communication U.J., Cross-listed Dept(s).	<del>-</del>

### Form Number

SUPPORTING STATEMENT	
We are deleting TC 475 and adding TC 499 as our directed studies cours courses.	
Are any special resources or facilities required for this course?	☐ Yes   No
Detail the Special requirements	